DISTRICT
NOWSHERA

KHYBER PAKHTUNKHWA - PAKISTAN

Developed by: Plans Wing,
National Disaster Management Authority,
Islamabad, Pakistan

MULTI HAZARD VULNERABILITY & RISK ASSESSMENT (MHVRA)

UN-HABITAT

ADAPTATION FUND

DISTRICT NOWSHERA

KHYBER PAKHTUNKHWA - PAKISTAN

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National Disaster Management Authority (HQ),
Main Murree Road Near ITP Office, Islamabad
www.ndma.gov.pk

The National Disaster Management Authority (NDMA) is the lead federal agency to deal with the whole spectrum of Disaster Management in Pakistan. It was established in 2007 through NDM Ordinance and was finally provided parliamentary cover by an act of Parliament in 2010. The NDMA is the executive arm of the National Disaster Management Commission (NDMC), which was established under the Chairmanship of the Prime Minister of Pakistan, as an apex policy making body in the field of Disaster Management. The NDMA aims to develop sustainable operational capacity and professional competence to coordinate the emergency response of Federal Government in the event of a national disaster.

Developed by
Plans Wing
National Disaster Management Authority, Prime Minister's Office
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We appreciate your feedback

Questions and comments concerning this publication may be addressed to the Plans Wing, National Disaster Management Authority, Pakistan vide contact details given below.

Contacts
Plans Wing
National Disaster Management Authority (HQ),
Main Murree Road Near ITP Office, Islamabad
www.ndma.gov.pk,
dirimp@ndma.gov.pk

FOREWARD

The National Disaster Management Authority (NDMA) is committed to fostering sustainable social, economic, and environmental development in Pakistan by reducing risks and vulnerabilities while ensuring effective disaster response and recovery.

Pakistan remains highly susceptible to both natural and human-induced disasters due to its geographic location, diverse topography, complex hydrological patterns, and active fault lines. These recurring disasters pose a significant challenge to the country's long-term development goals, with vulnerabilities increasing in both urban and rural areas, putting lives and livelihoods at greater risk.

As the principal body responsible for disaster management in Pakistan, NDMA remains steadfast in its mission to build a disaster-resilient nation. Substantial efforts have been made to mitigate vulnerabilities across multiple hazards. The National Disaster Risk Reduction (DRR) Policy and the National Disaster Management Plan (NDMP) 2012–2025 have been instrumental in transitioning towards a proactive disaster risk management approach. To operationalize key interventions under NDMP, NDMA developed an implementation roadmap (2016–2030), with a particular focus on Multi-Hazard Vulnerability & Risk Assessment (MHVRA).

MHVRA plays a critical role in integrated DRR planning and mainstreaming risk reduction strategies at Local, Provincial, and National levels. The insights gained from these assessments support land-use planning, inform national programs tailored to community vulnerabilities, and contribute to a robust knowledge management framework for long-term socio-economic sustainability.

NDMA has successfully conducted MHVRA studies in three selected Districts, Islamabad, Rawalpindi & Nowshehra leveraging in-house technical expertise. This initiative showcases NDMA's advanced capabilities in data processing and visualization, ensuring informed decision-making for all stakeholders. Furthermore, it strengthens NDMA's institutional capacity to undertake similar initiatives in the future.

Moving forward, NDMA is committed to expanding MHVRA studies across other provinces and regions, incorporating advanced geospatial technologies and predictive analytics to enhance the accuracy and effectiveness of disaster preparedness measures. By integrating real-time data from satellite feeds, early warning systems, and community-driven insights, NDMA aims to refine risk assessment methodologies and strengthen national resilience against disasters.

Additionally, NDMA continues to foster collaboration with national and international partners, academic institutions, and research organizations to develop innovative solutions for disaster risk management. This includes capacity-building programs, policy reforms, and technological advancements that will enable a more robust and adaptive disaster management framework.

I extend my sincere gratitude to the Plans Wing of NDMA for the endorsement of this study. A special acknowledgment goes to the United Nations Human Settlements Programme (UN-Habitat) Pakistan for their unwavering support in pioneering MHVRA initiatives and their continued assistance.

Together, through continued collaboration, innovation, and proactive planning, we can build a safer and more resilient Pakistan, ensuring that communities are better prepared to withstand and recover from disasters in the years to come.

Lieutenant General
Inam Haider Malik, HI (M)
Chairman, National Disaster
Management Authority (NDMA)

ACKNOWLEDGEMENT

NDMA is pleased to introduce the Multi-Hazard Vulnerability and Risk Assessment (MHVRA) Atlas for three selected districts—Islamabad, Rawalpindi, and Nowshera. This Atlas serves as a dynamic planning tool for Disaster Risk Management (DRM) officials, humanitarian agencies, and development partners at provincial and district levels, enhancing Disaster Risk Reduction (DRR), preparedness, and contingency planning efforts.

We extend our sincere appreciation to the Chairman of NDMA, Lieutenant General Inam Haider Malik, HI(M) for his visionary leadership, strategic direction, and unwavering support throughout this project. His guidance has been instrumental in ensuring its successful execution.

Our profound gratitude also goes to Program Manager (UN-Habitat) Mr. Javed Ali Khan and Project Manager (UN-Habitat) Mr. Khalil Ahmad for their continued support and collaboration, which have been invaluable to the success of this initiative.

We extend heartfelt thanks to Member (DRR), Mr. Idrees Mahsud, Executive Director (PLANS) Brigadier Muhammad Umar Chattha (Retd), and Senior Director (PLANS-A)Mr. Raza Iqbal TI(M) for their steadfast commitment, expert guidance, and invaluable contributions, which have greatly enriched this project.

We also recognize and appreciate the significant contributions of institutions and individuals at district, provincial, and national levels, who provided essential data and insights, ensuring the seamless execution of this initiative. The expertise of consultants from various disciplines played a crucial role in maintaining precision and quality throughout the assessment.

Lastly, we express our deepest gratitude to all stakeholders who actively participated in and supported this study. Their dedication, collaboration, and invaluable contributions are sincerely acknowledged and appreciated.

PREFACE

Pakistan's diverse topography makes it highly vulnerable to a wide range of natural and human-induced disasters. The country has witnessed numerous catastrophic events in the past, underscoring its susceptibility to such hazards. Until recently, disaster management in Pakistan primarily followed a reactive emergency response approach. However, the devastating impact of disasters on the nation's economy, human lives, and environment highlighted the urgent need for a strategic shift toward Disaster Risk Reduction (DRR). Recognizing this necessity, Pakistan transitioned from a response-based model to a proactive disaster management approach through the enactment of the National Disaster Management Ordinance in 2007, which was later formalized as the National Disaster Management (NDM) Act of 2010.

In accordance with the provisions of the NDM Act 2010 and in alignment with the DRR Policy, the National Disaster Management Authority (NDMA) developed National Disaster Management Plan (NDMP) 2012–2025. This plan identified ten priority areas and outlined 118 specific interventions and projects for implementation over a decade. Notably, priorities 3 and 4 emphasized the need for executing the Multi-Hazard Vulnerability and Risk Assessment (MHVRA) across the country. To operationalize this initiative, NDMA introduced the NDMP Implementation Roadmap 2016–2030, which provides a phased strategy for conducting MHVRA at the micro level, extending down to the Union Council level across all districts of Pakistan and Azad Jammu & Kashmir (AJ&K).

Given Pakistan's vulnerability to multiple hazards, the implementation of MHVRA is essential for fulfilling national and international commitments, including the Millennium Development Goals (MDGs), Sustainable Development Goals (SDGs), the Sendai Framework for Disaster Risk Reduction (SFDRR), the Climate Change Policy 2012, the National DRR Policy 2013, NDMP 2012–2025, and Pakistan Vision 2025.

Recognizing the significance of MHVRA, NDMA, as the apex body for disaster management in Pakistan, has undertaken the development of a structured and holistic methodology tailored to the country's specific needs. The primary objective of this study is to accurately assess and map disaster risks faced by communities across the selected Districts.

This MHVRA Study has been carried out under the Umbrella of MHVRA Guidelines through Plans Wing of NDMA and with support from the UN-Habitat under Adaptation Fund Project titled, "Enhance community, local and national-level urban climate change resilience to water scarcity, caused by floods and droughts in Rawalpindi/Islamabad and Nowshera".

This MHVRA Study Involved inputs from technical agencies in Pakistan, including representatives from the respective Provincial, State, and Regional Disaster Management Authorities (PDMAs, SDMA & GBDMA), Pakistan Meteorological Department (PMD), the Planning Commission, the Planning, Development & Reforms Division, the Finance Division, the Economic Affairs Division, the Ministry of Water & Power, the Ministry of Climate Change, the Federal Flood Commission (FFC), the Geological Survey of Pakistan (GSP), the Space & Upper Atmosphere Research Commission (SUPARCO), and the Survey of Pakistan (SOP), alongside representatives from academia.

By integrating a scientific and data-driven approach to disaster risk assessment, NDMA aims to enhance the country's resilience to disasters, ensuring better preparedness, mitigation, and response strategies in the future.

Methodology

This study involved the identification and analysis of prevalent hazards in the selected districts through extensive field consultations with local stakeholders and a thorough review of historical records. Three key hazards—drought, floods, and earthquakes—were selected for analysis due to their frequent recurrence in the study areas. The project encompassed various scientific and technical activities, including an assessment of past and ongoing studies related to hydrological, seismological, and geological phenomena. Exposure has been mapped in the dimensions of population, physical elements, life lines, essential facilities, transportation facilities, socio-economic aspects, economic activities, environmental elements, critical infrastructure, agriculture and livestock elements; being termed as elements at risk. Various statistical tools such as projection equations, dissimilarity index, have been employed in the Project to extrapolate information beyond the available frame.

Vulnerability analysis has been conducted considering three dimensions i.e. physical, social and agriculture (Food Insecurity). For physical vulnerability, fragility curves have been developed using available technical and statistical tools (Probabilistic or Empirical fragility models). For social vulnerability, several technical tools such as Principal Component Analysis (PCA) and Social Vulnerability Indicator (SoVI) have been utilized to obtain possible driving factors contributing to the social vulnerability in the study area. Vulnerability analysis in the context of agriculture and food security have also also been undertaken to determine sets of contributing factors to food insecurity and agricultural vulnerability. The stressor covered epidemic, endemic, biotic and edaphic factors and sudden shocks such as earthquake, flood and drought.

Coping capacity has been anticipated by assessing existing capacities of organization to manage disasters. The coping capacity has further been divided into three main factors i.e. capacity to anticipate risk, capacity to respond and capacity recover. Adaptive capacity has been evaluated using fifteen indicators.

For Risk Assessment, Analytical Hierarchy Process (AHP) and Multi Criteria Decision Making approaches have been employed in the Study. The risk assessment has been carried out using qualitative, quantities or semi quantitative approach. On basis of these factor components, the cumulative riskrofile of the study districts (risk indexing down to UC Level) have been developed. Various DRR intervention and mitigation measures have formulated and finally Cost Benefit Analysis (CBA) of proposed DRR interventions have been performed to estimate their economic feasibility.

Close linkages with the National, provincial and district organizations have been established through stakeholder consultation arrangements in order to facilitate secondary data collection, hazard specific information exchange, and sharing of any other relevant data. For this purpose, several data collection tools have been utilized in the Study such as focus group discussion, key informant interviews, participatory rural appraisal, semi structured interviews and one-to-one interviews with community level stakeholders and line departments.

ABOUT THIS ATLAS

Accurate, easily interpretable, and up-to-date information is a fundamental pillar of effective decision-making. In the field of disaster management, timely and precise information plays a crucial role in risk-informed Disaster Risk Reduction (DRR) planning. It equips relevant authorities with insights into potential losses, vulnerabilities, exposure, and impending disaster risks within a given area, enabling them to implement proactive prevention, mitigation, preparedness, and response measures before or during an emergency.

However, compiling and visualizing Multi-Hazard Vulnerability & Risk Assessment (MHVRA) data presents a significant challenge, as it requires a multi-dimensional analysis of various natural processes and their cumulative impacts on the study area. Additionally, conveying the findings of an MHVRA study in a user-friendly format demands the development of advanced data visualization tools, graphical aids, interactive charts, and effective cartographic representations. This Atlas marks a major step toward achieving these objectives by presenting complex data in an accessible and comprehensible manner.

The Atlas offers detailed baseline maps of the study district, covering diverse aspects such as geology, climatology, land use, land cover, elevation, population, settlements, infrastructure (transportation, telecommunication, health, education, irrigation), industries, agriculture, and livestock. To enhance readability, a variety of graphical tools—including pie charts, histograms, bar charts, matrix diagrams, line graphs, 3D charts, and informative tables—have been employed. The Atlas also provides an overview of hazard assessment methodologies for three key hazards: drought, earthquakes, and floods, along with hazard maps for various return periods. Exposure matrix tables have been developed to identify at-risk elements, supplemented by exposure maps. Additionally, a concise risk assessment methodology is outlined, along with risk maps. This study has been conducted at a micro level, down to the Union Council level, making it the first of its kind. It reflects a high level of technical expertise, rigorous analytical work, and a collaborative, cross-sectoral approach.

This Atlas will serve as an invaluable resource for policymakers and practitioners, supporting risk-informed land-use planning, the integration of DRR into development initiatives, and the implementation of national-scale programs grounded in comprehensive data. It provides a critical baseline for future micro-level DRR planning and serves as a cutting-edge tool for resource mapping within the study district.

List of Officers/Officials involved in MHVRA Punjab Study

Technical Team

Name	Designation/Position
Mr. Syed Muhammad Tayyab Shah	General Manager (Risk Assessment)
Ms. Zahra Hassan	General Manager (GIS)
Mr. Sheikh Rafay Ehsan	Deputy Manager (Geology)
Mr. Hafiz Muhammad Haris Mir	Deputy Manager (MHVRA / GIS)
Mr. Abdul Hanan Hamid	Deputy Manager (Hydrology / GIS)
Mr. Asfandyar Farooqi	Assistant Manager (GIS)

Administrative Team

Name	Designation/Position
Mr. Zohaib Durrani	Manager (Policy)
Mr. Owais Khan Yousafzai	Manager (Development Organizations / Finance)
Mr. Farhan Ahmad	Manager (United Nations)
Mr. Ghulam Rasool	Admin & Accounts Associate
Mr. Shahid Malik	Field Surveyor

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1 NOWSHERA DISTRICT OVERVIEW

Nowshera, a historically and economically significant district in Khyber Pakhtunkhwa, Pakistan, is situated along the Kabul River. Its diverse landscape includes fertile agricultural plains and the Cherat Hills, which offer a cooler retreat. The district experiences hot summers, mild winters, and monsoon rains, supporting key crops like wheat, sugarcane, and maize. The predominantly Pashtun population speaks mainly Pashto (95%), with smaller communities speaking Hindko, Punjabi, and Urdu. Traditional crafts such as carpet weaving, embroidery, wood carving, and pottery highlight the region's rich cultural heritage. Economically, Nowshera thrives on agriculture, trade, and industry, with the Nowshera Industrial Estate and major highways like the M-1 Motorway and Grand Trunk (GT) Road enhancing commerce and connectivity.

Historically, Nowshera was a key military and trade center during the Mughal and British eras. It is home to significant landmarks such as Akora Khattak, the birthplace of Khushal Khan Khattak, and the Nowshera Bridge. Scenic attractions like Kund Park, Cherat Hills, and Jinnah Park offer recreational opportunities. The district also holds strategic military importance, housing Risalpur Cantonment, known as the "Home of the Pakistan Air Force," and Cherat Cantonment. Balancing tradition with modern development, Nowshera continues to evolve, contributing significantly to the economy, culture, and history of Khyber Pakhtunkhwa.

Nowshera Overview

Kabul River Bridge Nowshera

Histroy

Nowshera, meaning "New City" in Persian, has a deep historical significance. It was part of Afghanistan's "Now-khaar" province before its annexation by the British through the Durand Line Agreement in 1893. Located in the Peshawar Valley, which was integral to the ancient Gandhara Civilization, Nowshera was a tehsil of Peshawar district until it was upgraded to a district in 1988.

The district is renowned as the birthplace of Khushal Khan Khattak, a great Sufi saint, poet, writer, and tribal chief of the Khattak tribe. Other prominent historical figures include Malik Ako, the first Khattak chief, Nawab Sir Khwaja Muhammad Khan Khattak, and Biland Khan of Khushal Garh.

Nowshera has been a battleground for various empires. In 1001 AD, Mahmud of Ghazni defeated Hindu King Jaipal on the plains between Nowshera and the Indus River. The region was later ruled by the Ghaznavids, Ghorids, and Mughals. Babar, the first Mughal Emperor, subdued the local Yousafzai tribe through strategic alliances. The Mughal rule continued until Ahmad Shah Abdali incorporated the region into the Durrani Empire in the 18th century.

The Sikhs, led by Ranjit Singh, took control in 1818, and the decisive Battle of Nowshera in 1823 solidified their rule, ending Durrani influence. After the Second Anglo-Sikh War in 1848, the British established control over Nowshera, making it a key military station. During the War of Independence in 1857, the 55th Native Infantry stationed here rebelled but was defeated.

Under British rule, Nowshera became an important cantonment along the North-Western Railway. Today, it remains a crucial military hub, housing Nowshera, Cherat, and Risalpur Cantonments. These include major Pakistan Army institutions like the Army School of Artillery, Army Services Corps (ASC) Center, and the School of Armour.

Taj Building of Nowshera

Land Scape

District Nowshera features a diverse landscape comprising fertile plains, riverine belts, and rugged hills. The Kabul River, a defining geographical feature, flows through the district, enriching its agricultural lands while also posing a risk of seasonal flooding. The central and southern parts of Nowshera are dominated by vast cultivable fields, supporting crops such as wheat, maize, and sugarcane, whereas the northern and western regions exhibit a more undulating and hilly terrain.

The district's strategic location along key trade routes, including the Grand Trunk (GT) Road and the M-1 Motorway, enhances its economic significance. The semi-arid to subtropical climate, with hot summers and mild winters, influences local livelihoods, particularly in agriculture and water resource management. Despite its natural richness, Nowshera remains vulnerable to environmental challenges such as floods and soil erosion, requiring sustainable land and water management practices

Culture

District Nowshera has a rich and vibrant culture deeply rooted in traditions, history, and the Pashtun way of life. The people of the district are known for their strong adherence to Pashtunwali, a traditional code of conduct emphasizing hospitality, honor, and respect. Cultural values such as jirga (tribal council) for dispute resolution and the importance of extended family structures remain integral to society. The district is home to diverse communities, primarily Pashtuns, with a blend of Hindko and other linguistic groups, adding to its cultural richness.

Traditional clothing reflects the local heritage, with men commonly wearing shalwar kameez, often accompanied by a waistcoat or turban, while women wear brightly colored dresses with intricate embroidery. Folk music and dance, such as the famous Attan, are an essential part of celebrations, particularly during weddings and festivals. Poetry, especially in Pashto, holds a special place in the cultural fabric, with deep influences from Sufi and classical Pashto literature.

Religious and cultural festivals, including Eid, Jashn-e-Baharan (Spring Festival), and mela (local fairs), are celebrated with enthusiasm. Nowshera also has historical significance, with several ancient sites and Mughal-era monuments that reflect its rich past. Despite modernization, the district has managed to preserve its cultural identity, maintaining a balance between tradition and contemporary influences.

Language

District Nowshera is a linguistically diverse region where Pashto serves as the primary language spoken by the majority of the population. It is deeply rooted in the local culture and is widely used in daily communication, social interactions, and traditional storytelling. Alongside Pashto, Hindko is spoken in some areas, particularly by communities with historical ties to trade and cultural exchanges, reflecting the district's multicultural influences. Urdu, as the national language of Pakistan, is commonly used in educational institutions, government offices, and formal communication, ensuring linguistic connectivity with other parts of the country. English is also spoken and understood, particularly among the educated population, professionals, and students, playing a crucial role in higher education and official documentation. This rich linguistic landscape showcases Nowshera's cultural diversity, shaped by centuries of migration, trade, and historical interactions with various

Tradational Crafts

Nowshera has a long-standing tradition of craftsmanship, with artisans excelling in various forms of handmade goods that reflect the region's rich cultural heritage. The district is particularly known for its exquisite woodwork, where skilled craftsmen create finely carved furniture, doors, and decorative items featuring intricate geometric and floral patterns. Textile weaving is another significant craft, with handwoven fabrics and elaborately embroidered garments showcasing vibrant colors and traditional motifs. The art of leatherwork thrives in the region, producing high-quality leather shoes, belts, and accessories, often crafted using age-old techniques. Pottery is also a notable craft, with artisans shaping beautiful clay pots, tiles, and decorative ceramics that are both functional and artistic. Additionally, brass and copperware items, such as engraved trays and utensils, are popular for their durability and detailed craftsmanship. These traditional crafts not only provide a livelihood for local artisans but also play a crucial role in preserving the artistic and cultural identity of Nowshera, ensuring that these time-honored skills continue to be passed down through generations.

Wood carving and furniture making

Pottery and ceramics

Embroidery and textile work

Notable People

A list of some of the most prominent people from Nowshera District:

- Khushal Khan Khattak, Poet
- Abdul Haq, Scholar
- Sami ul Haq, Religious Leader
- Zarsanga, Singer
- Gul Hassan Khan, Military
- Ghani Akbar, Military
- Pervez Khattak, Politician
- Tariq Hilal Zafar, Scientist
- Arshad Khan, Actor
- Muhammad Riaz, Sportsman

Tomb of Khushal Khan Khattak

DISTRICT NOWSHERA AT A GLANCE

Geography

Location

Lat: 34.0151°N
Long: 71.9747°E

Neighbouring Districts

- **North** — Mardan District
- **East** — Swabi & Attock District
- **West** — Peshawar & Charsada District
- **South** — Kohat District

Administrative Setup

Area	1748 sq. kms
District Capital	Nowshera City
Language	Phasto, Hindco & Punjabi

3	47	153	4
Tehsils	Union Councils	Mouzas	Muncipal Committees

Population Distribution

Total Population in District

1,520,995	2017 Census
1,740,705	2023 Census

Population Density (Person per sq.km)

870.13 per sq.km	2017 Census
995.83 per sq.km	2023 Census

Growth Rate

2.28%
(2023 Census)

Educational Facilities

Govt. Schools	Colleges	Universities
1027	26	04

Public Health Care Facilites
(Numbers)

54

Tourist Attractions

Picnic Resort
Taj Building, Manglot National Park.

Dams
Jabba Khattak Dam

Shrines
Kaka Sahib, Akhund Panju Baba, Sheikh Bahadur Baba, Mast Baba, and Sheikh Shahbaz Baba

Historical Sites
Darul Uloom Haqqania, Taj Building
Khushal Khan Khattak Library, Akora Khattak

Parks
Jinnah Park, Kund Park, Aza Khel Park
Mangloot Wildlife Park, Cherat Chapri Wildlife Park

Agriculture

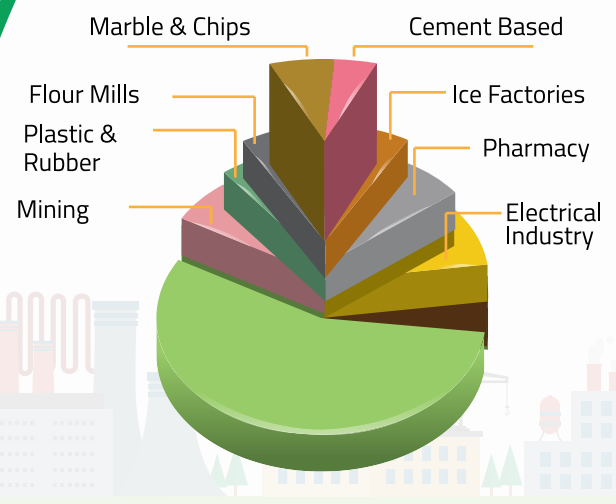
Major Crops
Wheat, Maize, Tobacco, Sunflower, Rice, Barley, Sugarcane, Gram, Cotton, Groundnut, Moong, and Canola.

Major Fruits
Citrus, Mango, Banana, Apple, Guava, Apricot, Peach, Pears, Plums, Grapes, Pomegranate, Loquat, Lychee, and Watermelon.

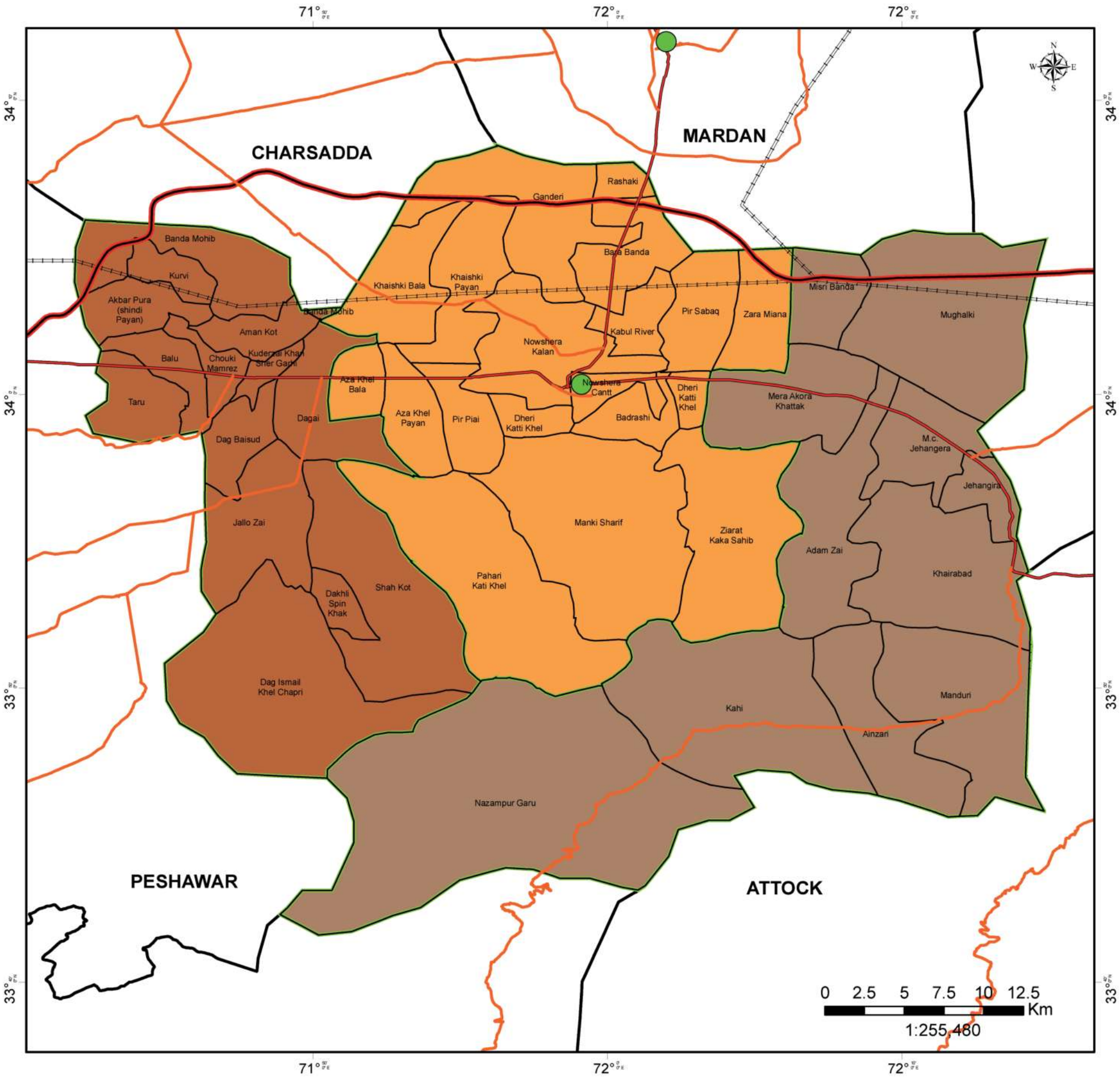
Major Vegetables
Chilies, Onions, Potatoes, Coriander, Garlic, Cauliflower, Turnip, Cucumber, Okra, Eggplant, Cabbage, Tomatoes, Garlic, and Pumpkin.

Major Livestock
Buffalos, Cows, Sheep, Goats, Poultry and Fishing.

Major Industries



DISTRICT ADMINISTRATIVE MAP



Legend

- District Headquater
- Major Roads
- National Highway
- Trunk Road
- Motorways
- Broad Guage Railway Track
- Other Guage Railway Track

Tehsil Boundary

- Jahangira
- Nowshera
- Pabbi
- Union Council Boundary
- District Boundary

Multi Hazard Vulnerability & Risk Assessment, Nowshera, Khyber Pakhtunkhwa, Pakistan

PAKISTAN National Disaster Management Authority NDMA

UN-HABITAT

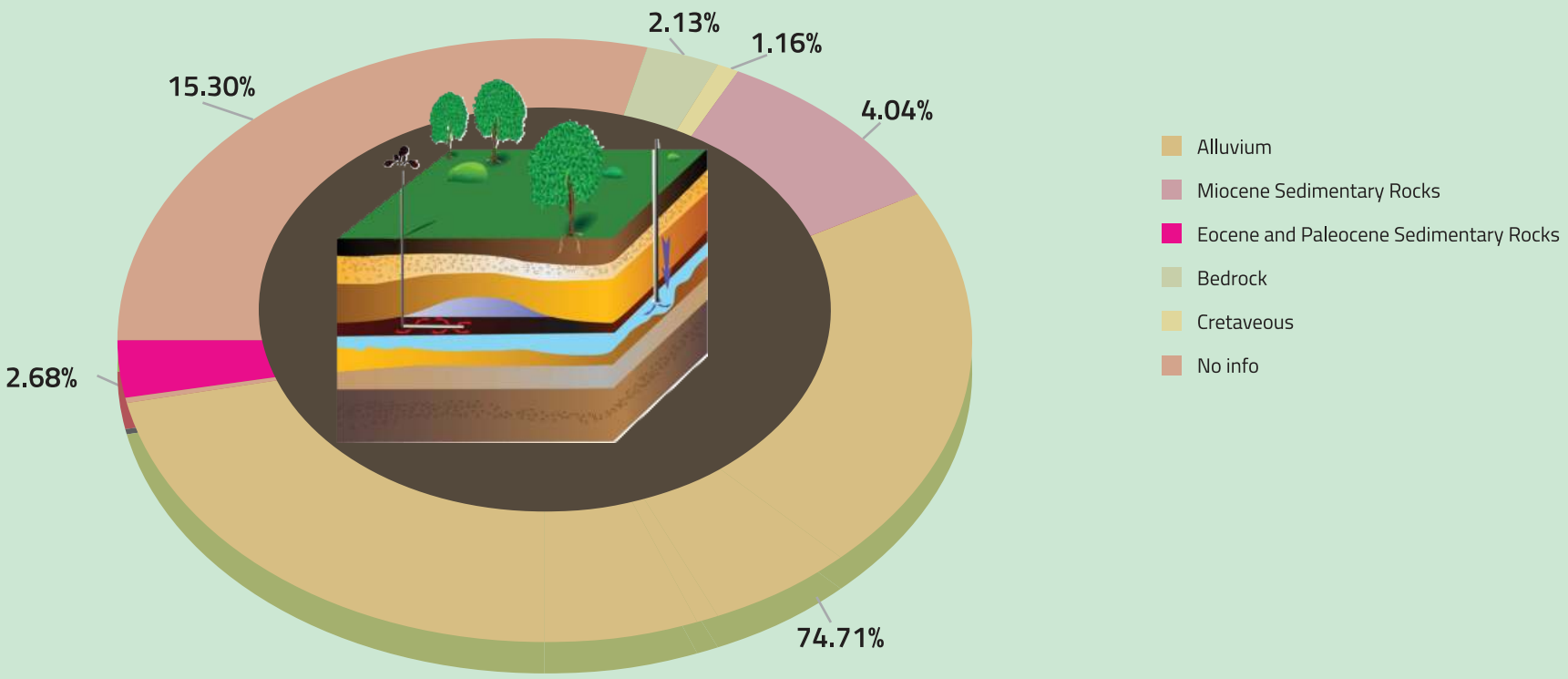
2 GEOLOGY

The geology of Nowshera is diverse, comprising sedimentary and metamorphic formations, including Quaternary deposits like alluvium, river terraces, and floodplain deposits, along with older Paleozoic and Mesozoic sedimentary rocks. Major geological formations include Jurassic, Triassic, Cambrian, and Eocene rocks, as well as ultramafic and ophiolitic formations. Situated at the junction of the Peshawar Basin and the Himalayan fold-and-thrust belt, the district features faulted and folded rock structures shaped by tectonic activity, particularly the Main Boundary Thrust (MBT) and associated faults.

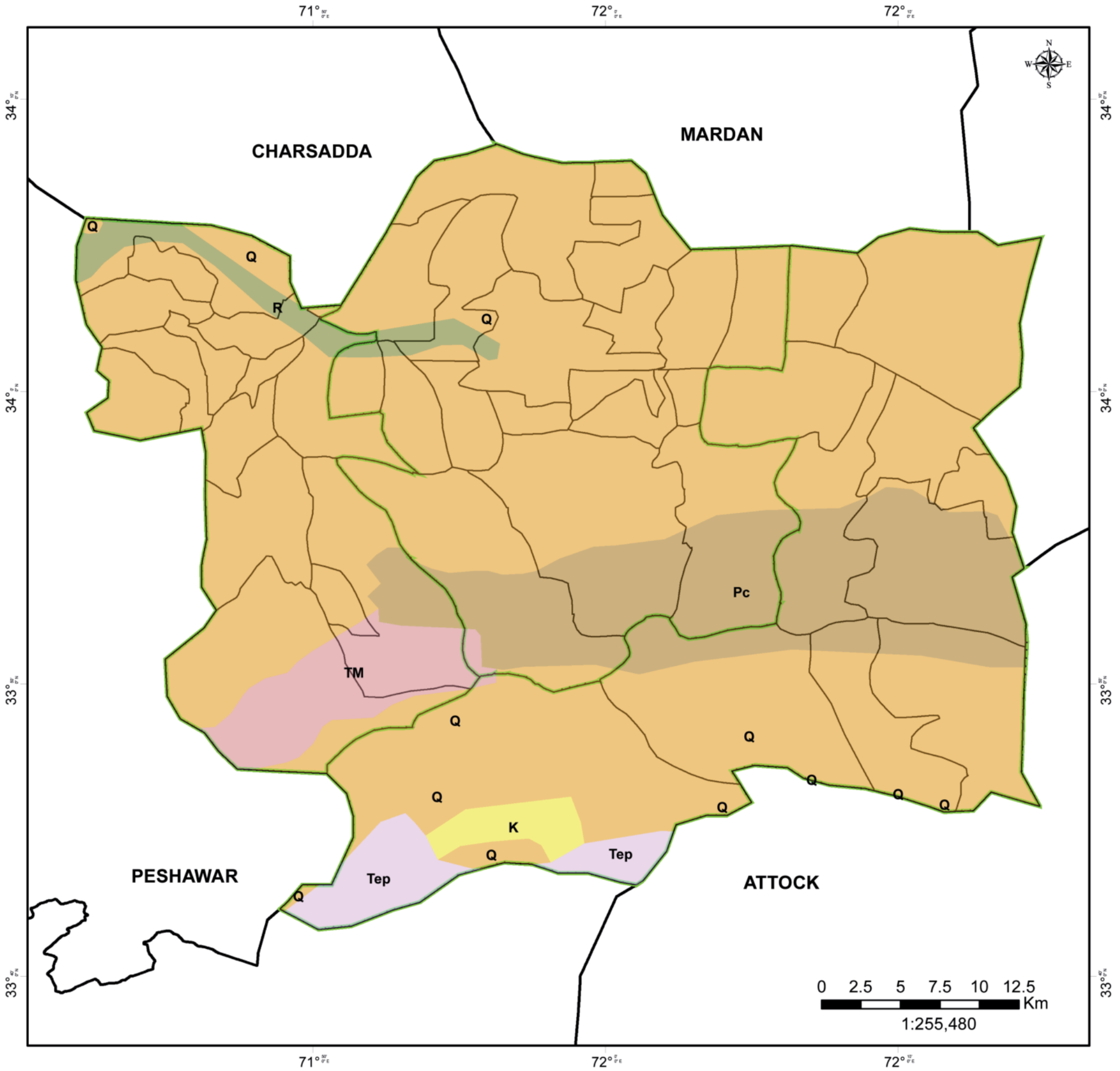
Rich in mineral resources, Nowshera has significant deposits of limestone (used in cement production), marble, gypsum, dolomite, and clay, which support ceramics and construction industries, along with abundant gravel and sand for infrastructure development. Its location along active tectonic zones makes it crucial for seismic activity studies and structural geology research. The district's landscape varies from hilly terrains in the west and north to flat alluvial plains near the Kabul River.

Geological Formation	Area (sq.km)	Composition
No info	265.8385	15.30%
Alluvium	1297.373	74.71%
Miocene Sedimentary Rocks	70.21069	4.04%
Eocene and Paleocene Sedimentary Rocks	46.51512	2.68%
Bedrock	36.93694	2.13%
Cretaveous	20.202814	1.16%

Geological Composition



GEOLOGY MAP



Legend

- Cretaceous (K)
- No
- Alluvium (Q)
- Bedrock (R)
- Miocene Sedimentary Rocks (TM)
- Eocene and Paleocene Sedimentary Rocks (Tep)

Tehsil Boundary

- Jahangira
- Nowshera
- Pabbi
- Union Council Boundary
- District Boundary

Multi Hazard Vulnerability & Risk Assessment, Nowshera, Khyber Pakhtunkhwa, Pakistan

UN-HABITAT

3 LAND USE & LAND COVER

Land Cover (LC) refers to the observed physical cover on the earth's surface, while Land Use (LU) describes human activities and arrangements that modify or maintain the land for specific purposes. Understanding the LC/LU distribution helps in effective land-use planning and sustainable resource management.

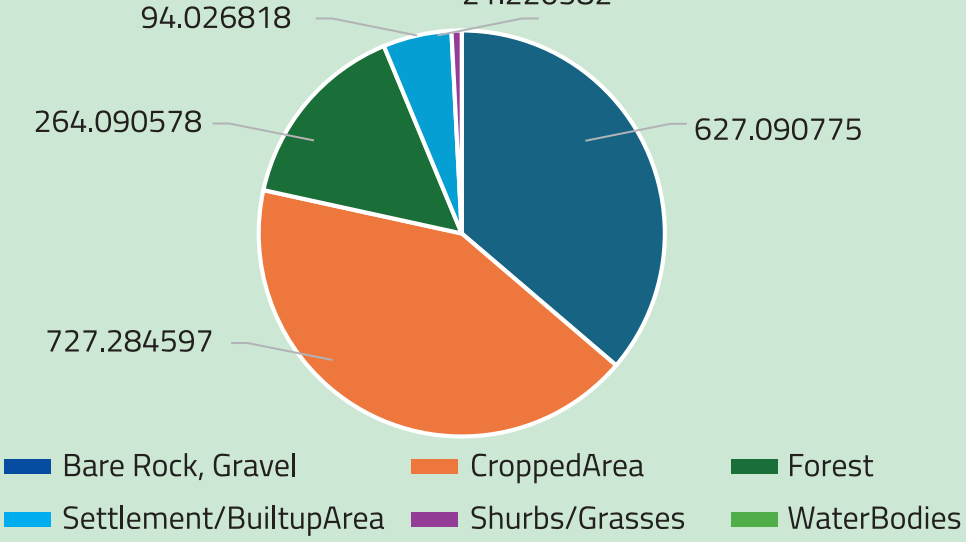
Nowshera's land cover and land use are vital to monitor as they are influenced by climate change, urban expansion, and agricultural activities. For this study, LC/LU demarcation has been conducted using remote sensing techniques and GIS analysis, providing a comprehensive overview of natural and human-modified landscapes. The study includes various categories such as cultivated land, natural vegetation, barren land, rocky areas, water bodies, and urban settlements.

A Land Cover Classification System (LCCS) approach has been applied to capture the district's physiographic characteristics at a detailed level. The geospatial database, prepared through satellite imagery and field validation, serves as a foundation for improved natural resource management and land-use planning.

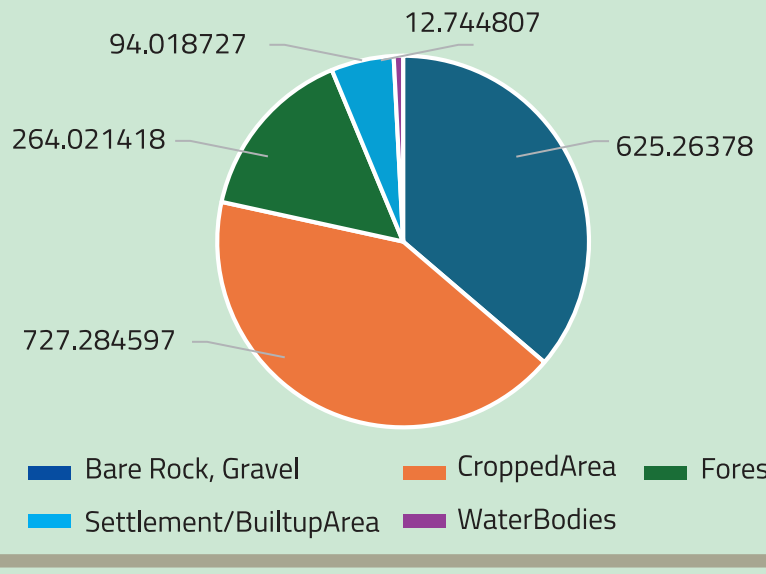
The study identifies different land cover classes, further subdivided into detailed categories based on analysis and validation of high-resolution satellite imagery. These images were segmented into homogeneous land units and classified using LCCS standards, ensuring accuracy in mapping the district's diverse landscape.

Land Cover Distribution of District

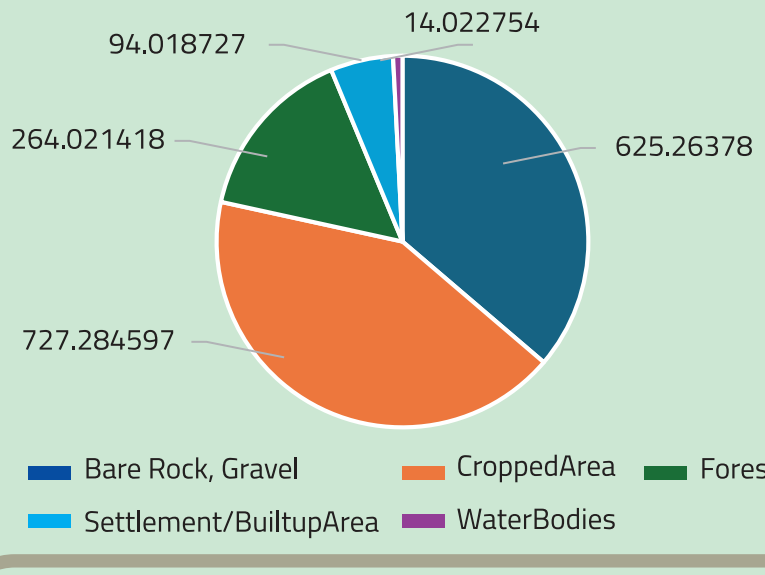
(Percentage)



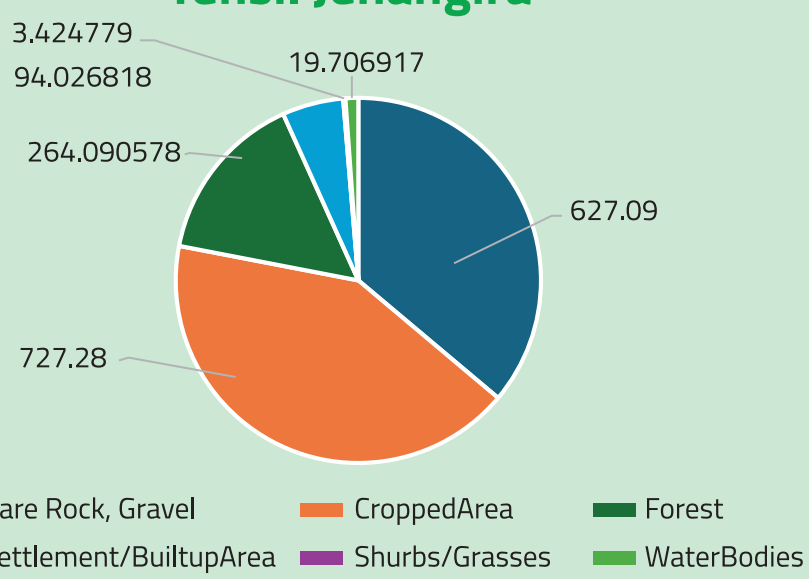
Tehsil Nowshera



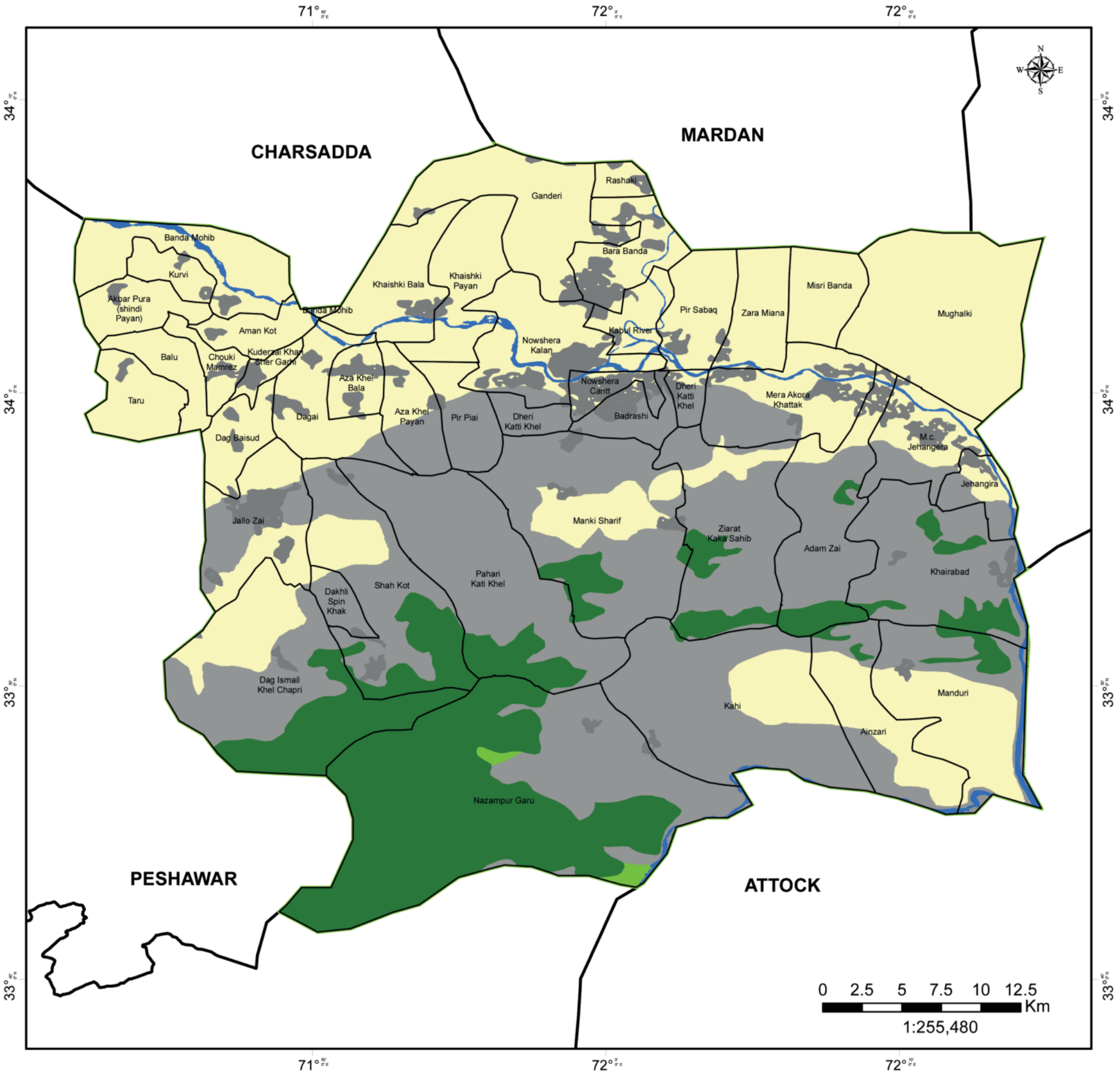
Tehsil Pabbi



Tehsil Jehangira



LAND USE & LAND COVER



Legend

- Bare Rock, Gravel
- CroppedArea
- Forest
- Settlement/BuiltupArea
- Shurbs/Grasses
- WaterBodies

Tehsil Boundary

- Jahangira
- Nowshera
- Pabbi
- Union Council Boundary
- District Boundary

Multi Hazard Vulnerability & Risk Assessment, Nowshera, Khyber Pakhtunkhwa, Pakistan

PAKISTAN National Disaster Management Authority NDMA

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4 ELEVATION

Nowshera District in Khyber Pakhtunkhwa has a varied elevation, ranging from approximately 250 meters to 1,200 meters above sea level. The district's low-lying areas, including the Kabul River floodplain, are around 250–300 meters, while the hilly and mountainous regions in the northwest, near the Cherat Range, reach elevations of 1,000–1,200 meters.

The Cherat Hills form the district's highest points, influencing its climate, hydrology, and land use patterns. The lowlands are primarily agricultural and urbanized, whereas the higher elevations are covered with natural vegetation and rugged terrain. This topographic diversity plays a crucial role in the region's land-use planning, disaster risk management, and infrastructure development.

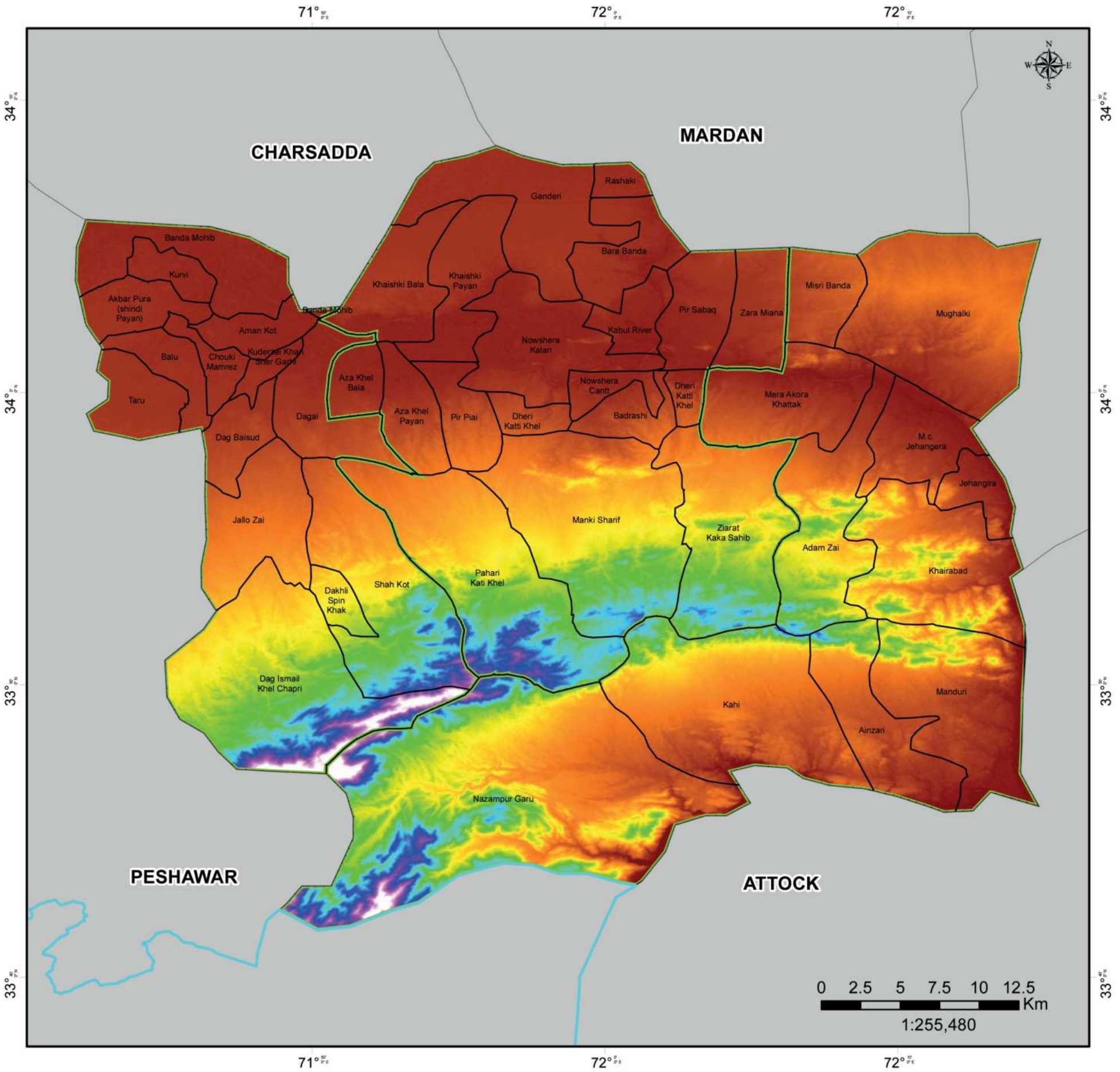
Tehsil-wise Elevation

Tehsil	Elevation Range (meters above sea level)	Terrain Type
Nowshera	250 – 350	Low-lying plains, riverbanks (Kabul River)
Pabbi	280 – 400	Agricultural plains, scattered settlements
Jehangira	250 – 450	Riverine plains, semi-arid lands

Elevation Distribution

Elevation Range (meters)	Area Coverage (%)	Description
250 – 300	~40%	Low-lying plains, riverbanks, and agricultural land along the Kabul River
300 – 500	~35%	Semi-arid plains, settlements, and agricultural fields
500 – 800	~15%	Rolling hills and foothills, scattered vegetation
500 – 800	~10%	Cherat Hills, rugged terrain, limited settlements

ELEVATION MAP



Legend

Elevation (m)

Value

High : 1541

Low : 189

District Boundary

Union Council Boundary

Tehsil Boundary

Jahangira

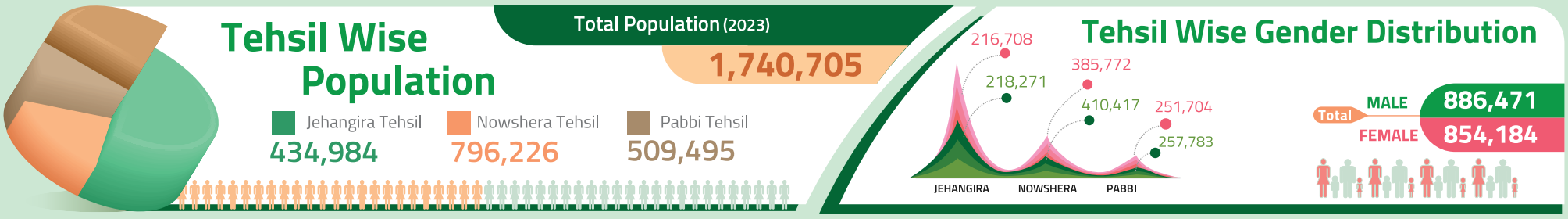
Nowshera

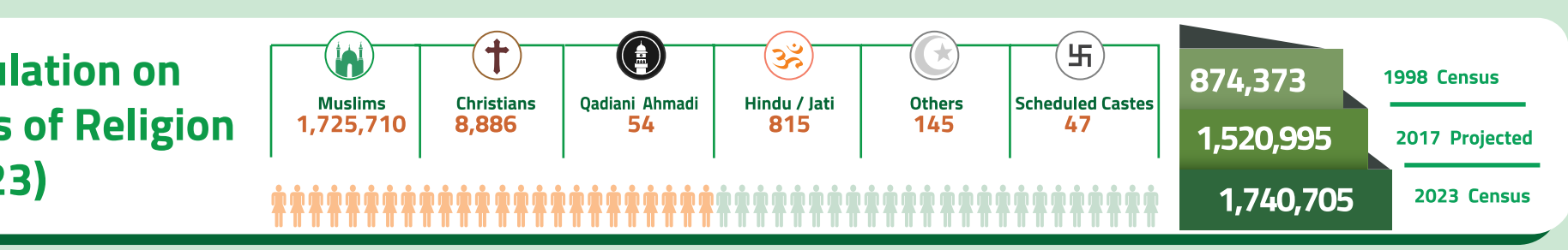
Pabbi

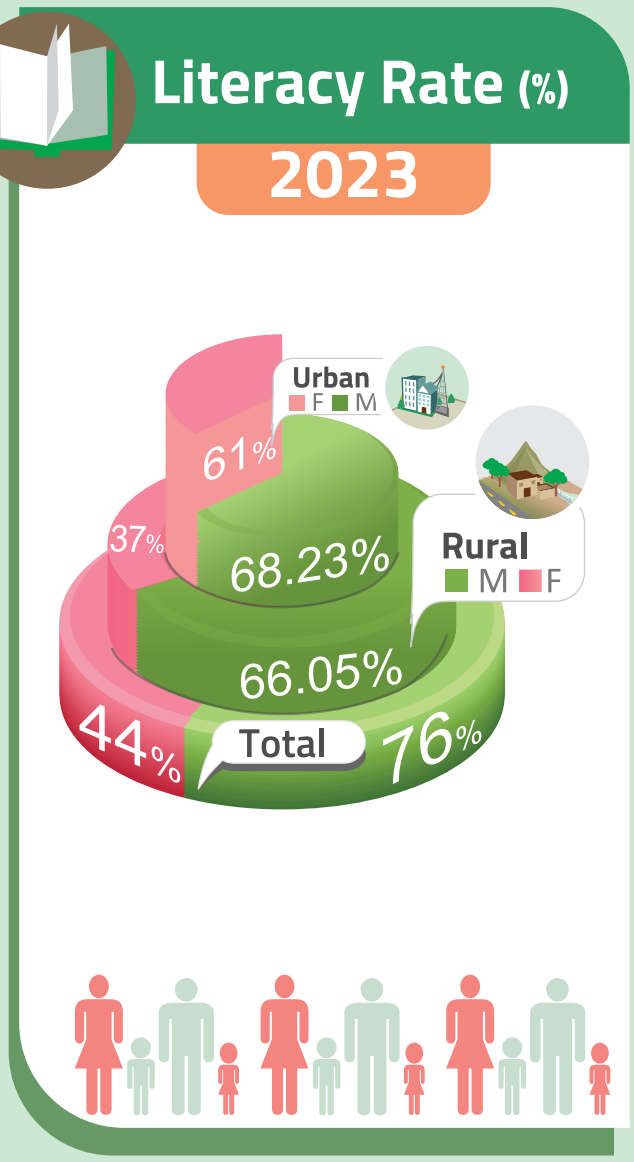
Multi Hazard Vulnerability & Risk Assessment, Nowshera, Khyber Pakhtunkhwa, Pakistan

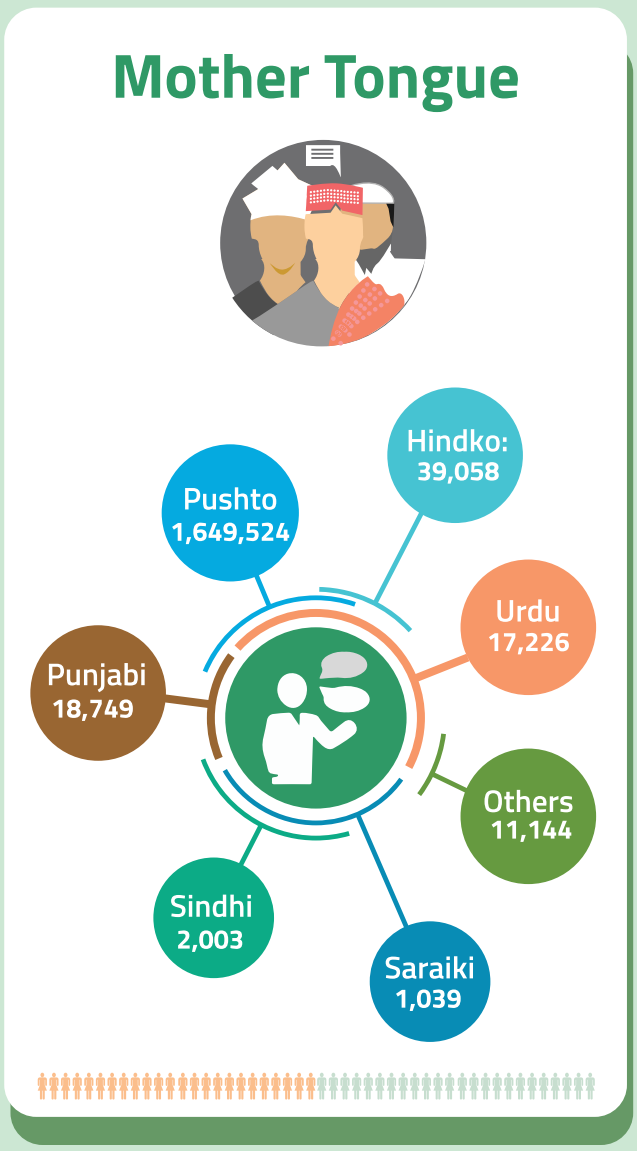
5 POPULATION DISTRIBUTION

According to the 2023 census, Nowshera district has a total of 259,774 households and a population of 1,740,705. The district's sex ratio stands at 103.78 males for every 100 females. Additionally, Nowshera has experienced a population growth rate of 2.28% , reflecting a notable increase in its population over the recent years.

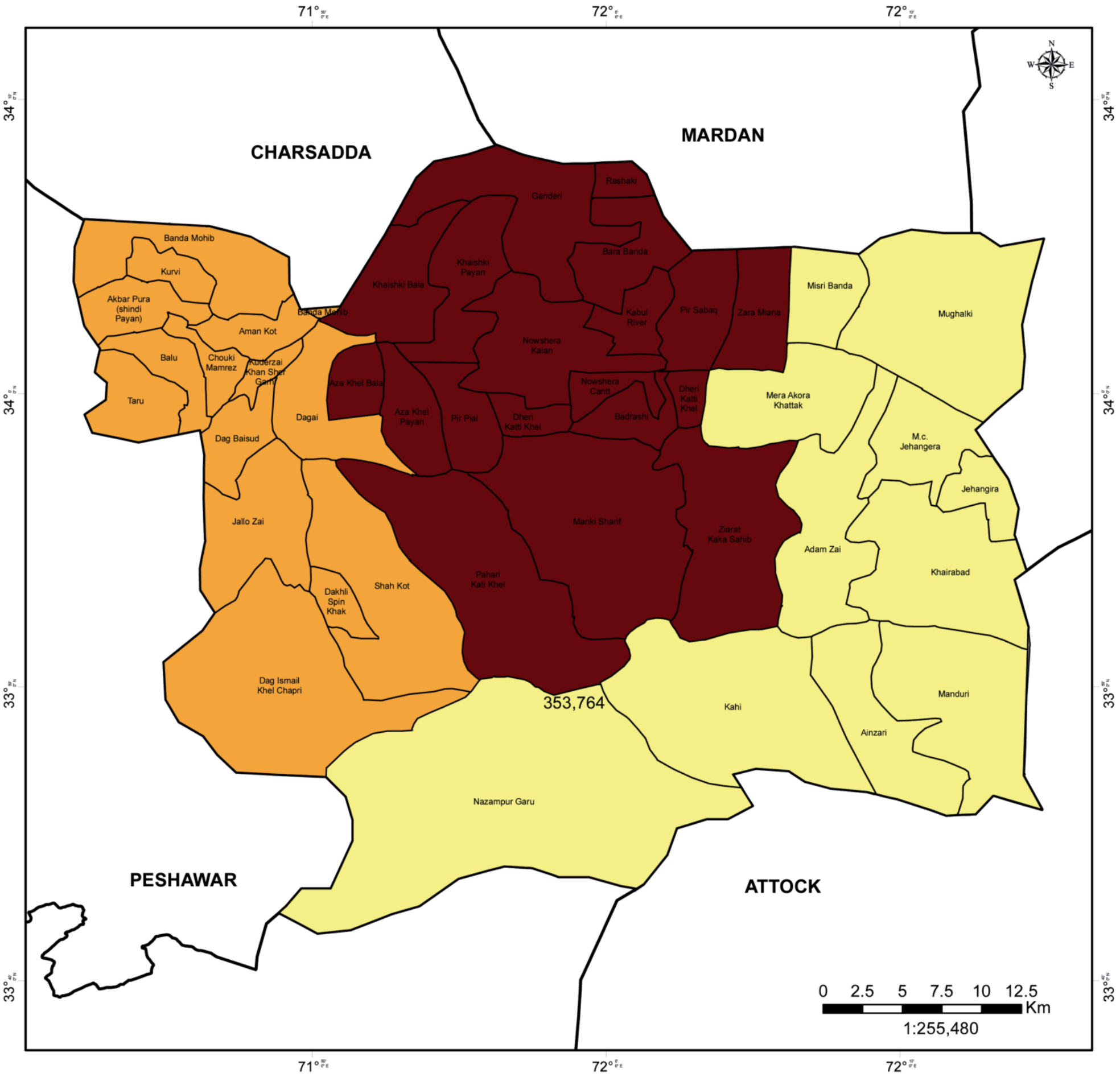








POPULATION DISTRIBUTION MAP



Legend

Population Distribution

- < 350000
- 351000 - 430000
- 431000 - 730000
- Union Council Boundary
- District Boundary

Multi Hazard Vulnerability & Risk Assessment, Nowshera, Khyber Pakhtunkhwa, Pakistan

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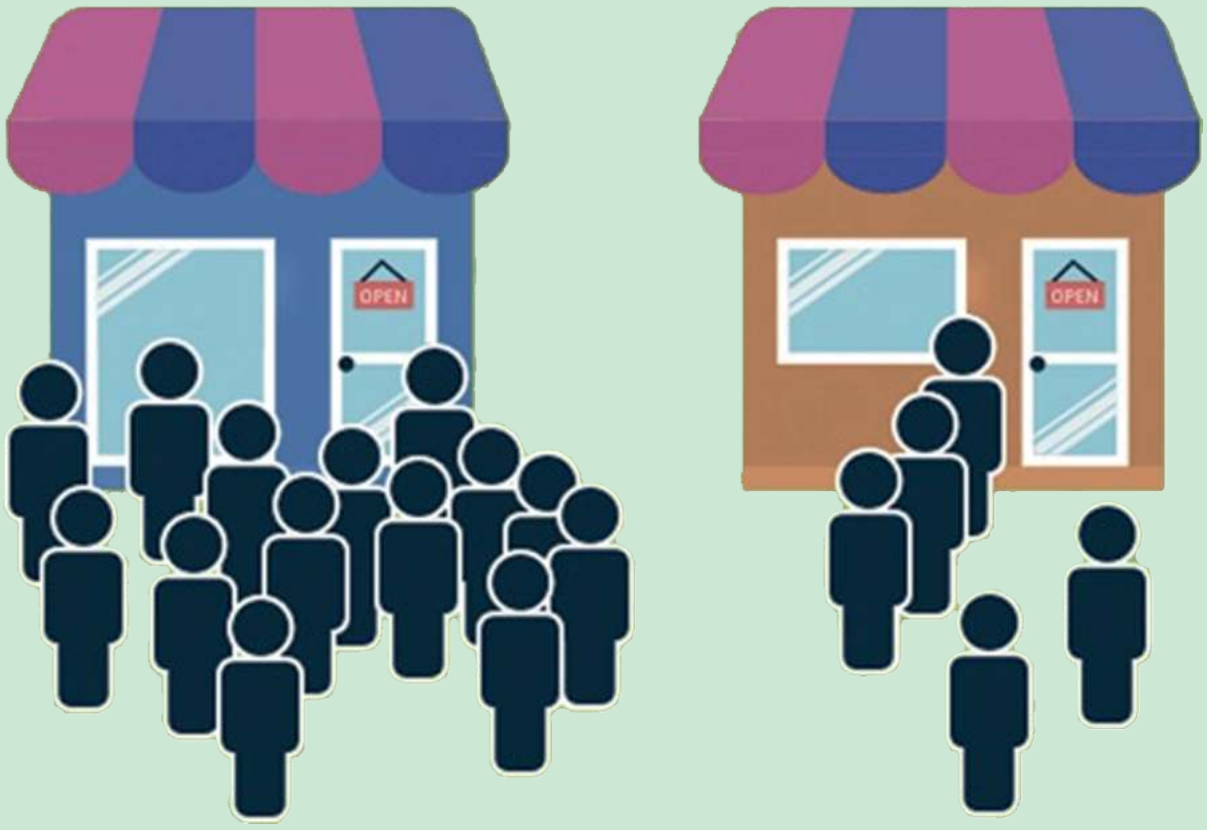
6 POPULATION DENSITY

The average population density of Nowshera district has significantly increased over the years. As per the 1998 census, the population density was much lower, but by 2017, it had grown to around 600 persons per sq. km, reflecting rapid urbanization and population growth. According to the 2023 census, Nowshera Tehsil is the most densely populated, with 1,173 persons per sq. km, followed by Pabbi Tehsil with 1,452 persons per sq. km, making it the most crowded area in the district. In contrast, Jehangira Tehsil remains the least densely populated, with 606 persons per sq. km. This trend highlights the growing population pressure on urban centers while rural areas remain relatively less populated.

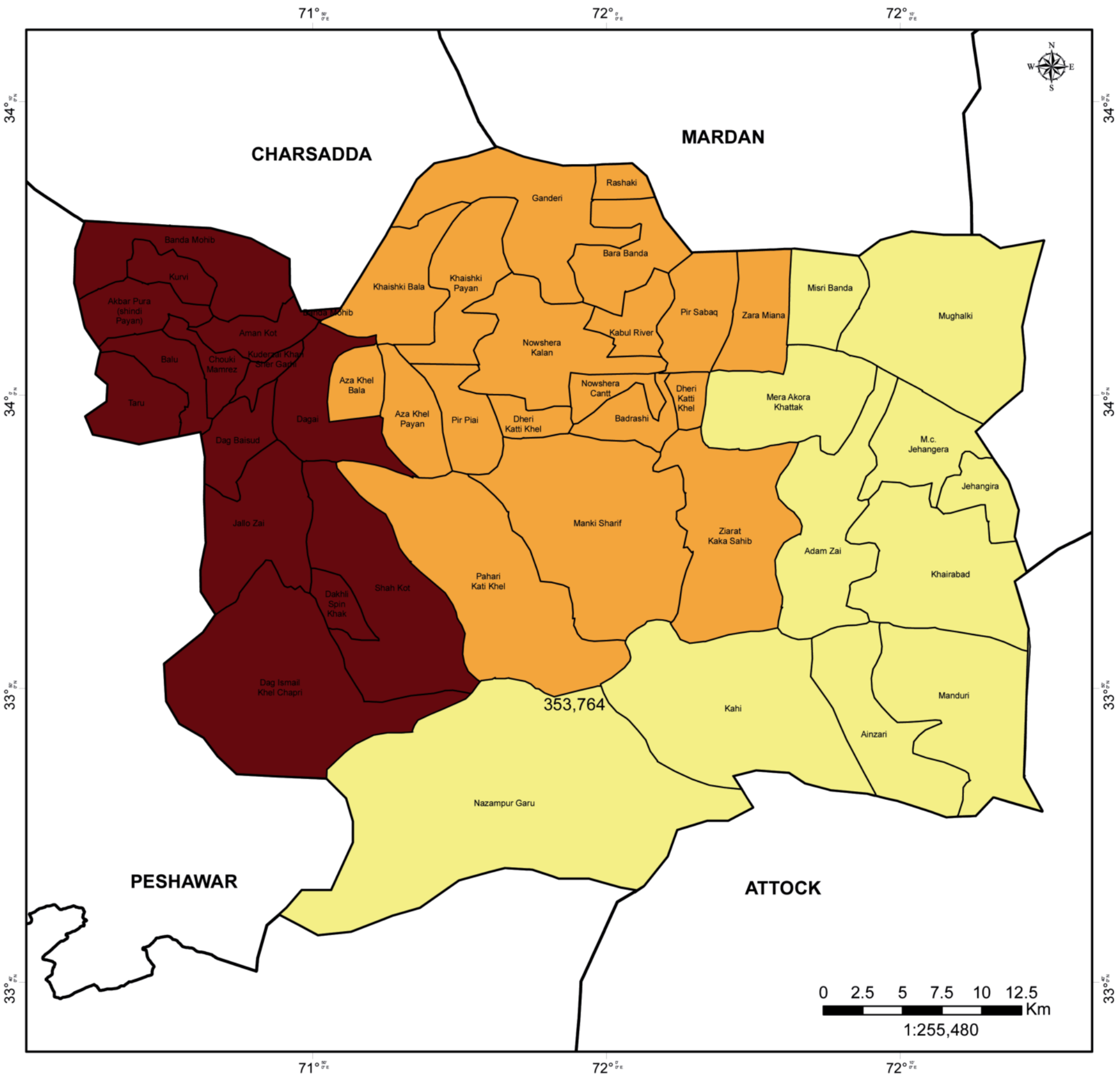
Tehsil wise Population Density

Tehsil	Area(Km²)	Male Population	Female Population	Population Density (people/km²)
Jehangira	718	221,953	213,031	606
Nowshera	679	405,342	390,884	1,173
Pabbi	351	259,681	249,814	1,452

Indicator	Estimated Value for Nowshera (2023)
Unemployment Rate	6.1% (National: 6.3%)
Family Member Working Outside Village/Town	27% (Provincial trend)
Household Members Having More Then 2 Possessions	93% (Based on PSLM trends)
Reciving Remittances from Pakistan	21% (Similar to KPK average)
Receiving Remitances from Abroad	4.2% (Provincial trend)



POPULATION DENSITY MAP



Legend

Population Density

- < 495
- 496 - 1075
- 1076 - 1250
- Union Council Boundary
- District Boundary

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PAKISTAN National Disaster Management Authority NDMA

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7 SETTLEMENTS

The settlements of Nowshera District include tehsils, union councils, cities, and villages. The district can be broadly classified into Urban Settlements and Rural Settlements based on population distribution and land use patterns. Nowshera primarily remains a rural district with a large number of villages spread across its area. However, rapid urban expansion, especially in areas along major highways and rivers, has contributed to the growth of urban settlements over time.

Land Use Pattern (2000 & 2023)

Land Use Class	Area		Change
	Year 2000	Year 2023	
Built-Up Area	15.8%	21.3%	5.5%
Agriculture	62.5%	69.1%	6.6%
Water Bodies	0.22%	0.18%	-0.04%
Barren	21.5%	9.4%	-12.1%

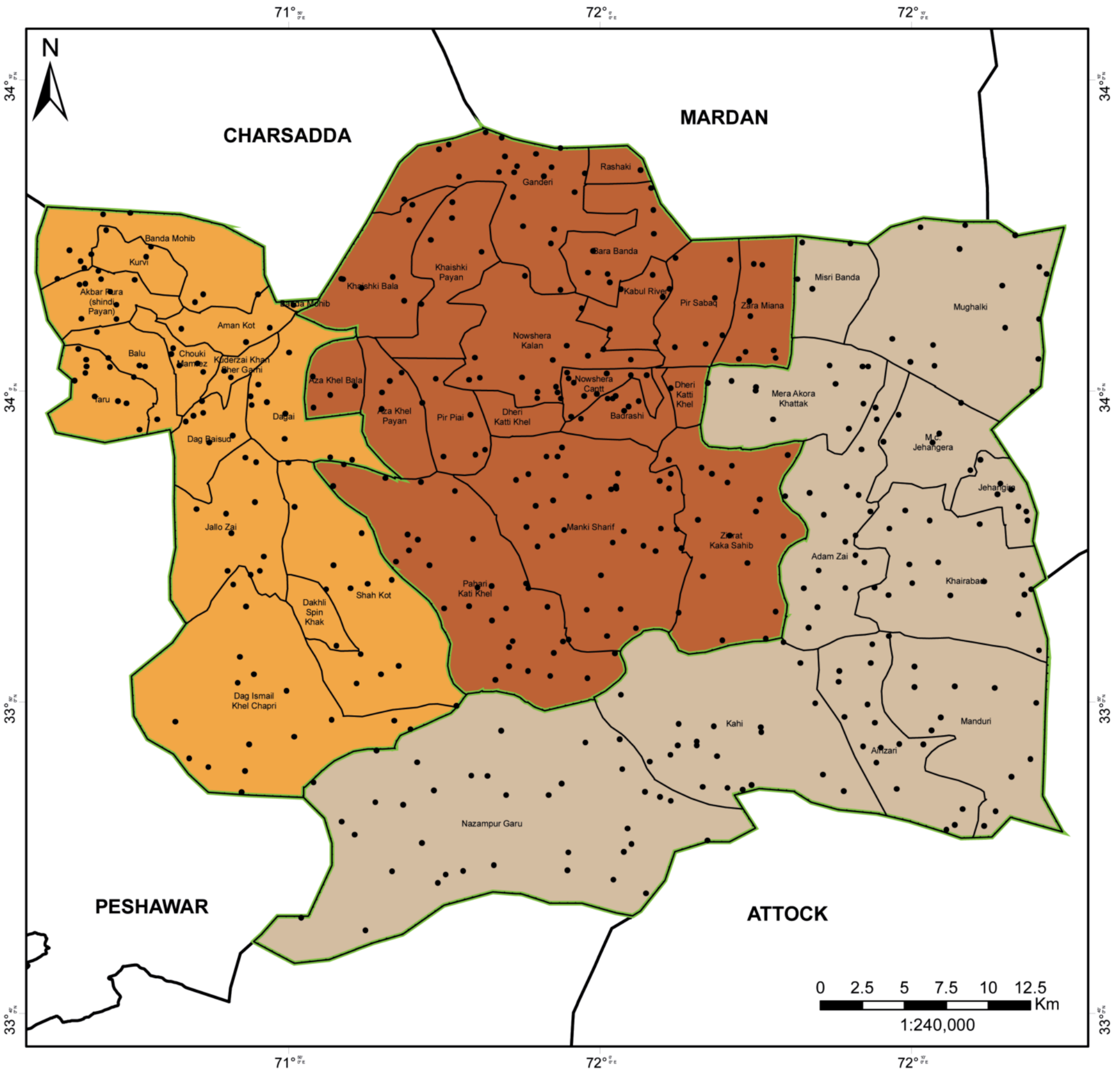
Urban expansion in Nowshera between 2000 and 2023 reflects a transformation in land use, with increased built-up areas and reduced barren land. Agricultural land remains a dominant feature, but urbanization and infrastructure development have influenced its distribution.
The built-up area in Nowshera has increased from 15.8% in 2000 to 21.3% in 2023, reflecting urban sprawl and population growth. Agricultural land also expanded slightly, while barren land saw a notable decline. The reduction in barren land highlights the conversion of land into settlements and cultivated areas.

Nowshera's strategic location along major transport corridors, including the Grand Trunk (GT) Road and M-1 Motorway, has significantly contributed to urban expansion, making it a key urban-rural transition district in Khyber Pakhtunkhwa.

List of Settlements of Nowshera

Katti Miana	Pir Pai	Pir Piai	Dokhala	Akhkari Dheri	Khawari Banda	Pir Sabak	Cherat
Sanwar Khel	Amangarh	Sado Khel	Aba Khel	Kheshgi Payan	Kuz Malli Khel	Piran	Cherat Forest
Nandrak	Lockhart Lines East	Kawari	Kuz Pitao	Kheshgi Bala	Khashki Kandao	Gumbad Minor Number Two	Jani Kandao
Musa Darra Khwar	Sadr Bazar	Maroba	Shaheenabad	Sadr Bazar	Khuno Pitao	Indus Branch	Jarobai
Mala Kili	Hafiz Talao	Mir Kalan	Khan Kol	Munro Lines	Garhi Miangan	Mian Kili	Faqirabad
Khairabad	Kabul River	Garu	Jaffarabad	Khartum Barracks	Chamiaran Jor	Babar Kili	Dawarabad
Kutarpan	Khattak	Tut Talao	Maharramabad	Barret Lines	Gandab	Willock Lines West	Naki Kot
Mian Isa	Shaikhan	Gul Muhammed Talao	Assui Khel	Khushhal Kot	Shawangai	Akhkari Dheri	Dag
Tar Khel	Mandanr Yusufzai	Tarkai	Faizabad	Tor Dheri Baba	Pitao	Jahangira Minor Indus Branch	Arando Khwar
Warmando Khwar	Ali Muhammad	Tang Khwar	Shamshabad	Khat Kili	Dheri	Sahib Khel	Halkai Banda
Kanna Khel	Mashak	Kurona	Abdul Rashidabad	Dere Kili	Amiruh	Palosa Dhand	Shaikh Babar Shah Ziarat
Pirano	Maira, Sar-i-	Bahadur Khan Baba Ziaret	Darwaza Charpani	Sheno Kili	Mirbat Talao	Amangarh	Dawalas Ghaiban
Shekhai	Surkamar Dheri	Surang Kandao	Jalala Sar	Tor Dher	Mian Nur Talao	Saratoi Kandao	Dag Besud
Mandori	Lockhart Lines	Ashu Khel Tapo	Pole Baba	Hindu Talao	Tor Alged Kandao	Chittai Dheri	Dag Besud
Mandu Khel	Risalpur	Torosallo Talao	Darra	Lal Din Talao	Dwokhula Talao	Malakand Lines	Mirza Gul Baba
Mali Khel	Sewi	Malik Talao	Saro Sar	Zandau Talao	Mir Zangu	Turlandi	Shaikhan
Kahi	Shah Nur Talao	Haflizullah Talao	Ganderi	Nawe Kili	Ismail Khel	Pir Sabak Minor	Panah Kot
Nizampur	Karappa Talao	Akbar Shah Talao	Sar Toi	Dheri Zardad Distributary	Khawari Khwar	Naushahra	Gul Rekhan Kilai
Masum Khel	Mian Talao	Nowshera Cantonment	Wuch	Doshra Branch	Walai	Ambela	Karamzai Khwar
Spin Kana	Tarakai Ghashi Kandao	Peshawar Division	Kalladher Talao	Sultan Koruna	Wattar	Titara	Afghan Refugee Camp NO 3
Tangi Khwar	Mairasar	Mansfield Lines	Khatab Koruna	Tamid Khan Kili	Manai	Pabbi	Afghan Refugee Camp NO 2
Kalanjar	Sais Mandi	Nur Gul Babu Khwar	Sura Khel	Rahim Talao	Kabul River Canal	Bara River	Afghan Refugee Camp NO 1
Khat	Karappa Kandao	Tarkai Warbuz	Pir Sabak Dheri	Umarai	Shaidu	Akbarpura	Jabba Khattak
Rashaki	Narai	Musa Talao	Baba Lalma	Tangaru	Tangi	Banda Shaikh Ismail	Sherabad
Shagai	Pairmo Kandao	Irshadabad	Parazmian Kandre	Sarkai Algad	Kalinjar Khesh	Chauki Mamrez	Banda Khwar
Kalpani Nala	Mama Khel	Malikabad	Chitral Lines	Gajju Khel	Ziarat Kaka Khel Sahib	Amankot	Dagi
Khawari	Qazi Koruna	Zer Gul Talao	Tahsil	Kamar Sar	Mir Mian Talao	Kurwi	Och Khattack
Mughalki	Palmer Lines	Baruk Talao	Bangla Dheri	Mela	Ghoramunda Talao	Khush Maqam	Nurabad
Palosai	Mohmand	Manki	Gumbad Minor Number One	Chajut Sar	Bere Gashi Kandao	Banda Muheb	Banda Nabi
Akora Khattak	Kund	Manki Ghakhal	Nurak Talao	Tresir	Risalpur Railway Station	Peshungry	Qasim China
Dargai	Chashmai	Kuz Maharaji	Khwari Khwar	Tar Khel	Darwaza	Pabbi	Khan Bahadur Garhi
Darwazagai	Misri Banda	Ziarat Ijamal Baba	Sadr Nala	Roshani Kandao	Saman Talao	Babi Nao	Shabat Talao
Maharaji	Durran	Kutri Malang Baba	Kam Khwar	Dangarzai Talao	Shaikh Ahmad Baba, Ziarat	Chola Khwar	Shabra
Iseri	Amanpura	Malik Jafar Ghundai	Ghazi Talao	Mian Talao	Ziarat	Taru	Nobatabad
Hissartang	Shahidan Khwar	Garangai Baba Khwar	Risalpur Airfield	Mela Pitao Kandao	Pirano Kandao	Natkai Khwar	Jamal Mela China
Dangdang	Pitao	Asha Khel	Hafiz Talao	Teran Sar Kandao	Isori Banda	Tazadin Kanda	Shwake Khwar
Inzari Gandab	Urmandal Khwar	Spin Talao	Gid Bannu Koruna	Raja Hodi	Gharibpura	Ali Beg	Jabbar Khan Ghari
Behram Kili	Nariwala Kas	Mian Nur Talao	Spinkani	Naiano Kor	Kund Ghakhai	Lakarai Khwar	Hakim Khan Garhi
Bara Banda	Khasarai	Shaikhi Banda	Kam Walai	Ranjo Kandao	Kheshgi Distributary	Ghund	Zakhi Char Bagh
Bahadur Khel	Gandai Khwar	Palosin Khwar	Drang Khwar	Tangi Kandao	Pir Mela	Mulgana	Dheri Zardad
Dheri Kati Khel	Spina Mela	Aza Khel Bala	Garab Kandao	Kawa	Bazigai Talao	Shah Dhand	Shaikh Baba Ziarat
Jabbi	Lashora	Aza Khel Payan	Nowshera District	Thoa	Sarkan Dhand	Bagga Patai	Jabba
Bazidi	Khawarra	Miruddin Talao	Tutki	Baba Sahib, Ziarat	Toru Inspection Bungalow	Tarif	Jindai Khwara
Nasar Talao	Spin Kanare Kalon	Lakarai	Sarkai Algad	Baba Talao	Buchaki Shahid Ziarat	Wazir Garhi	Ali Shah
Massam Dheri	Bar Palosai	Cherat Cement Factory	Nowshera	Tagha Jor	Suria Khel	Mindao Shahid	Banda Malahan
Karan Sar Talao	Mast Baba Ziaret	Garmazai Khwar	Mazari Tang Payan	Nawab Talao	Tangaru Kandao	Spera Kandao	Kudezai
Mian Dheri	Qamar Mela	Khawarra	Mazari Tang Bala	Mela Talao	Nawa Kalai	Jalozai	Dheri
Pir Sabak Distributary	Uch Khar	Badrashi	Khawarra Reserve Forest	Sur Talao	Shalidullah Talao	Zao Banda	Mumin Garhi
Biro Dhand	Shilgai Khar	Afghan Refugees Camp	Dargai Ziarat	Balish Baba Talao	Jahangira Road	Manduro Baba	Pabbi Branch
Misri Banda Minor	Nizamai	Shah Kalim Khwar	Jungrai	Abak Baba Ziarat	Jammu	Bakhtai	Akhun Panjo Sahib Ziarat
Zando Banda	Kunar Kandao	Thula Hawai	Toru Sar	Kalai Kandao	Bori Khwar	Silah Khana	Khazam
Khairuddin Dhand	Katti Khel	Adamzai	Kwaharra	Faqir Baba Ziarat	Watar	Shahkot Bala	Nasar Kili
Halim Akhun	Bachai Nala	Nehalpura	Kamalzai	Khairabad-Kund	Parara	Kotli	Jabba
Pir Kandah	Lagrai Baba Ziaret	Afghan Refugees Camp	Azim Dhand	Wuch Tangi Khwar	Kandar	Shahkot Payan	Zakhi Kono
Toru Minor	Ghalib Gul Baba	Naudehl	Tutkai Talao	Kuz Parara	Zara Miana	Chapri	Kandar

SETTLEMENTS MAP



Legend

- Settelments

Union Council Boundary

District Boundary

Tehsil Boundary

Jahangira

Nowshera

Pabbi

Multi Hazard Vulnerability & Risk Assessment, Nowshera, Khyber Pakhtunkhwa, Pakistan

10 TRANSPORTATION NETWORK

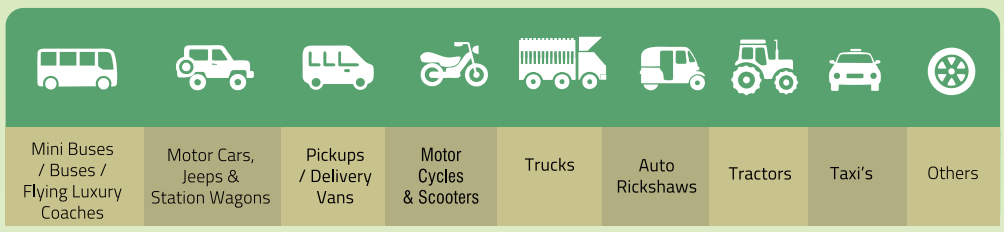
Nowshera District has a well-developed transportation network that plays a crucial role in connecting it to major cities and regions. The district is a key transit hub due to its location along the Grand Trunk (GT) Road, M-1 Motorway, and railway lines.
The district has an extensive road network, including primary highways, secondary roads, and rural access roads. Major roads in the district include:

- Grand Trunk (GT) Road (N-5): Connects Peshawar, Nowshera, and Rawalpindi.
- M-1 Motorway: Provides a high-speed link between Peshawar and Islamabad.
- Nowshera-Charsadda Road: Connects Nowshera with Charsadda and Mardan.
- Nowshera-Swabi Road: Links Nowshera to Swabi and the Tarbela region.

Road Length in Nowshera District (km)

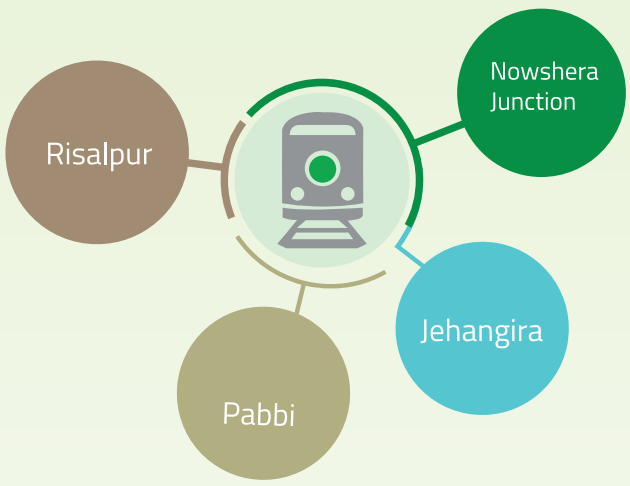
Road Type	Length (km
National Highways (GT Road - N5)	110 km
Motorways (M-1 Section in Nowshera)	50 km
Provincial Highways	200 km
District Roads (Paved)	600 km
Rural Access Roads (Unpaved)	540 km
Industrial Roads (CPEC & Others)	100 km

Vehicles Types

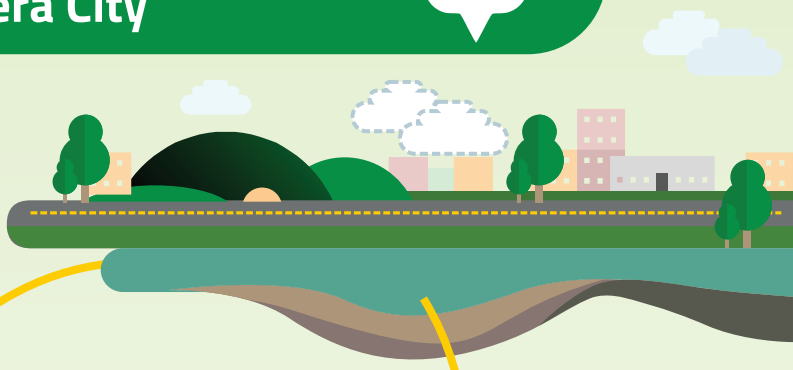


Total Vehicles Registration
80,590

Railway Stations



Nearest Major Airports from Nowshera City



45 km

Bacha Khan International Airport (Peshawar)

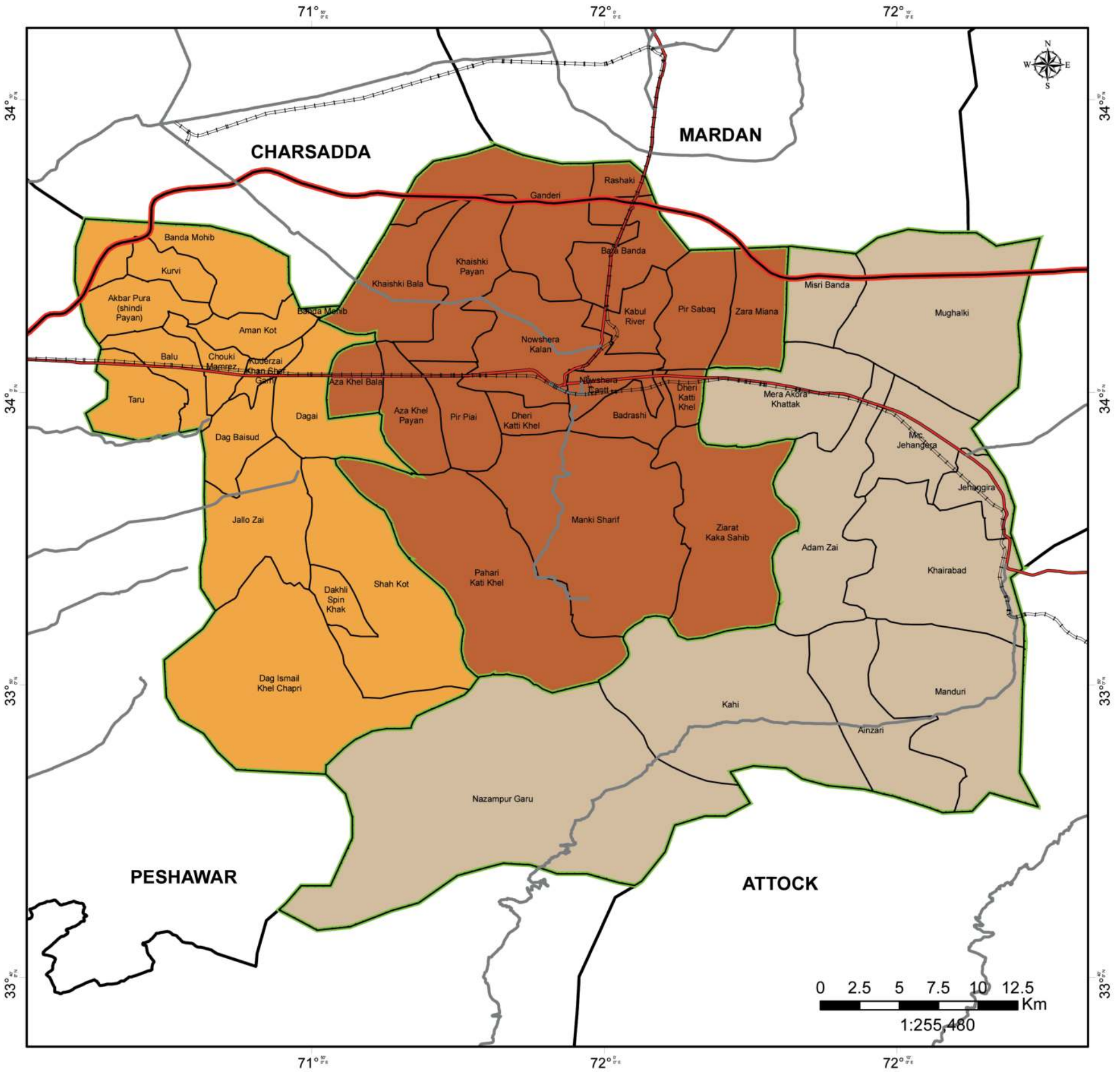
Peshawar

110 km

Islamabad International Airport

Islamabad

TRANSPORTATION NETWORK MAP



Legend

- Railway Tracks
- Major Roads
- Motorways
- National Highway
- Strategic Road
- District Boundary
- Union Council Boundary

Tehsil Boundary

- Jahangira
- Nowshera
- Pabbi

Multi Hazard Vulnerability & Risk Assessment, Nowshera, Khyber Pakhtunkhwa, Pakistan

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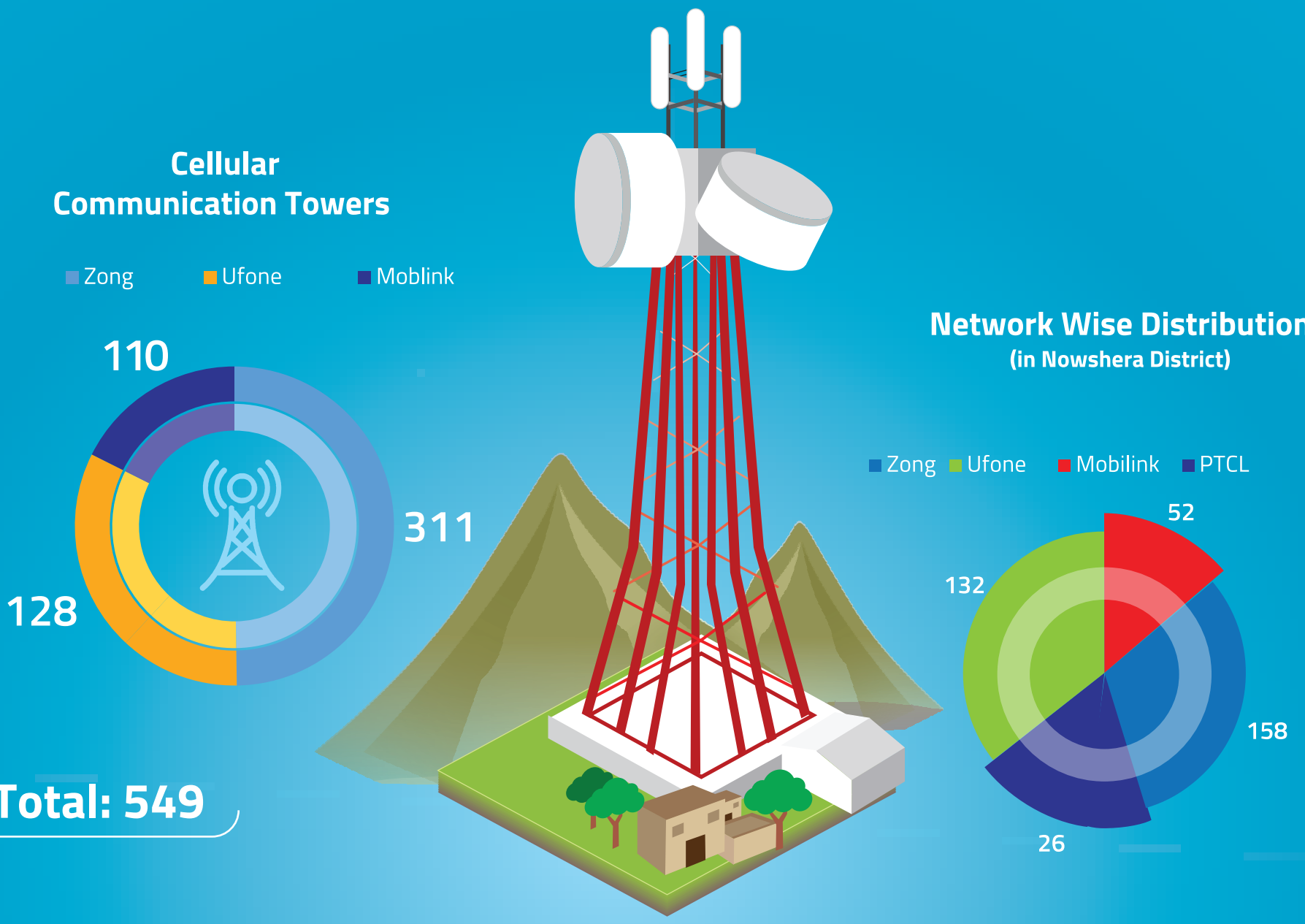
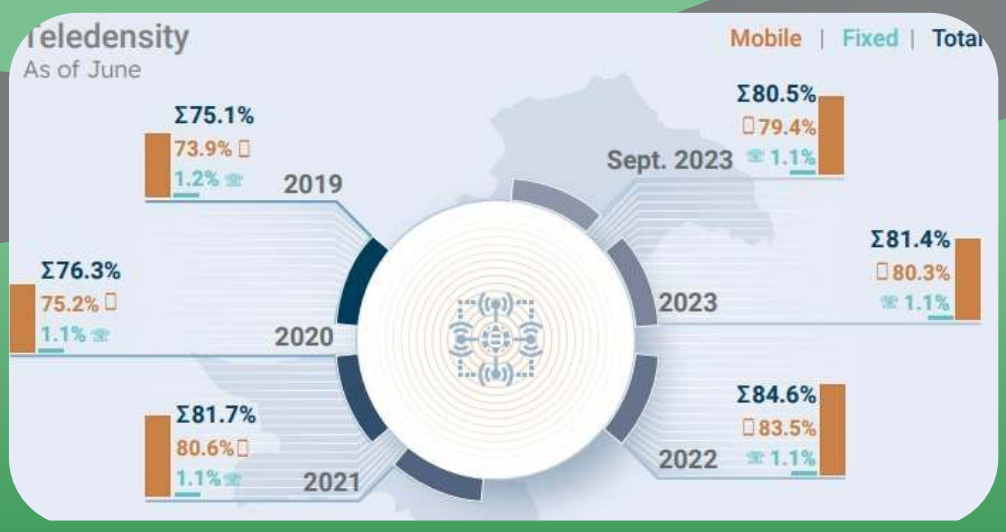
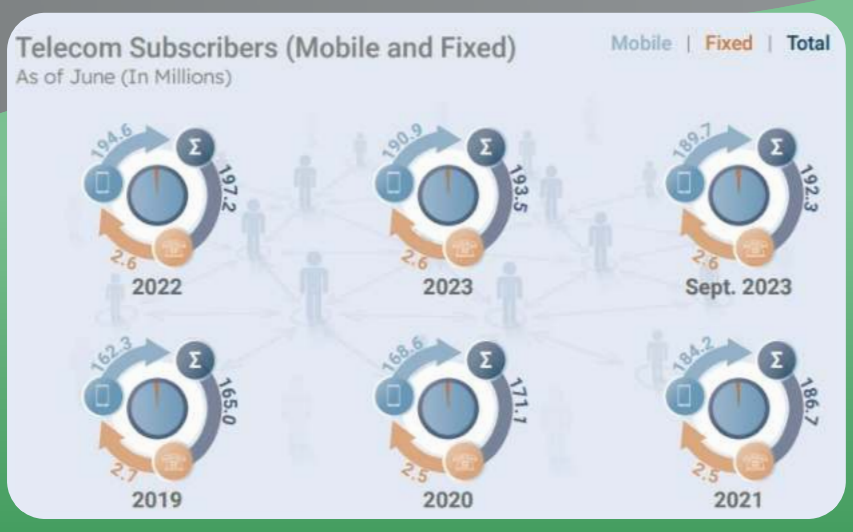
11 TELECOMMUNICATION

Telecommunication services in Nowshera District have evolved significantly over the past two decades, transitioning from traditional landline-based communication to a rapidly expanding mobile and broadband network. With growing digital connectivity, the district now enjoys extensive coverage from multiple cellular networks, improving communication, business opportunities, and access to digital services.

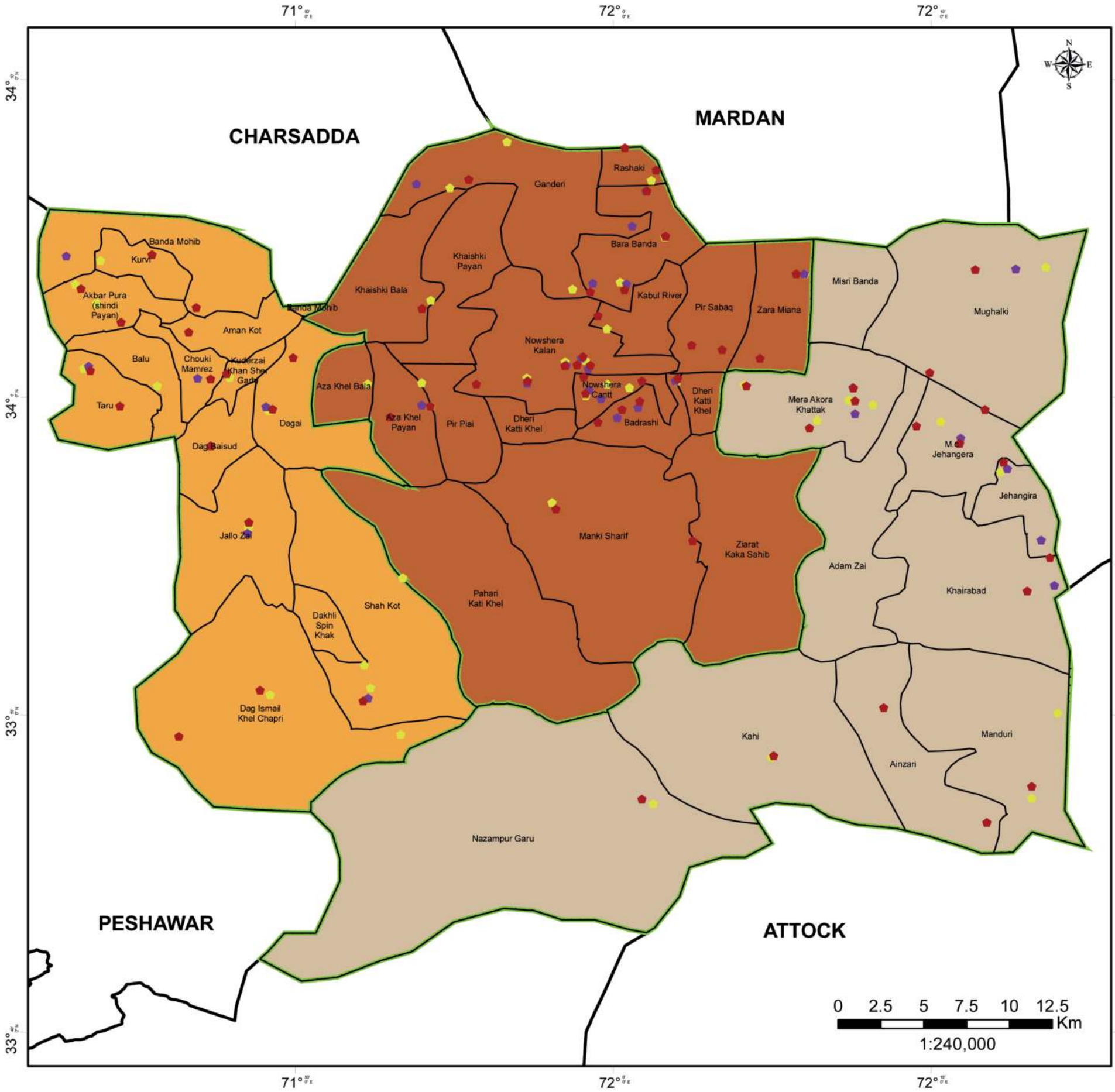
Nowshera District has a well-established telecommunication infrastructure, with 26 telephone exchanges providing 8,136 landline connections to residential and commercial users. Despite the decline in landline usage, mobile networks have seen significant growth, with Zong leading with 158 cellular towers, followed by Ufone with 132 towers and Jazz with 52 towers. This widespread mobile coverage ensures reliable connectivity across the district, supporting communication, business activities, and digital services. As mobile broadband continues to expand, Nowshera is well-positioned for further advancements in digital connectivity and network enhancements.







COMMUNICATION TOWER MAP



Legend

- Zong
- Mobilink
- Ufone
- Union Council Boundary
- District Boundary

Multi Hazard Vulnerability & Risk Assessment, Nowshera, Khyber Pakhtunkhwa, Pakistan

PAKISTAN National Disaster Management Authority NDMA

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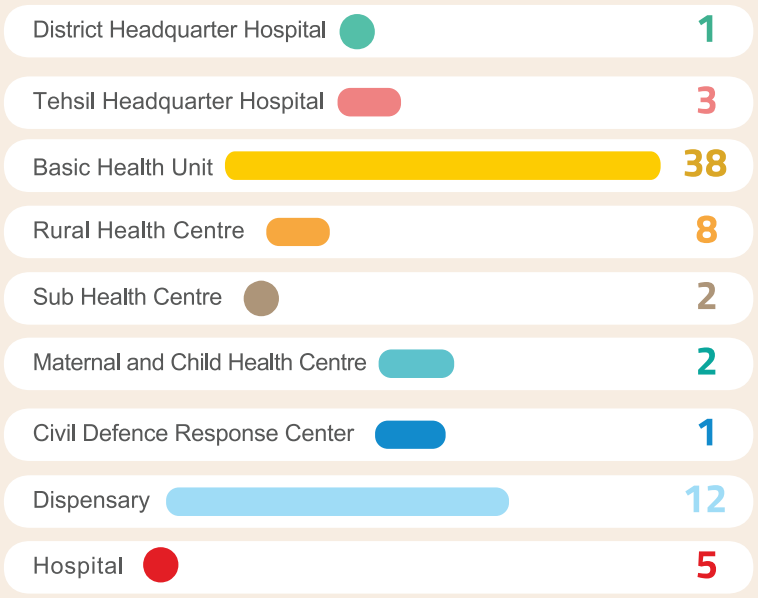
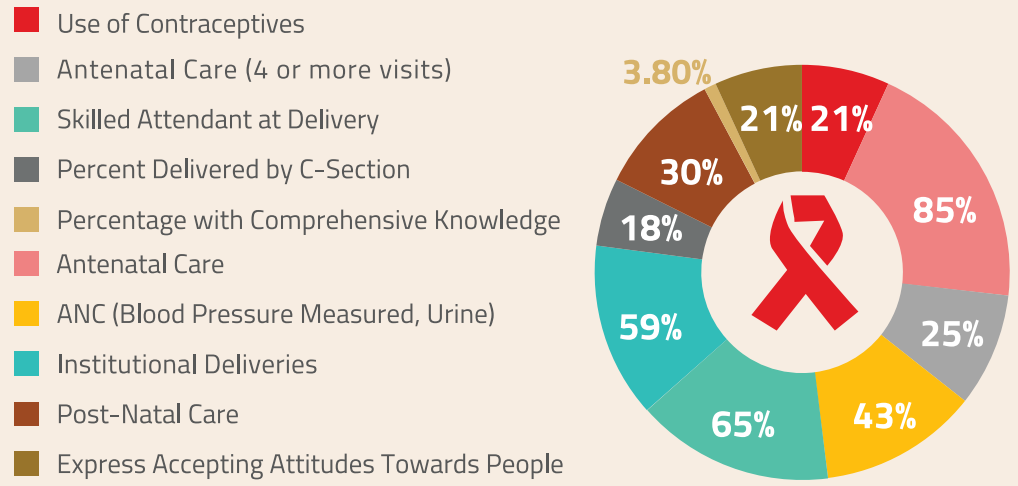
12 PUBLIC HEALTHCARE FACILITIES

The provision of easily accessible, affordable and quality Healthcare facilities is among the basic amenities of life that must be provided to the people for their wellbeing and health safety. Health facilities include hospitals, clinics, maternal & birth centers, dispensaries and other forms of health care centers.

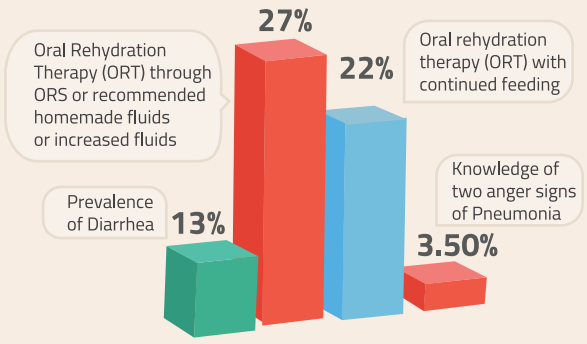
Health Facilities by Type



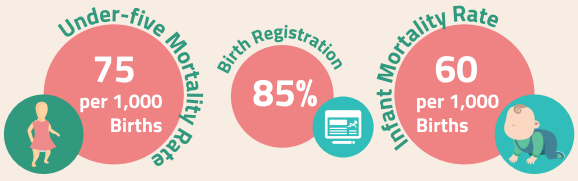
Reproductive Health (HIV /AIDS Statistics)



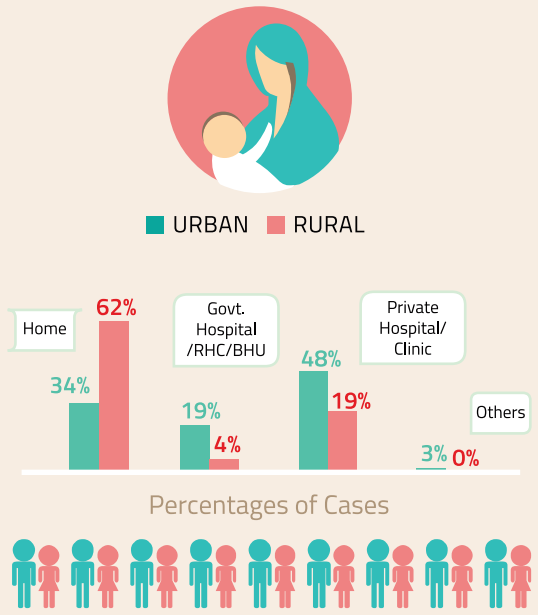
Statistics of Disease in Children



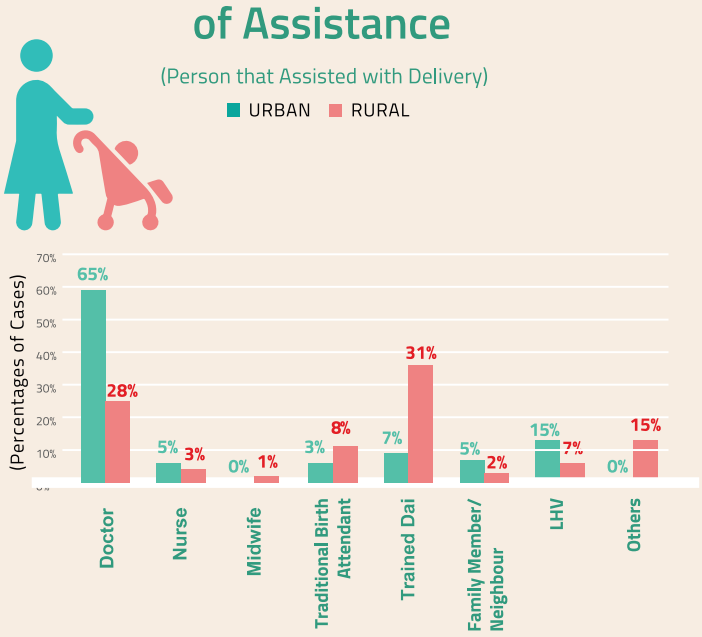
Child Mortality Statistics



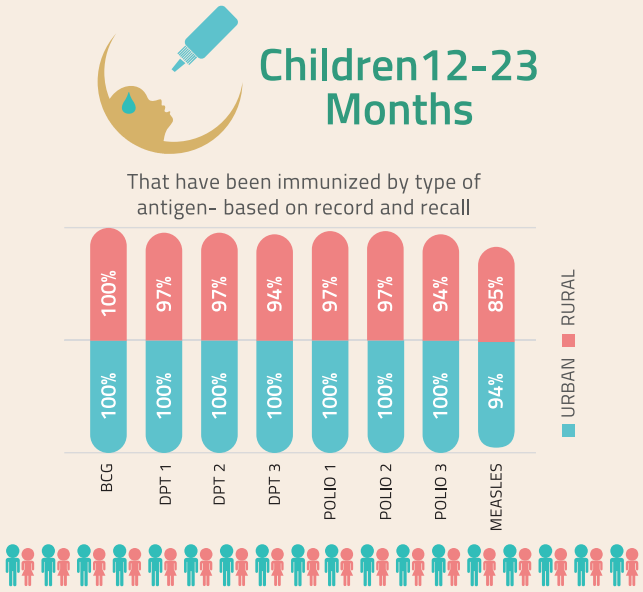
Child Delivery by Location



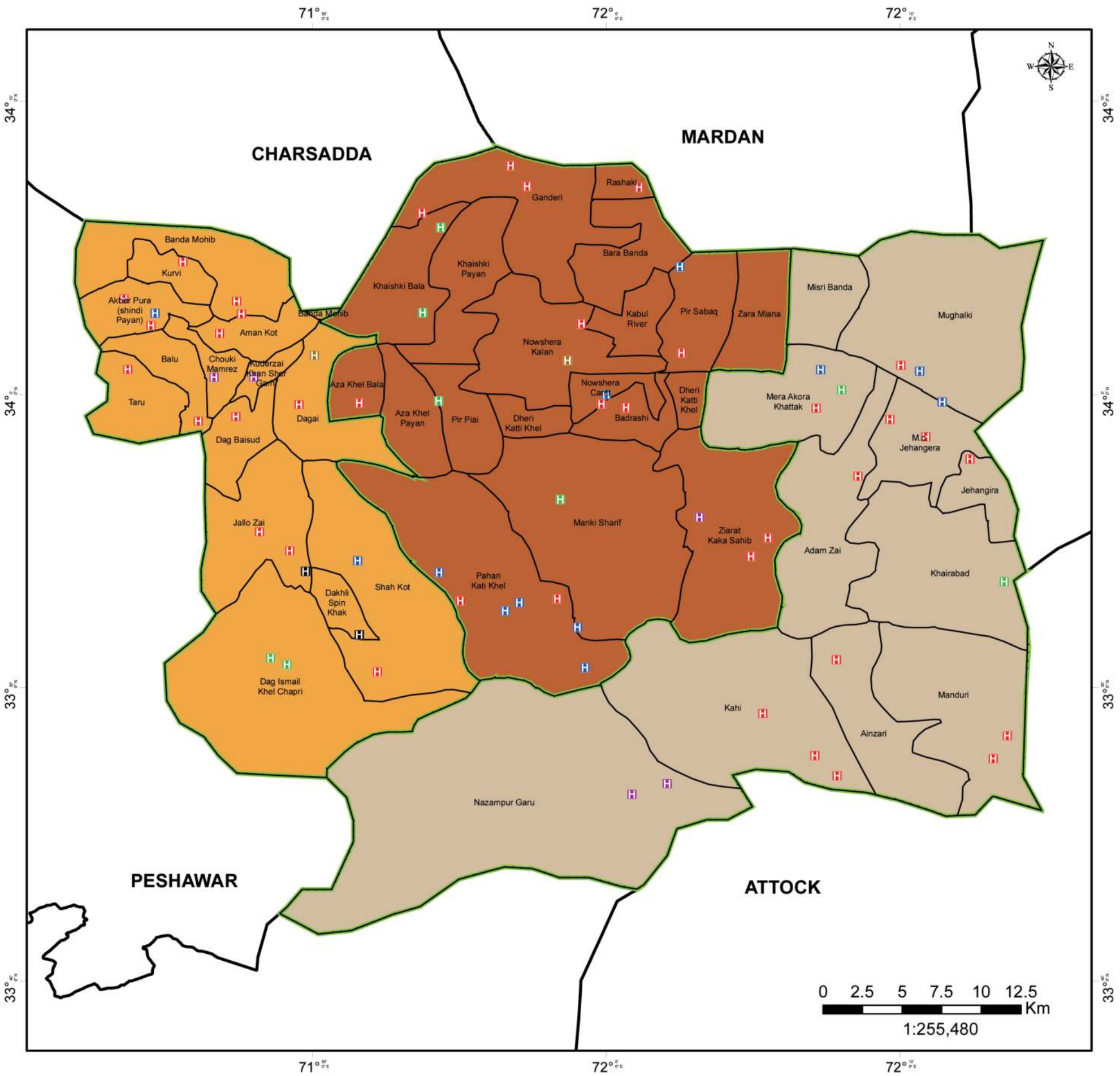
Child Delivery by Type of Assistance



Children12-23 Months



HEALTH FACILITIES



Legend

- BASIC HEALTH UNIT
- DISPENSARY
- HOSPITAL
- MATERNAL & CHILD HEALTH CENTRE
- RURAL HEALTH CENTRE
- SUB HEALTH CENTRE

- District Boundary
- Union Council Boundary

Tehsil Boundary

- Jahangira
- Nowshera
- Pabbi

Multi Hazard Vulnerability & Risk Assessment, Nowshera, Khyber Pakhtunkhwa, Pakistan

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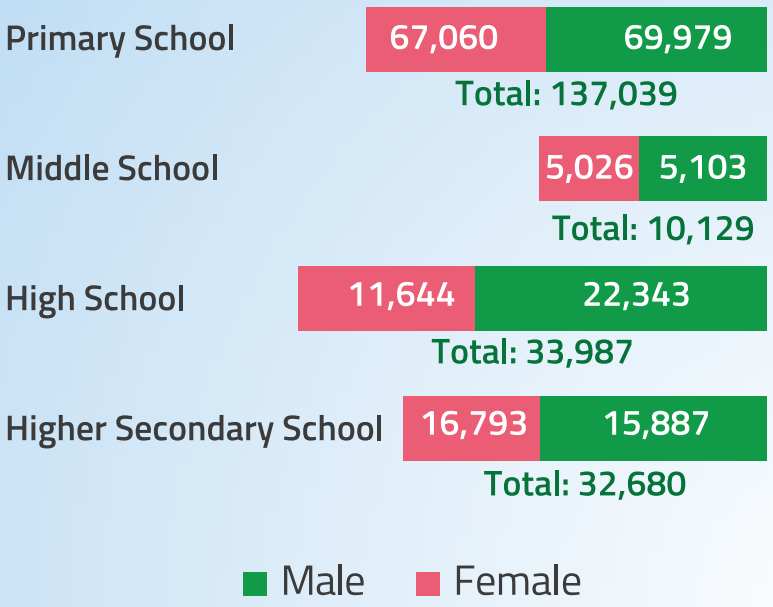
13 PUBLIC EDUCATION FACILITIES

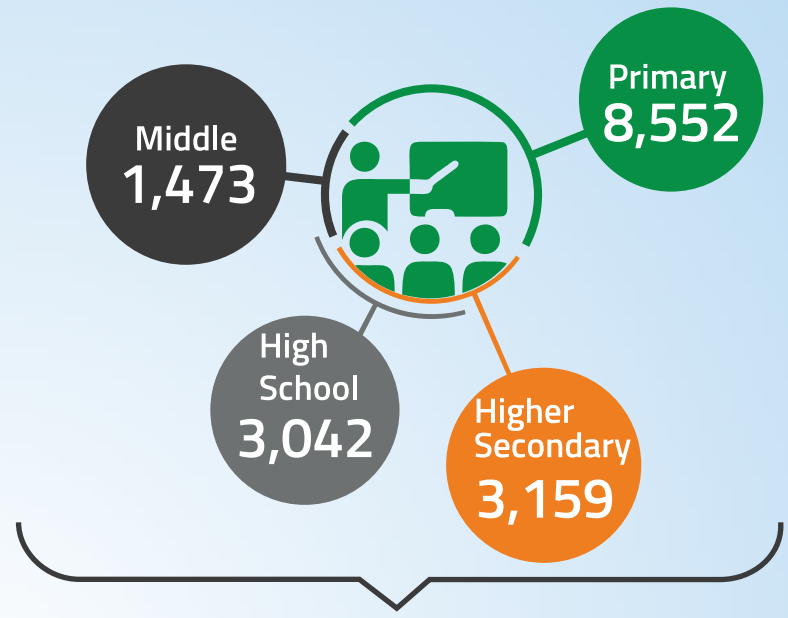
Education Facilities

Govt. Schools	Private Schools	Colleges	Universities
1027	305	26	4

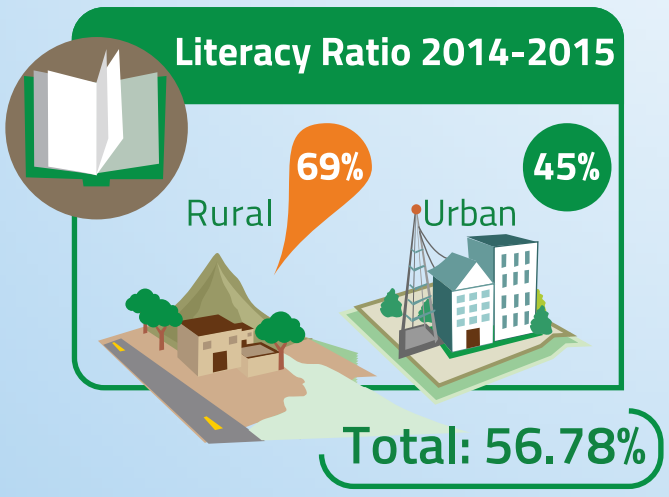
Total Enrollment by Type

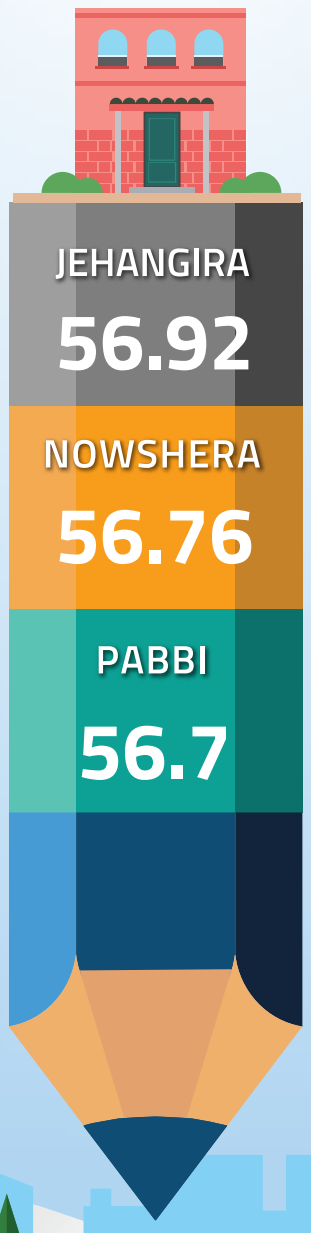


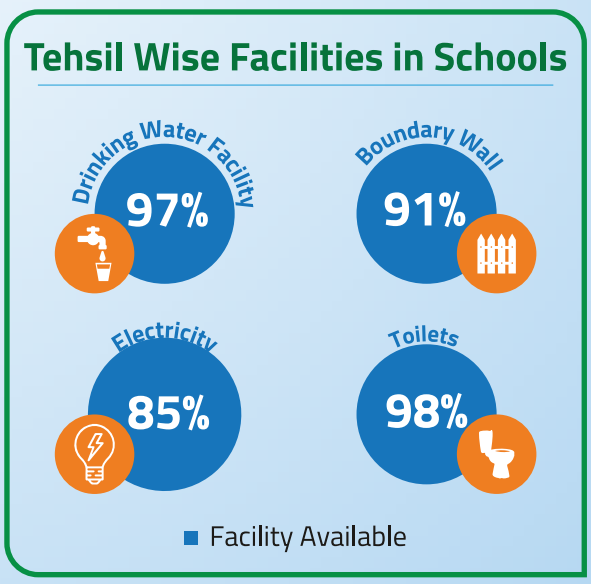
Number of Teachers



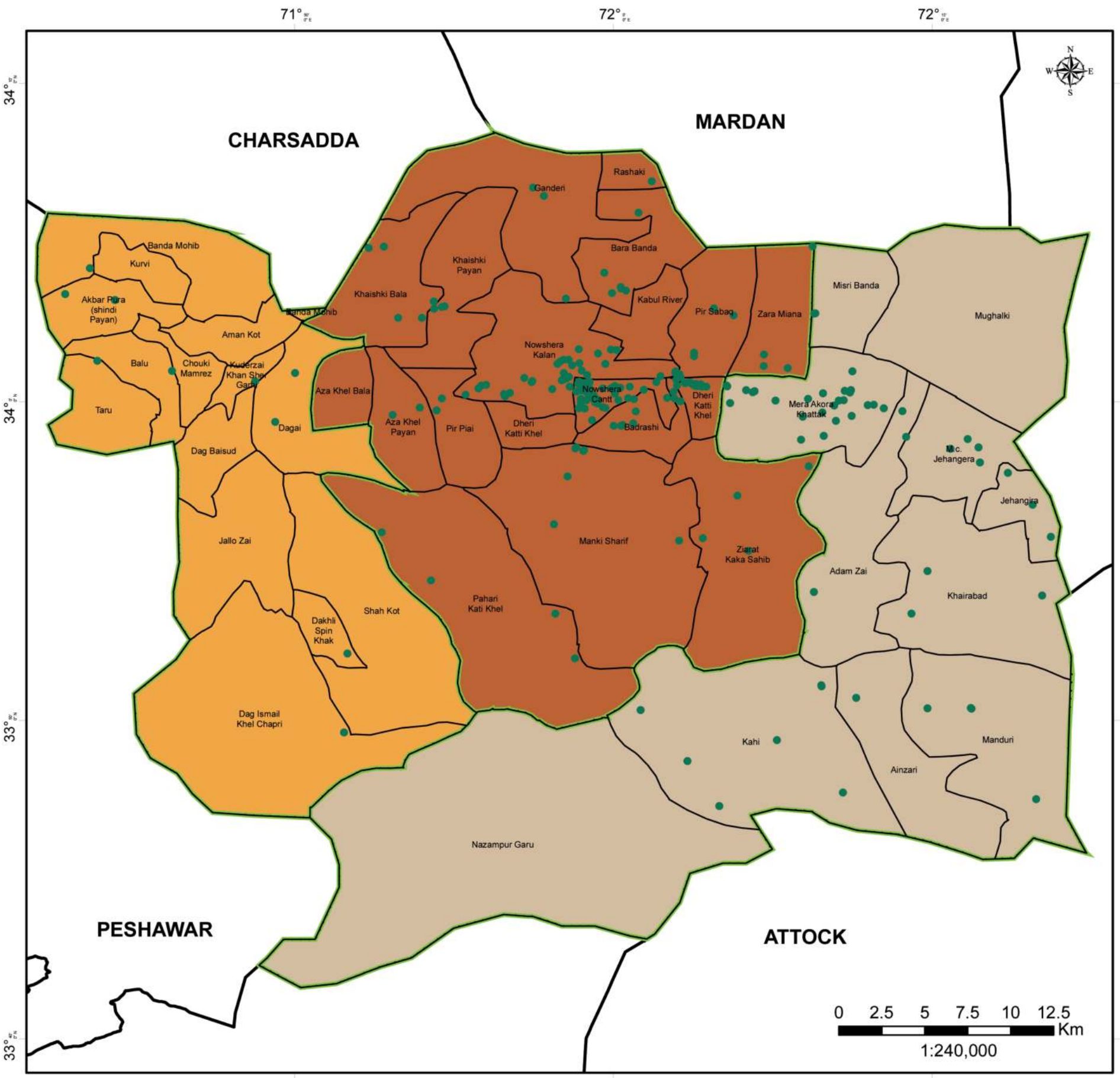
Tehsil Wise Literacy Rate







EDUCATION FACILITIES MAP



Legend

- Education Facilities
- Union Council Boundary
- District Boundary

Tehsil Boundary

- Jahangira
- Nowshera
- Pabbi

Multi Hazard Vulnerability & Risk Assessment, Nowshera, Khyber Pakhtunkhwa, Pakistan

PAKISTAN National Disaster Management Authority NDMA

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14 IRRIGATION INFRASTRUCTURE

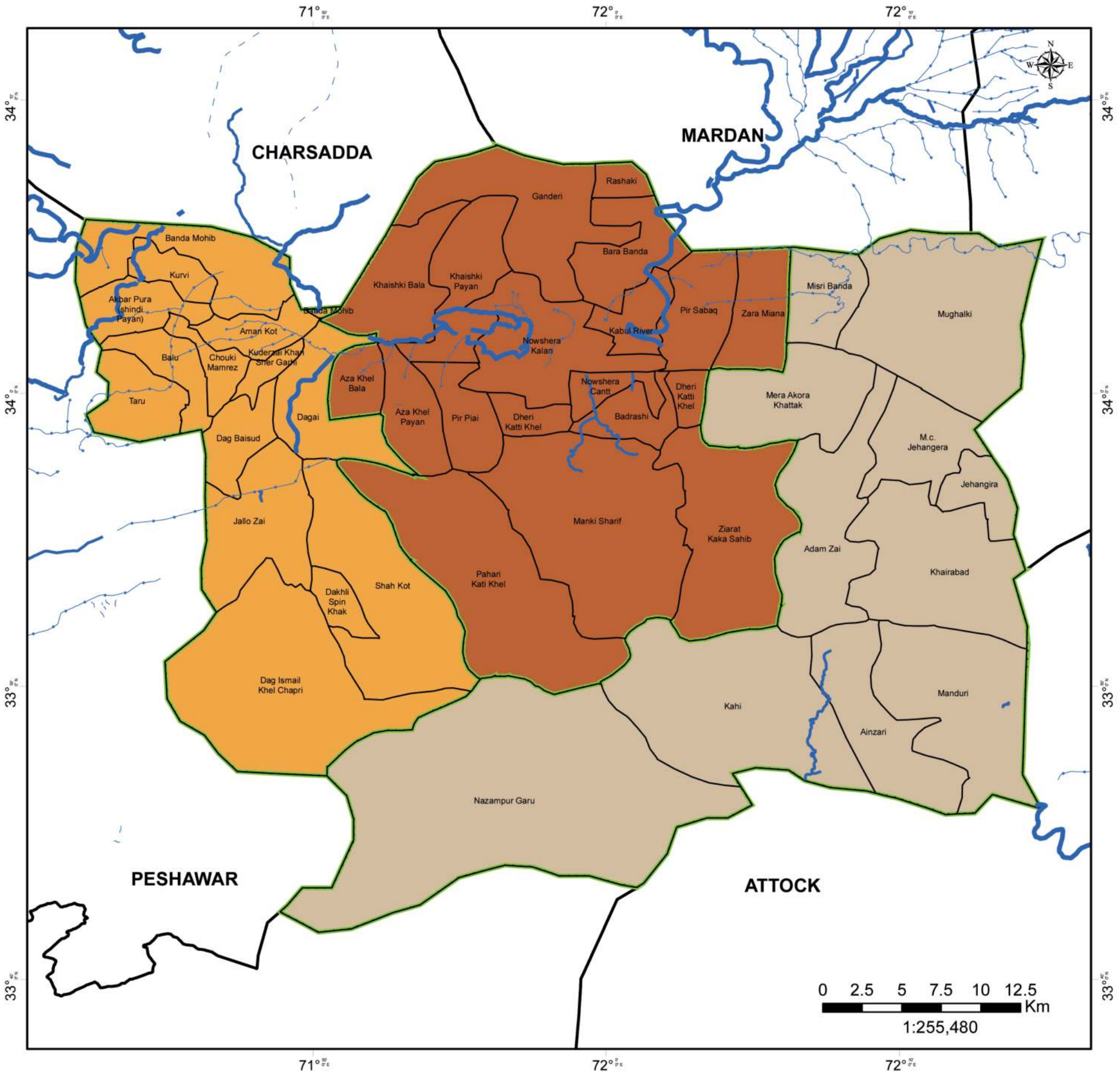
District Nowshera, located in Khyber Pakhtunkhwa (KP), Pakistan, has a well-established irrigation system that plays a crucial role in sustaining its agriculture-based economy. The district primarily relies on surface water irrigation, sourced from the Kabul River and Swat River, which supply water to an extensive canal network. The Upper Swat Canal, originating from the Amandara Headworks, is the largest irrigation source, stretching approximately 261 km and distributing water through multiple branches, including the Lower Swat Canal and Jalala Canal, to farmlands in Nowshera and neighboring districts. The Warsak Canal, sourced from the Warsak Dam on the Kabul River, extends 110 km and serves both irrigation and flood control functions. Additionally, the Lower Kabul River Canal (80 km) provides supplementary water to agricultural areas along the Kabul River basin. Apart from surface water, a significant number of tube wells and wells are used for irrigation, particularly in areas where canal water is insufficient. However, excessive groundwater extraction has led to declining water tables in certain regions. In some areas, rain-fed (barani) agriculture is practiced, but it remains vulnerable to climate variability and droughts. The irrigation system faces several challenges, including seasonal water shortages, siltation of canals, waterlogging, and flooding from the Kabul River, which often damages agricultural lands. The government and irrigation authorities have undertaken projects to modernize the system, including canal lining, improved water distribution mechanisms, and the promotion of water-efficient irrigation techniques like drip and sprinkler irrigation. The Khyber Pakhtunkhwa Irrigation Department and other organizations are working to enhance water conservation strategies and introduce climate-resilient agricultural practices to ensure long-term sustainability. Despite these efforts, population growth, increasing water demand, and climate change impacts pose ongoing challenges, making it imperative to adopt integrated water resource management and sustainable irrigation solutions to secure agricultural productivity in Nowshera.

Canal System of District Nowshera

District Nowshera has an extensive canal network sourced primarily from the Swat and Kabul Rivers. These canals provide essential irrigation to agricultural lands, ensuring food security and livelihood support for local farmers. Below is a detailed overview of the canal system in the district:

Canal Name	Source	Length (km)	Main Branches & Distributaries	Areas Served	Key Features & Remarks
Upper Swat Canal	Amandara Headworks (Swat River)	261 km	Lower Swat Canal, Maira Branch, Machai Branch	Mardan, Nowshera, Swabi	Major irrigation canal, serving thousands of acres of farmland.
Warsak Canal	Warsak Dam (Kabul River)	110 km	Various minor distributaries	Peshawar, Nowshera	Supplies water for irrigation and also helps in flood control.
Lower Swat Canal	Branch of Upper Swat Canal	84 km	Connected to various minor canals	Nowshera, Mardan	Provides additional irrigation water to lower areas of Nowshera.
Lower Kabul River Canal	Kabul River	80 km	Sub-canals and distributaries	Nowshera, Peshawar	Helps irrigate fields along the Kabul River Basin.
Kheshgi Canal System	Kabul River	261 km	Lower Swat Canal, Maira Branch, Machai Branch	Mardan, Nowshera, Swabi	Major irrigation canal, serving thousands of acres of farmland.
Upper Swat Canal	Amandara Headworks (Swat River)	30 km	Minor irrigation channels	Kheshgi, Nowshera	Supports irrigation in Kheshgi plains, crucial for local farming.
Jalala Canal	Upper Swat Canal System	40 km	Small branches	Nowshera, Mardan, Swabi	Supports irrigation of major crops like wheat and maize.
Zarai Distributary System	Various sources	50 km	Multiple small distributaries	Throughout Nowshera District	Supplies water to remote agricultural areas.
Total Length of Major & Minor Canals	Multiple Sources	500 km		Entire Nowshera District	Includes both primary canals and secondary irrigation networks.

IRRIGATION MAP



Legend

- River
- Ditch
- Drain
- Canal
- stream
- District Boundary
- Union Council Boundary

Tehsil Boundary

- Jahangira
- Nowshera
- Pabbi

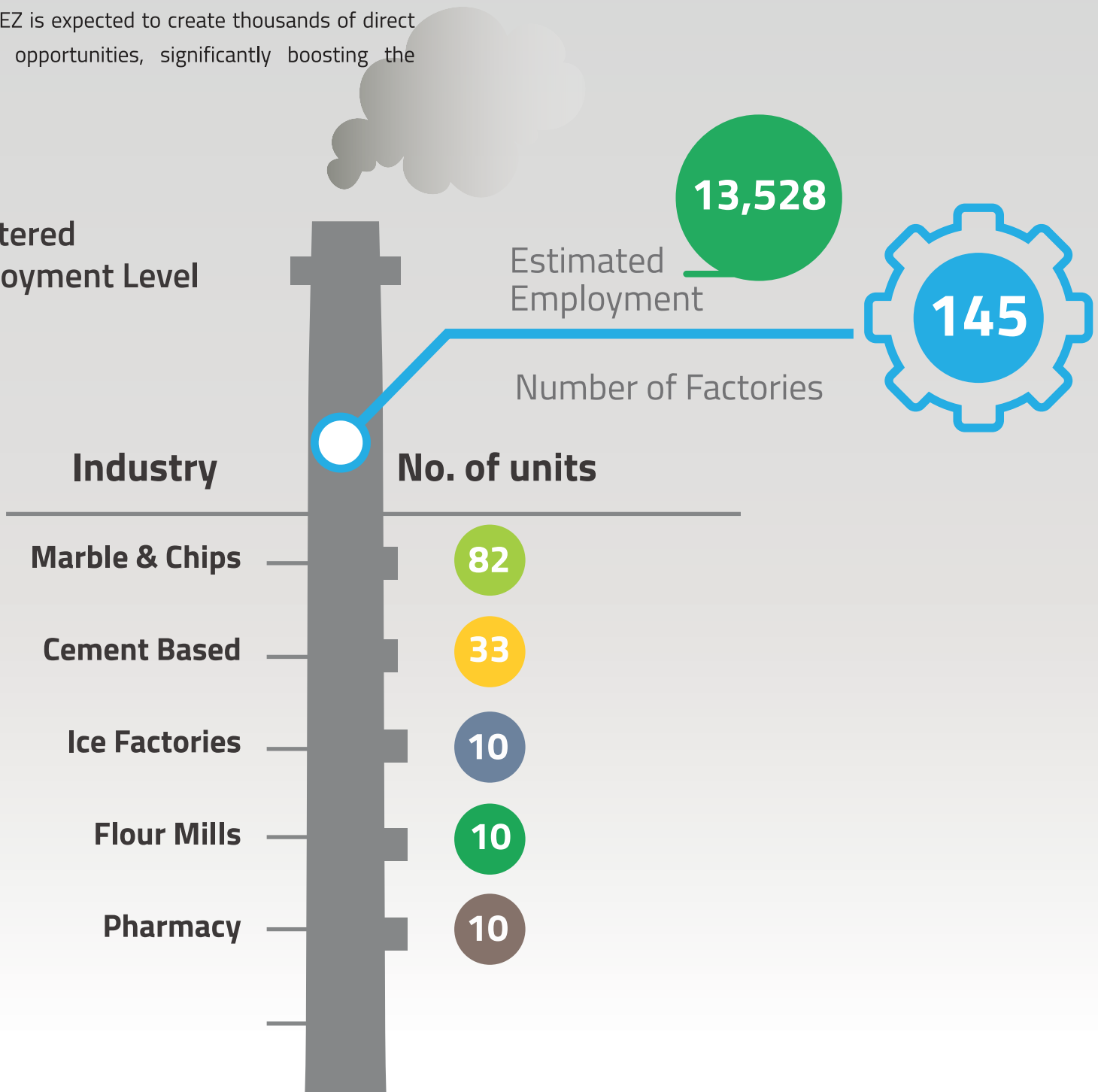
Multi Hazard Vulnerability & Risk Assessment, Nowshera, Khyber Pakhtunkhwa, Pakistan

UN-HABITAT

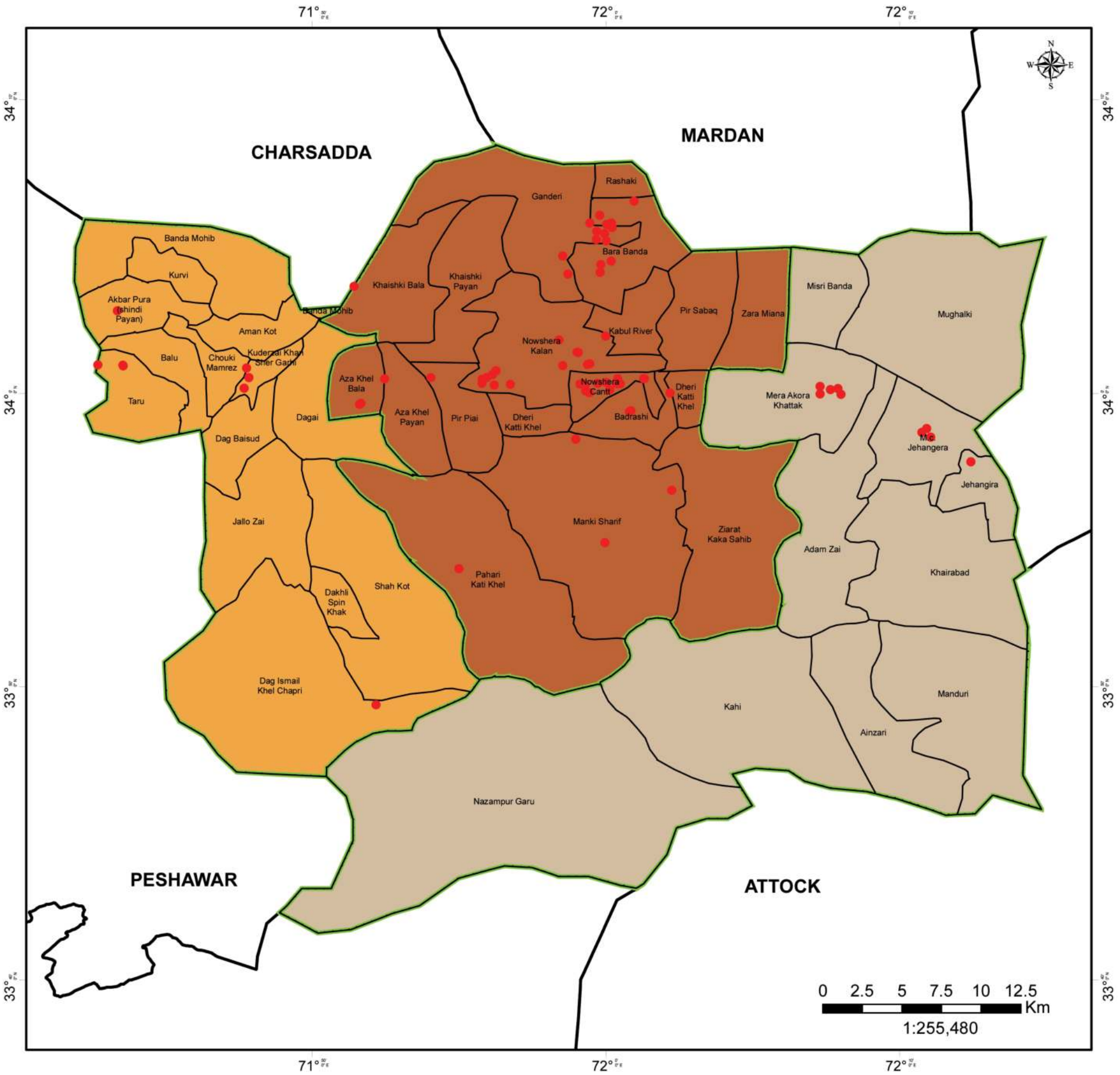
15 MAJOR INDUSTRIES

Nowshera District, is emerging as a key industrial hub due to its strategic location along major transportation routes, including the M-1 Motorway. The district hosts a diverse range of industries, including textiles, food processing, cement, pharmaceuticals, and metal works. One of the most significant developments is the Rashakai Special Economic Zone (SEZ), which spans approximately 1,000 acres and is designed to attract both local and foreign investment in sectors such as manufacturing, automotive, and technology. The SEZ is expected to create thousands of direct and indirect employment opportunities, significantly boosting the region's economy. In addition to large-scale industries, Nowshera also has small and medium enterprises, including flour mills, brick kilns, and edible oil extraction plants, contributing to local commerce. Despite its industrial growth, challenges such as energy supply and environmental management remain, necessitating sustainable industrial policies for long-term economic progress.

Number of Registered Factories & Employment Level



INDUSTRIES MAP



Legend

- Industries
- Union Council Boundary
- District Boundary

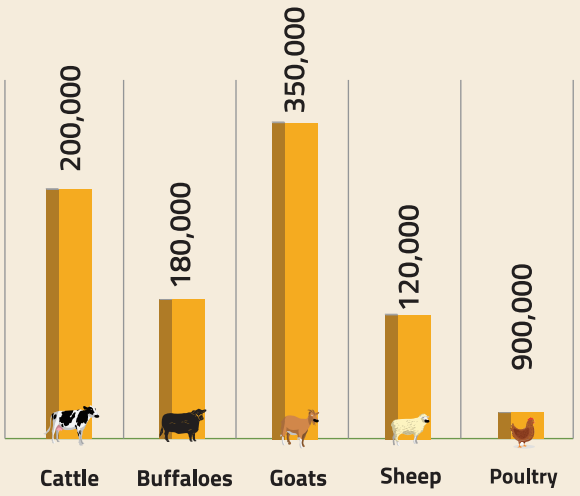
Tehsil Boundary

- Jahangira
- Nowshera
- Pabbi

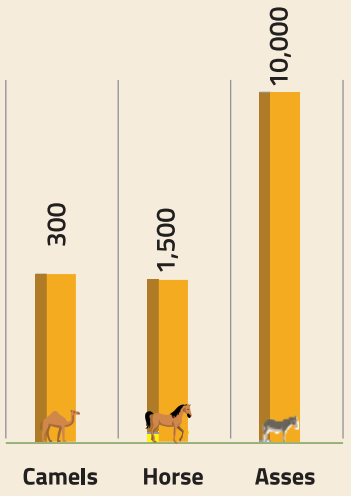
Multi Hazard Vulnerability & Risk Assessment, Nowshera, Khyber Pakhtunkhwa, Pakistan

16 LIVESTOCK

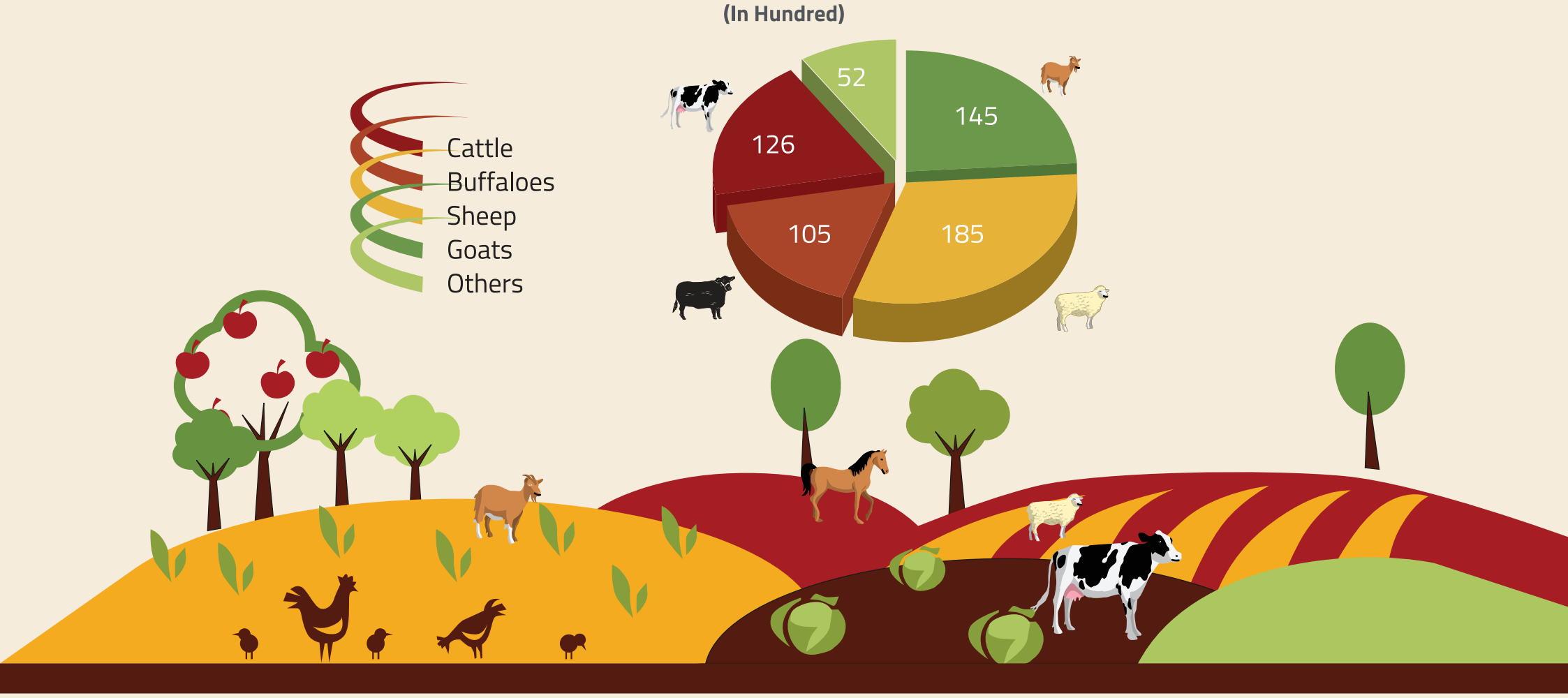
Number of Domestic Livestock
(Thousand)



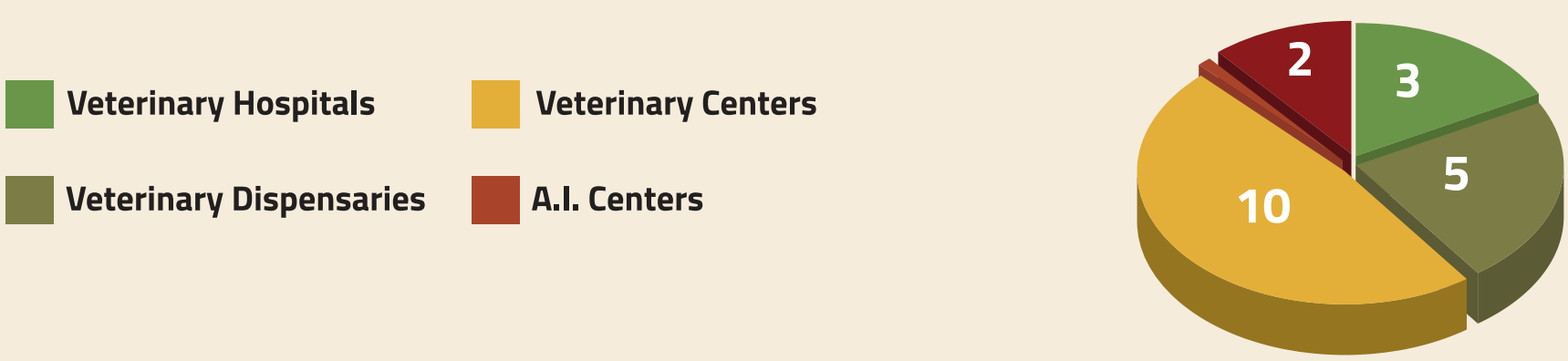
Number of Work Animals by Type (2006)
(Number)



Animals Slaughtered in Recognized & Unrecognized Slaughter Houses by Type (2013-14)
(In Hundred)



Veterinary Healthcare Facilities



Established Private Poultry Farms

	Broiler Farms	Layer Farms	Breeding Farms
Number	100	30	5
Capacity to Rear Birds per Annum (Thousand)	7,310	150	100

17 AGRICULTURE

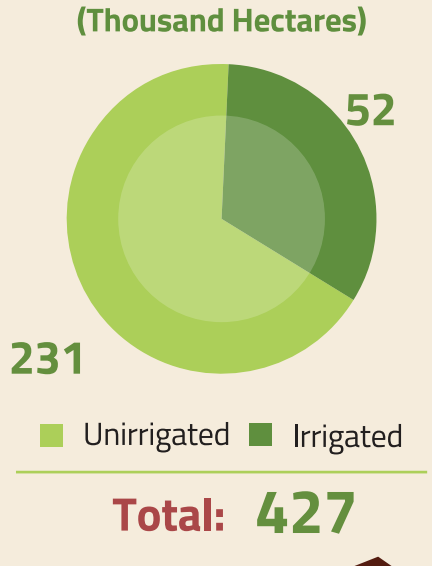
Nowshera District, located in Khyber Pakhtunkhwa, has a diverse and productive agricultural landscape, playing a crucial role in the local economy. The district benefits from fertile plains, a well-developed canal irrigation system, and a moderate climate, making it suitable for a variety of crops, fruits, and livestock farming. The Kabul River and its canal network, including the Upper Swat Canal and Lower Kabul River Canal, serve as the primary sources of irrigation, while tube wells and traditional wells supplement water supply in areas with less canal coverage.

The district follows a two-season cropping pattern, with major crops grown in both Rabi (winter) and Kharif (summer) seasons. In the Rabi season, wheat, barley, mustard, gram, and vegetables are widely cultivated, whereas the Kharif season supports the growth of rice, maize, sugarcane, cotton, and pulses. Additionally, Nowshera has a well-established horticulture sector, producing a variety of fruits, including citrus (oranges, kinnow), guava, pomegranate, mango, and apricot. Vegetables such as potatoes, onions, tomatoes, and spinach are also grown extensively, contributing to both local consumption and trade.

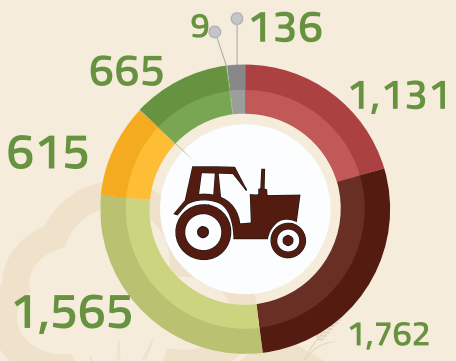
Major Crop Production

Total Area Sown

(Thousand Hectares)



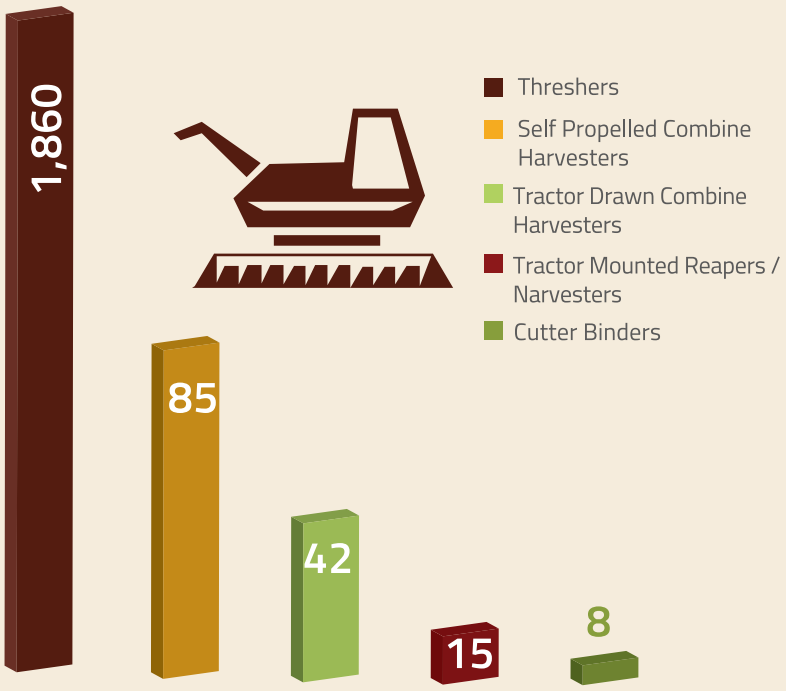
Tractors by Make



Total: 5,883

Sales of Fertilizer (2013-2014)

Threshers & Harvesters



Total: 2,010

18 RESCUE 1122

Rescue Equipment

Life Jackets	206	Fire Vehicles	5
Water R.Vans	2	Emergency Responders	322
Boats	4	Volunteers	200

Address

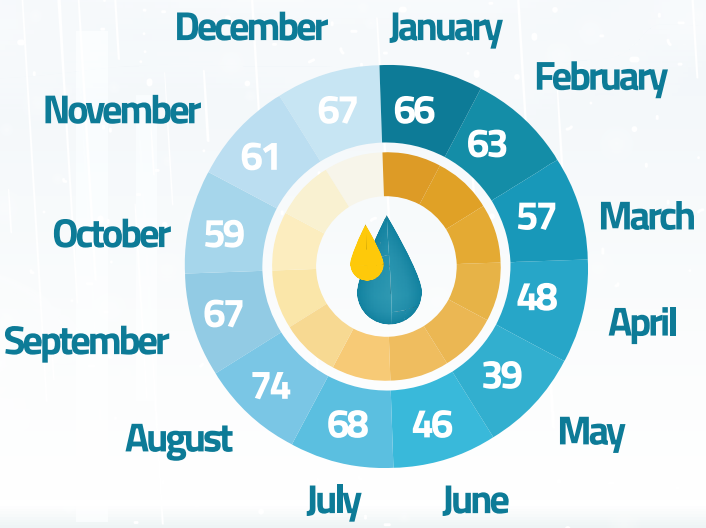
Kamiri Town, Khat Kalay, Nowshera

Longitude : 71.95 **Latitude :** 34.01

19 CLIMATOLOGY

Nowshera, located in Khyber Pakhtunkhwa, Pakistan, experiences a semi-arid to subtropical climate characterized by hot summers, mild winters, and moderate rainfall. The summer season, from May to September, brings high temperatures often exceeding 40°C, with June being the hottest month. The monsoon period, occurring from July to September, contributes a significant portion of the annual precipitation, although variability in monsoon patterns can lead to occasional flooding, especially due to the nearby Kabul River. Winters, spanning from December to February, are relatively mild, with temperatures occasionally dropping below 5°C. Spring and autumn are short transitional seasons with moderate temperatures. The region is also prone to climate-related hazards such as heat-waves, flash floods, and occasional windstorms.

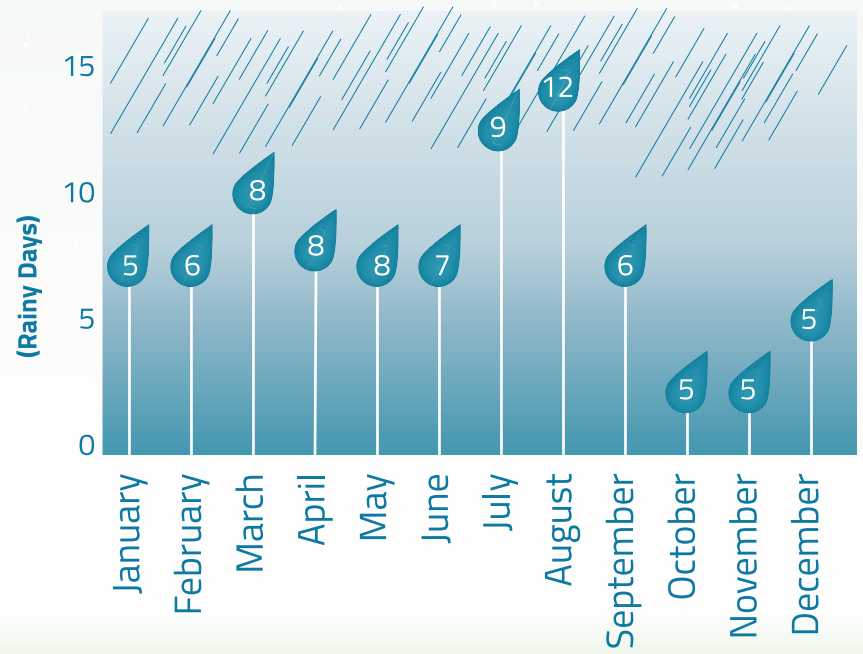
Relative Humidity (%)



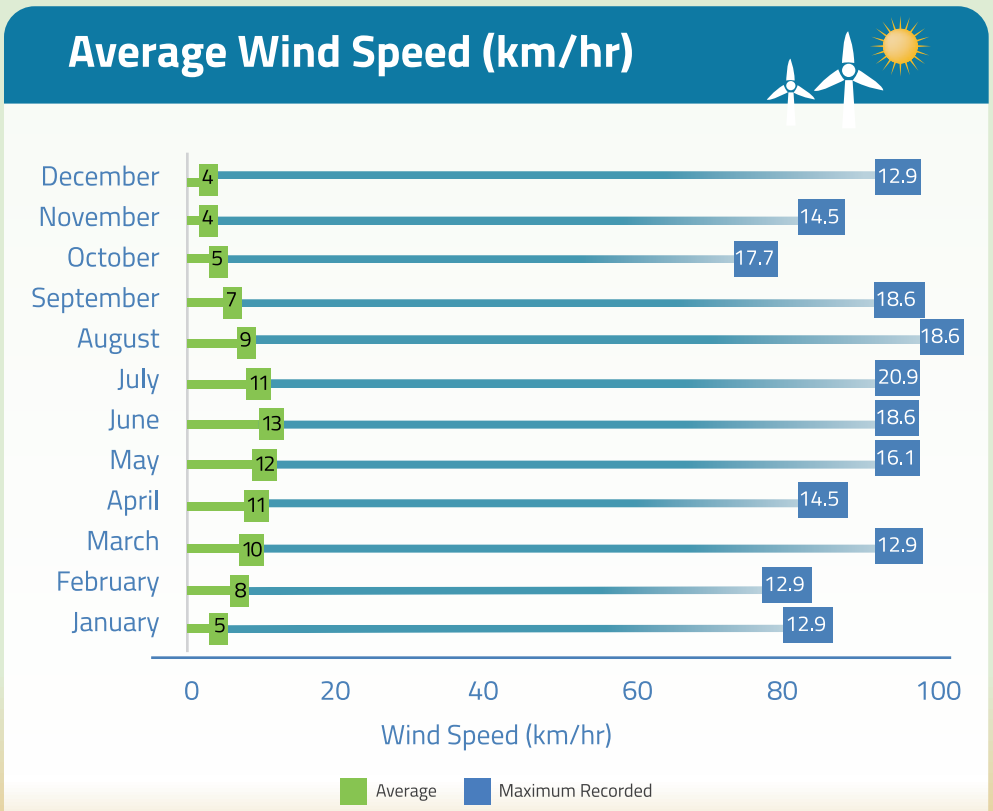
Average Precipitation (mm)

January	20.3	February	42.4	March	65.6
April	70.1	May	70.1	June	63.5
July	80.0	August	201.1	September	20.3
October	15.2	November	15.2	December	15.2

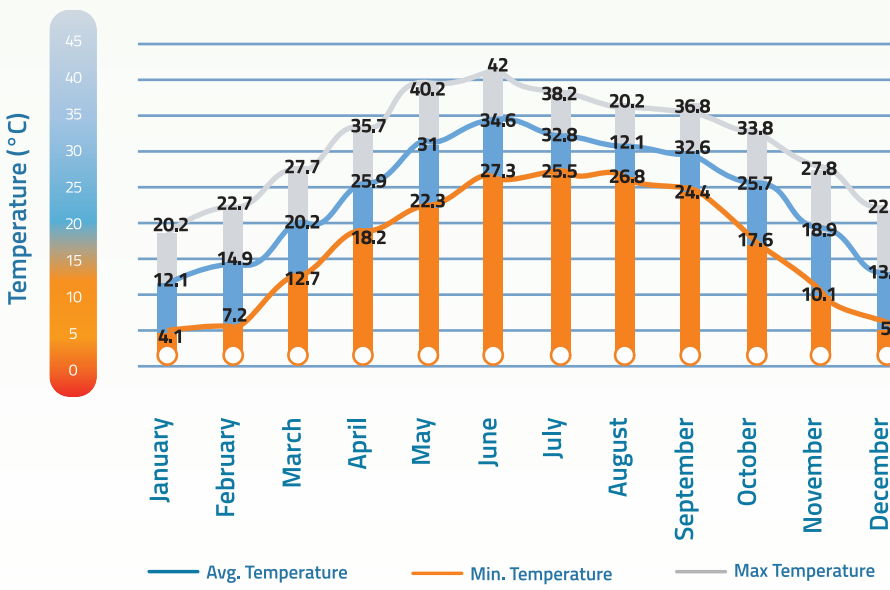
Average Rain Day (per month)



Average Wind Speed (km/hr)



Monthly Average Temperature (°C)



B | HAZARD ASSESSMENT

- DROUGHT
- EARTHQUAKE
- FLOOD

2 DROUGHT HAZARD ASSESSMENT

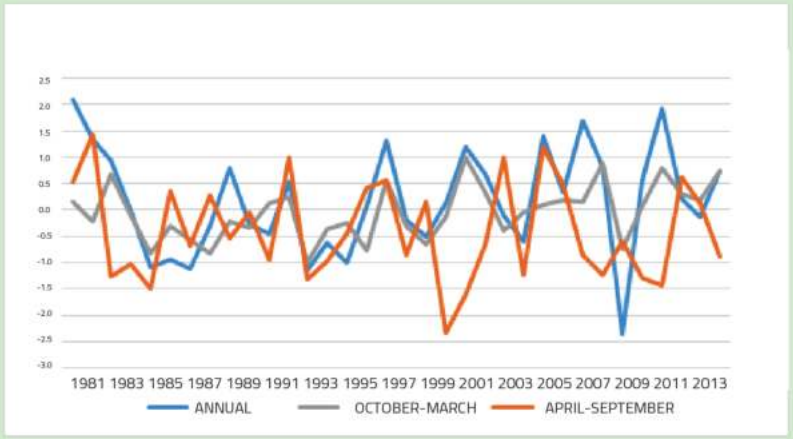
A large part of Pakistan faces severe effects of drought for most part of the year. Long-drawn-out precence of drought is signiciant challenge to agriculture, human lives, livestock, forests, water resource management, urban planing and food security. Due to changing climatic patterns, the drought phenomenon is likery to increase in terms of recurrence, extent, and intensity. In this study follwing indices are used for assessment for drought hazard

a. Standard Precipitation Index (SPI)
b. Normalized Difference Vegetation Index(NDVI)
c. Temperature condition index (TCI)
d. Vegetation Condition Index (VCI)
e. Vegetation Health Index (VHI)

Drought return period

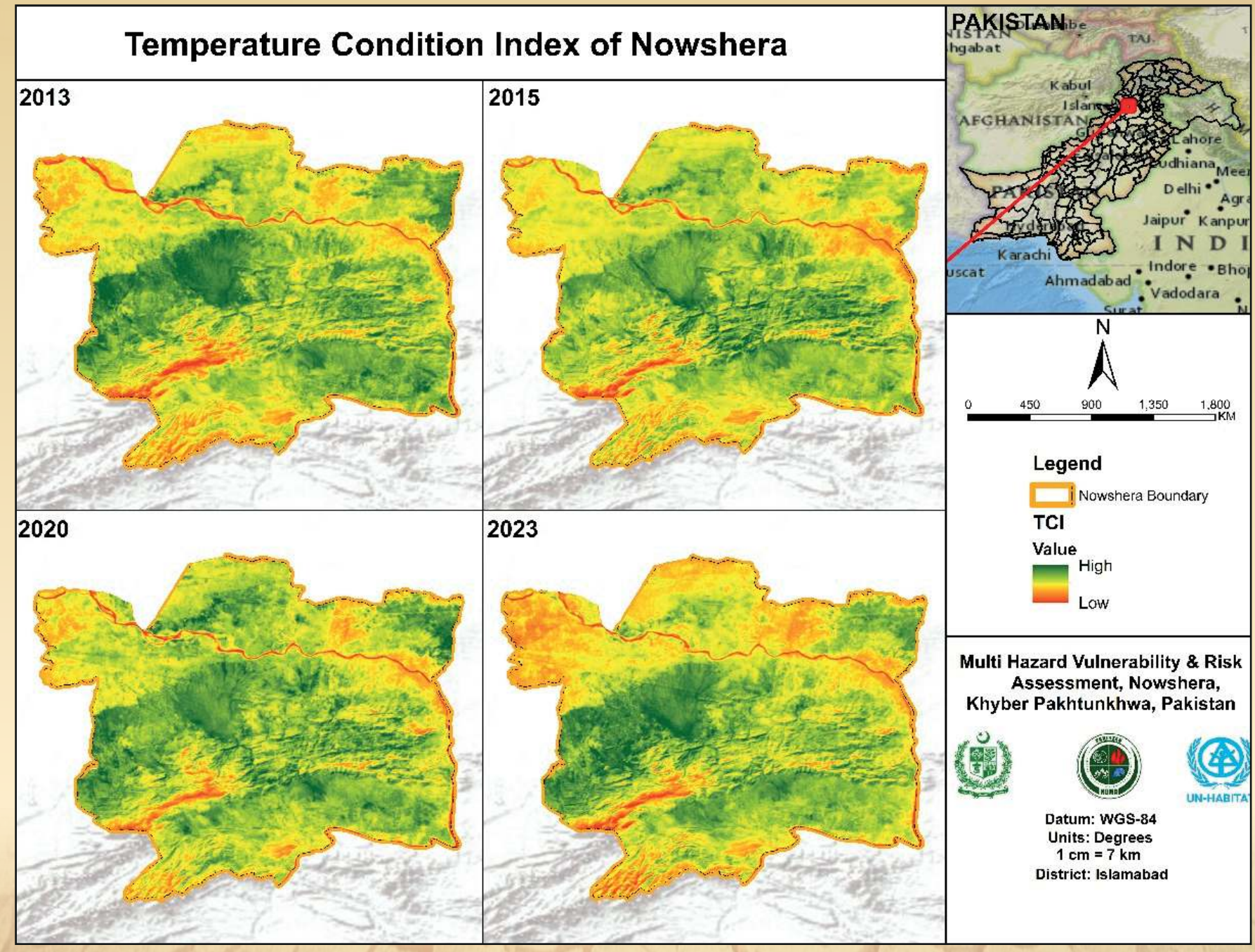
A return period is the recurrence interval of a drought. Its is a statistical measurement, particulary based on previous data. Strategic planning and management of water resources under climate change and drought conditions ofetn require the assessment of return periods of drought events catergorized by high severities.

Standard Precipitation Index (SPI) 1981-2024

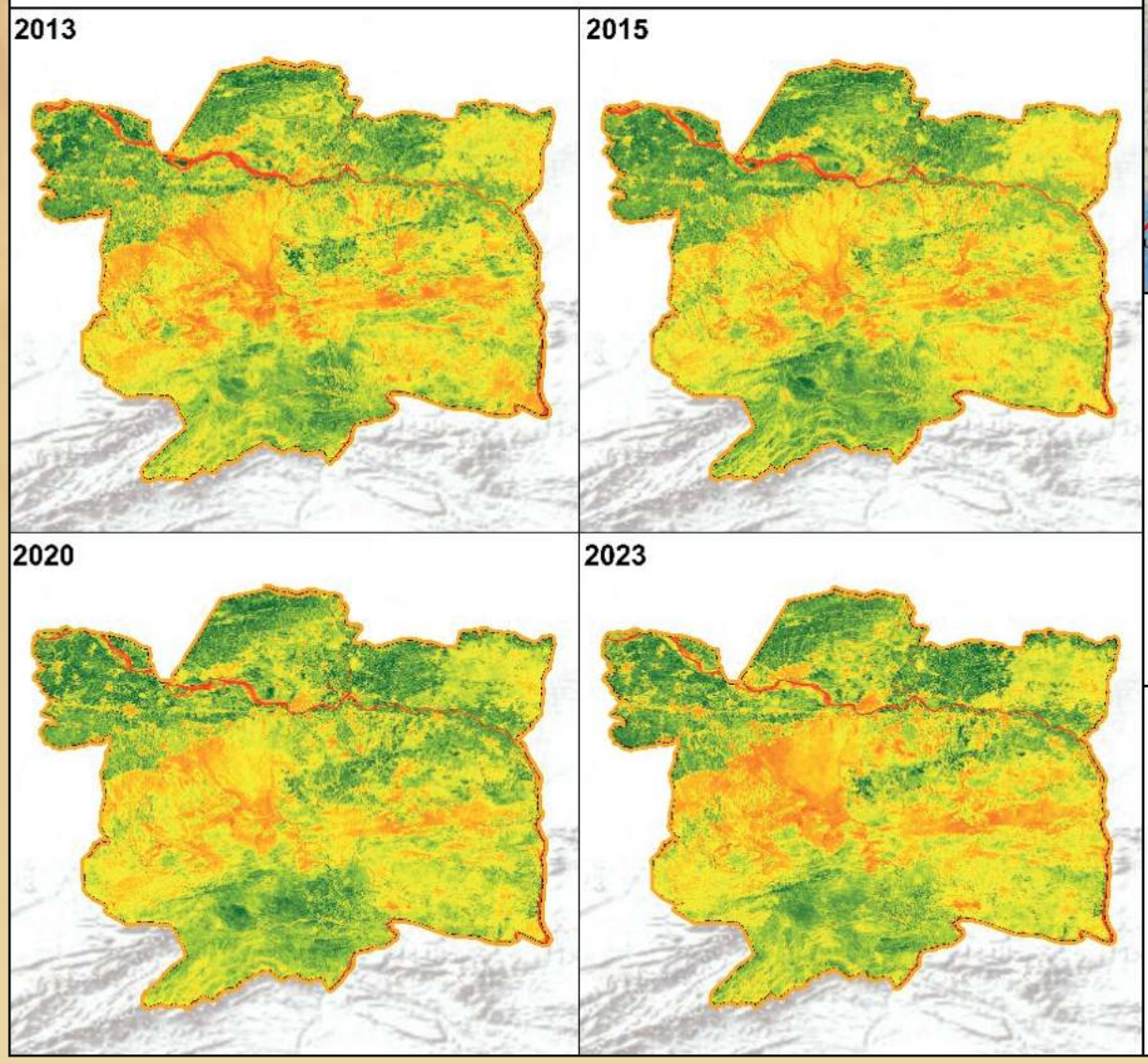


SPI Value	Conditions
2.0+	Extremely Wet
1.5 to 1.99	Very Wet
1.0 to 1.49	Moderately Wet
-0.99 to 0.99	Near Normal
-1.0 to -1.49	Moderately Dry
-1.5 to -1.99	Severely Dry
-2.0 and less	Extremely Dry

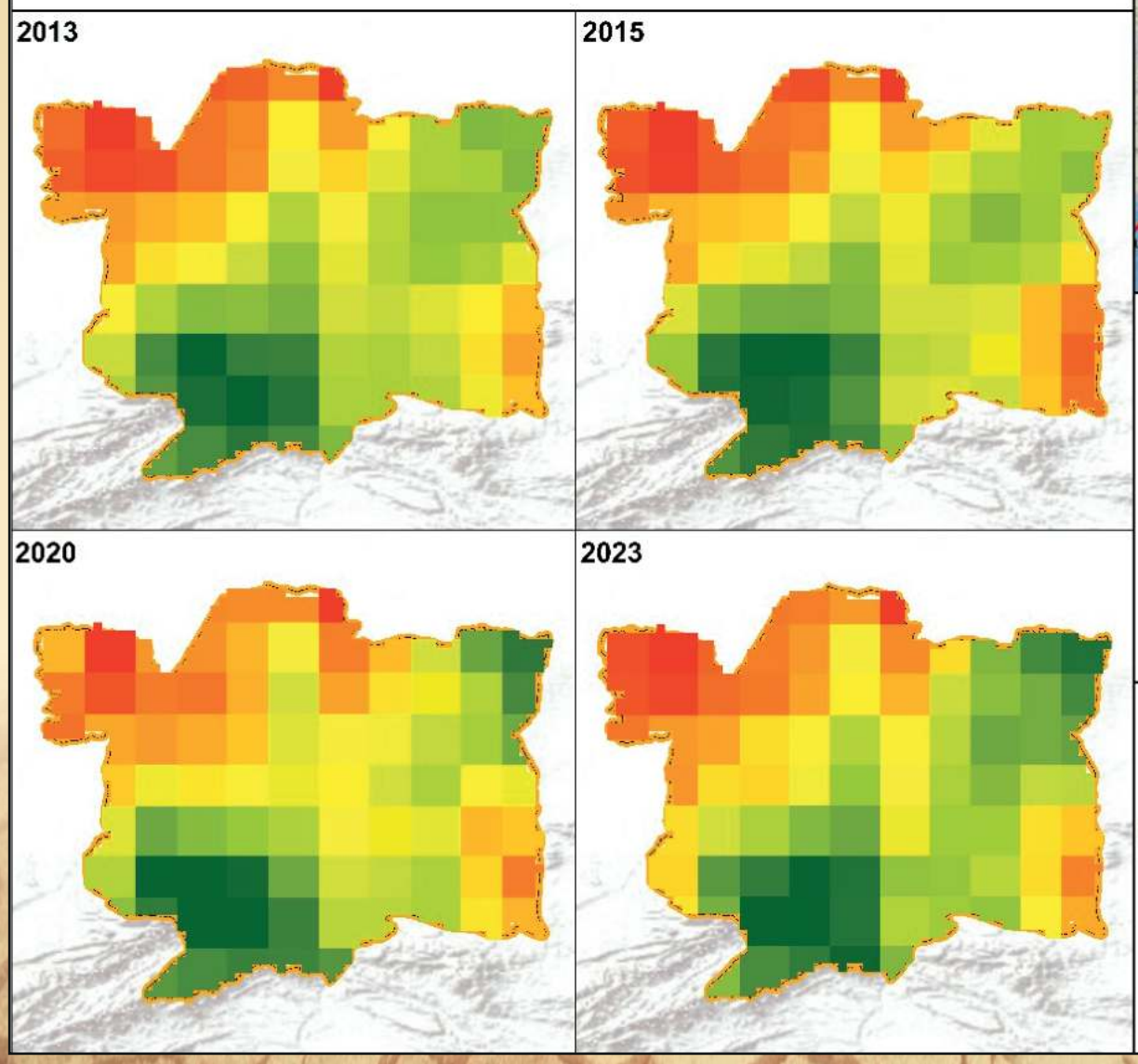
Description:
SPI is a tool to determine the severity of a drought at a given time scale of interest for any rainfall station with historic data. Mathematically, SPI is based on the cumulative probability of a given rainfall event occurring at a station.



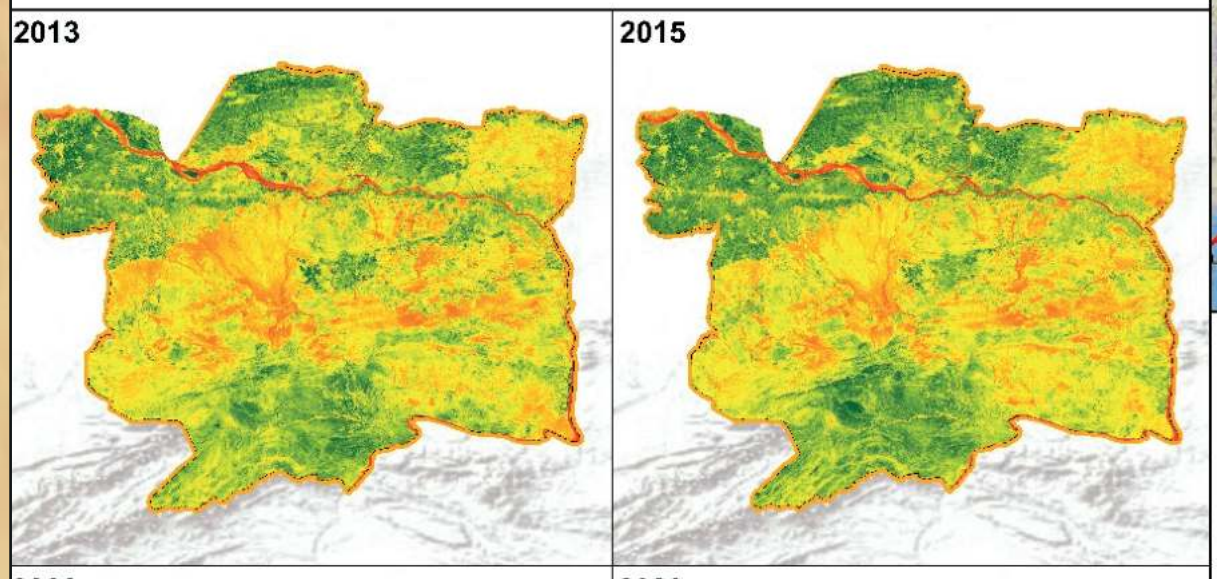
Normalized Difference Vegetation Index of Nowshera



Standardized Precipitation Index of Nowshera



Vegetation Condition Index of Nowshera



N

0 450 900 1,350 1,800 KM

Legend

Nowshera Boundary

VCI

Value

High

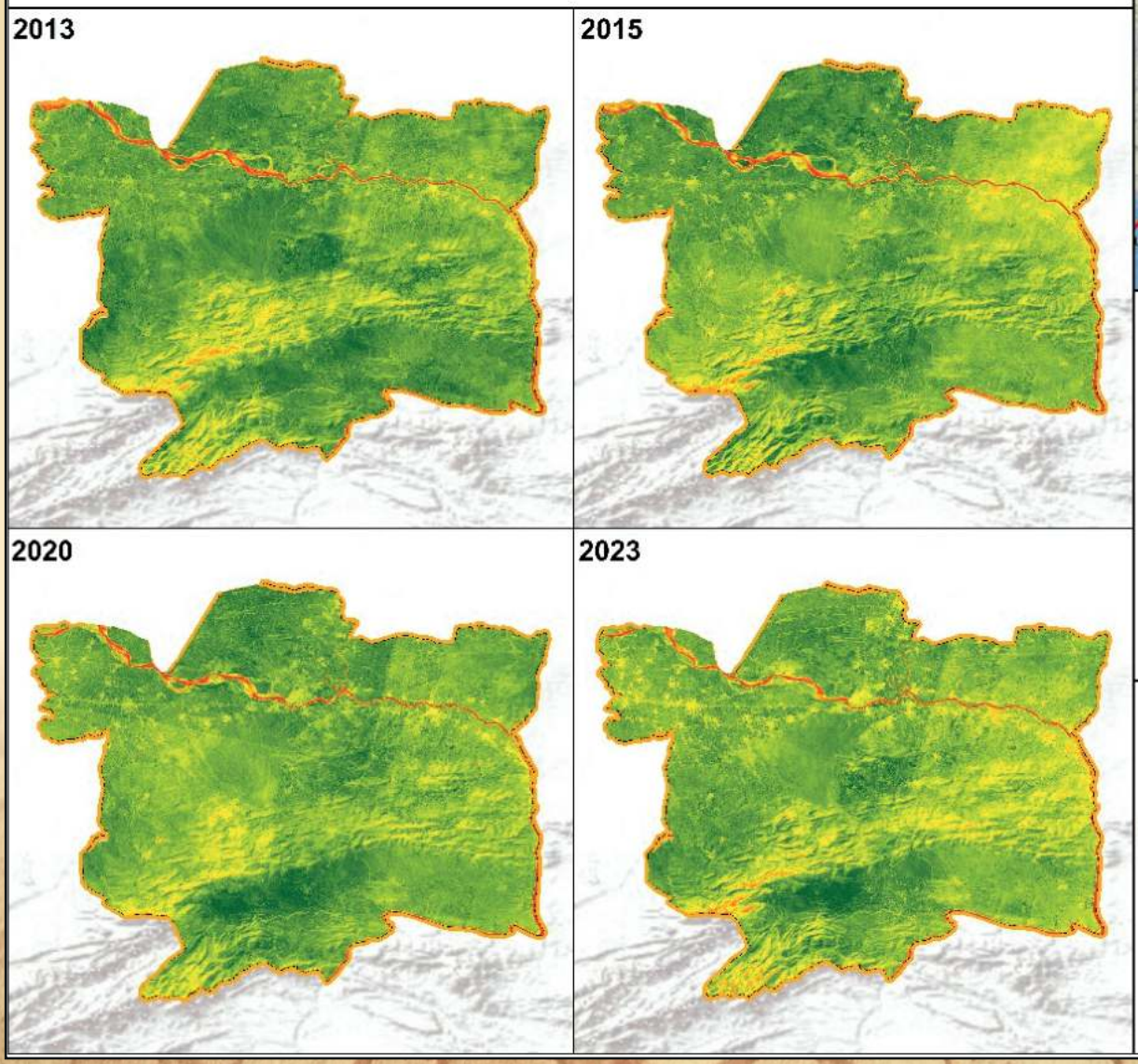
Low

Multi Hazard Vulnerability & Risk Assessment, Nowshera, Khyber Pakhtunkhwa, Pakistan

UN-HABITAT

Datum: WGS-84
Units: Degrees
1 cm = 7 km
District: Islamabad

Vegetation Health Index of Nowshera



N

0 450 900 1,350 1,800 KM

Legend

Nowshera Boundary

VHI

Value

High

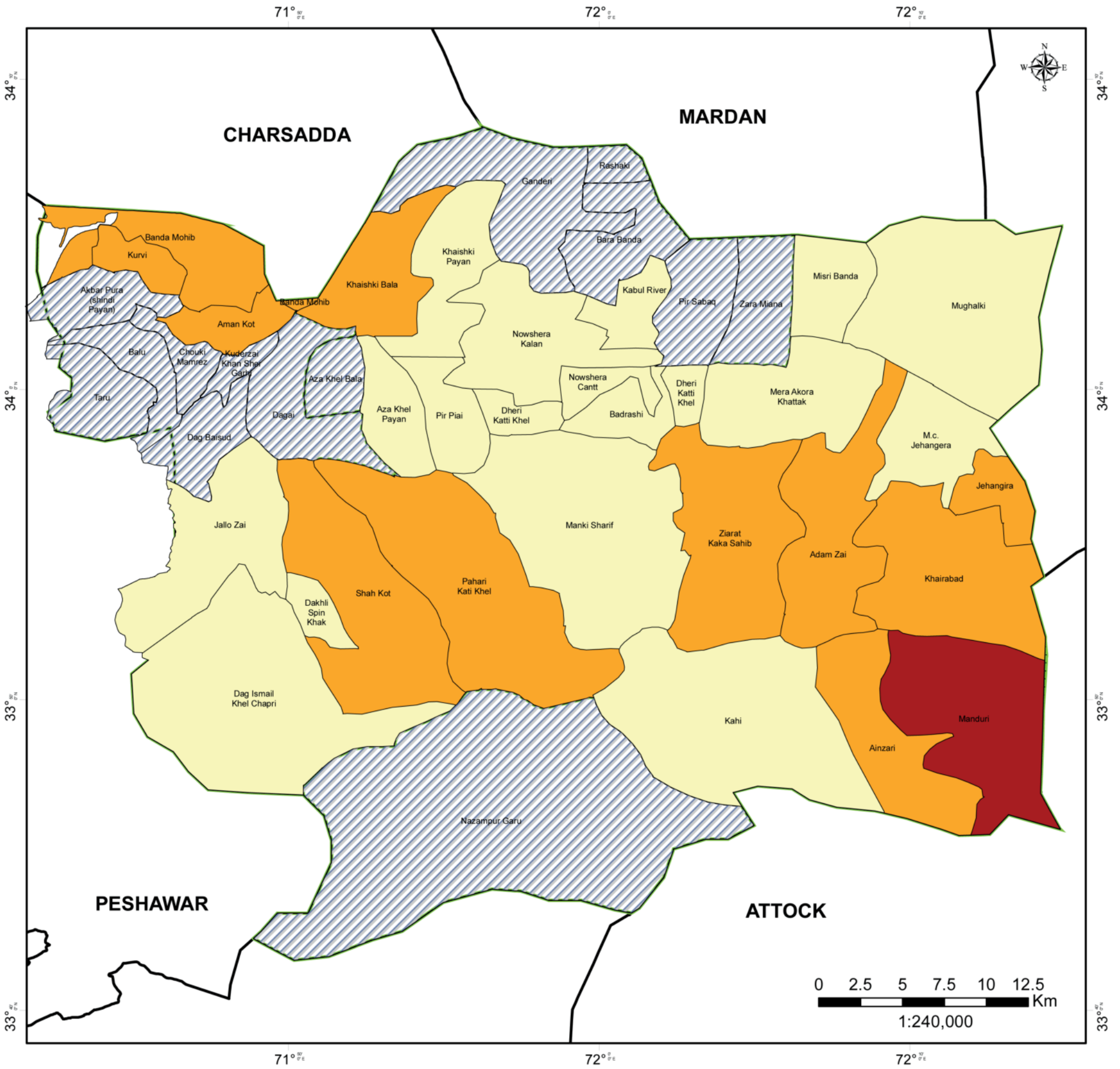
Low

Multi Hazard Vulnerability & Risk Assessment, Nowshera, Khyber Pakhtunkhwa, Pakistan

UN-HABITAT

Datum: WGS-84
Units: Degrees
1 cm = 7 km
District: Islamabad

DROUGHT HAZARD MAP



Legend

- No Drought
- Mild Drought
- Moderate Drought
- Severe Drought
- Union Council Boundary
- Tehsil Boundary
- District Boundary

Multi Hazard Vulnerability & Risk Assessment, Nowshera, Khyber Pakhtunkhwa, Pakistan

PAKISTAN National Disaster Management Authority NDMA

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21 EARTHQUAKE HAZARD ASSESSMENT

Earthquake is defined as the shaking and vibration at the surface of the earth resulting from underground movement along a fault plane due to volcanic activity, cryoseismic activity, the sudden cracking of frozen soil or rock, or the movement of plate boundaries of the Earth. Earthquake hazard at a site is characterized by either probabilistic or deterministic seismic hazard analyses. Probabilistic seismic hazard analysis involves the quantification of the rate of probability of exceeding certain motion intensities at all possible earthquake sources.

Deterministic analysis evaluates the site-specific seismic hazard, which is influenced by maximum hazard from controlling sources. The general probabilistic seismic hazard analysis procedure quantifies the annualized rate of exceedance of specified ground motion levels of various intensities, which is then transformed to obtain the probability of exceedance of ground motions within the lifetime of the structure and infrastructure of interest.

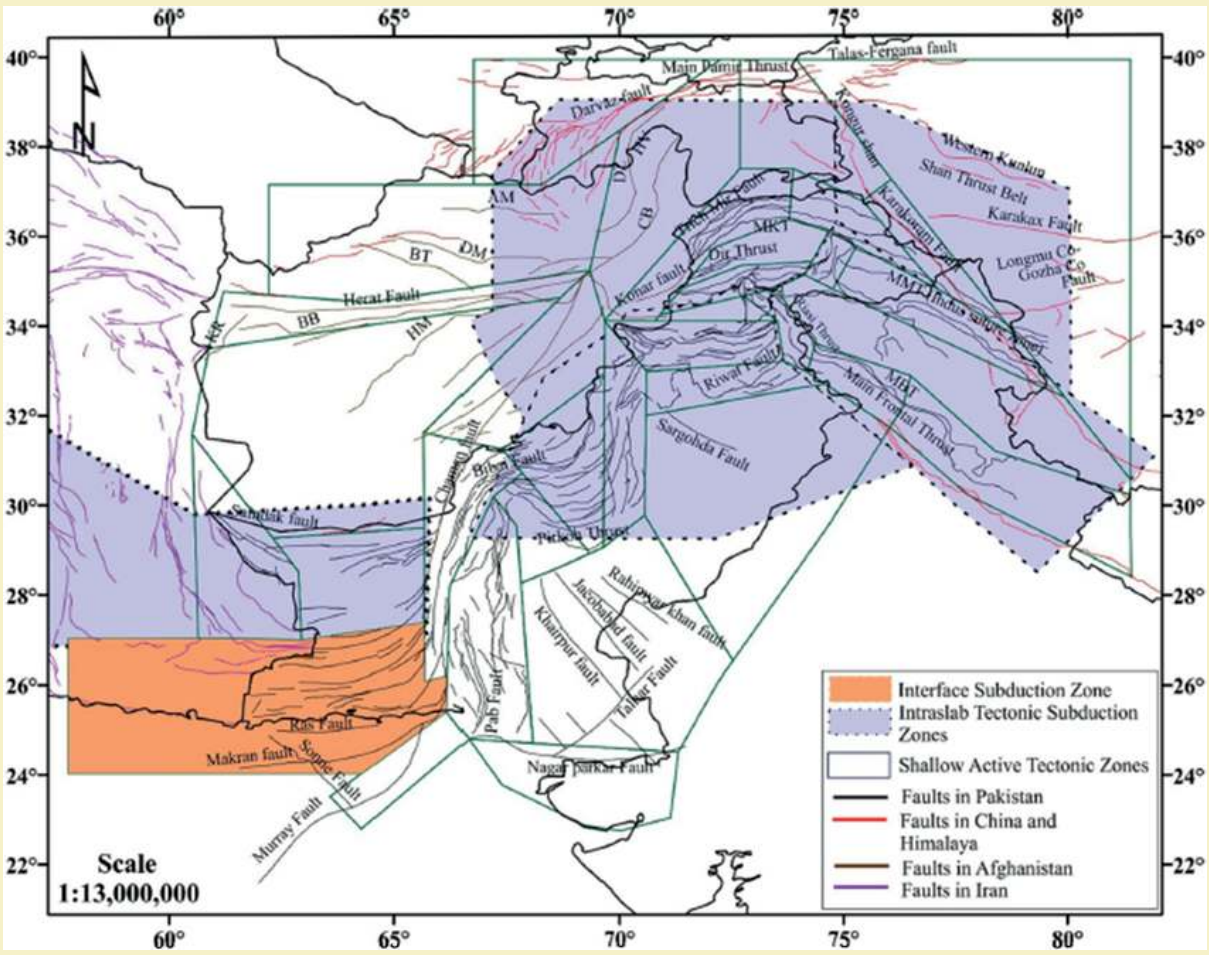
District Nowshera is located in a seismically active region and has experienced earthquakes of varying magnitudes. The region is influenced by the active fault systems of the Himalayan tectonic belt. Historical earthquake catalogues and recent seismic studies suggest that Nowshera has moderate to high seismicity, with past earthquake magnitudes ranging between 4.5 and 6.5 on the Richter scale.

The main findings of the probabilistic seismic hazard assessment reveal that ground motion in District Nowshera exhibits spatial variability, with higher intensities near fault lines and diminishing levels in areas further from active faults. The study categorizes the seismic hazard levels into five zones based on Peak Ground Acceleration (PGA), aligned with Pakistan's Building Code guidelines. These zones range from very low to very high hazard levels, as presented in the accompanying hazard maps

The first step for the Earthquake Hazard Assessment involved defining the area of interest by compiling earthquake catalogues from various national and international sources. The catalogues were homogenized, declustered, and checked for completeness. Ground Motion Prediction Equations (GMPEs) were selected, and the data was processed in hazard computation software (CRISIS). The probabilistic seismic hazard mapping was conducted for return periods of 50, 100 and 475 years. Sensitivity analysis was performed to refine the estimates, followed by Site-Specific Seismic Response Analysis incorporating soil conditions using the Deepsoil software.

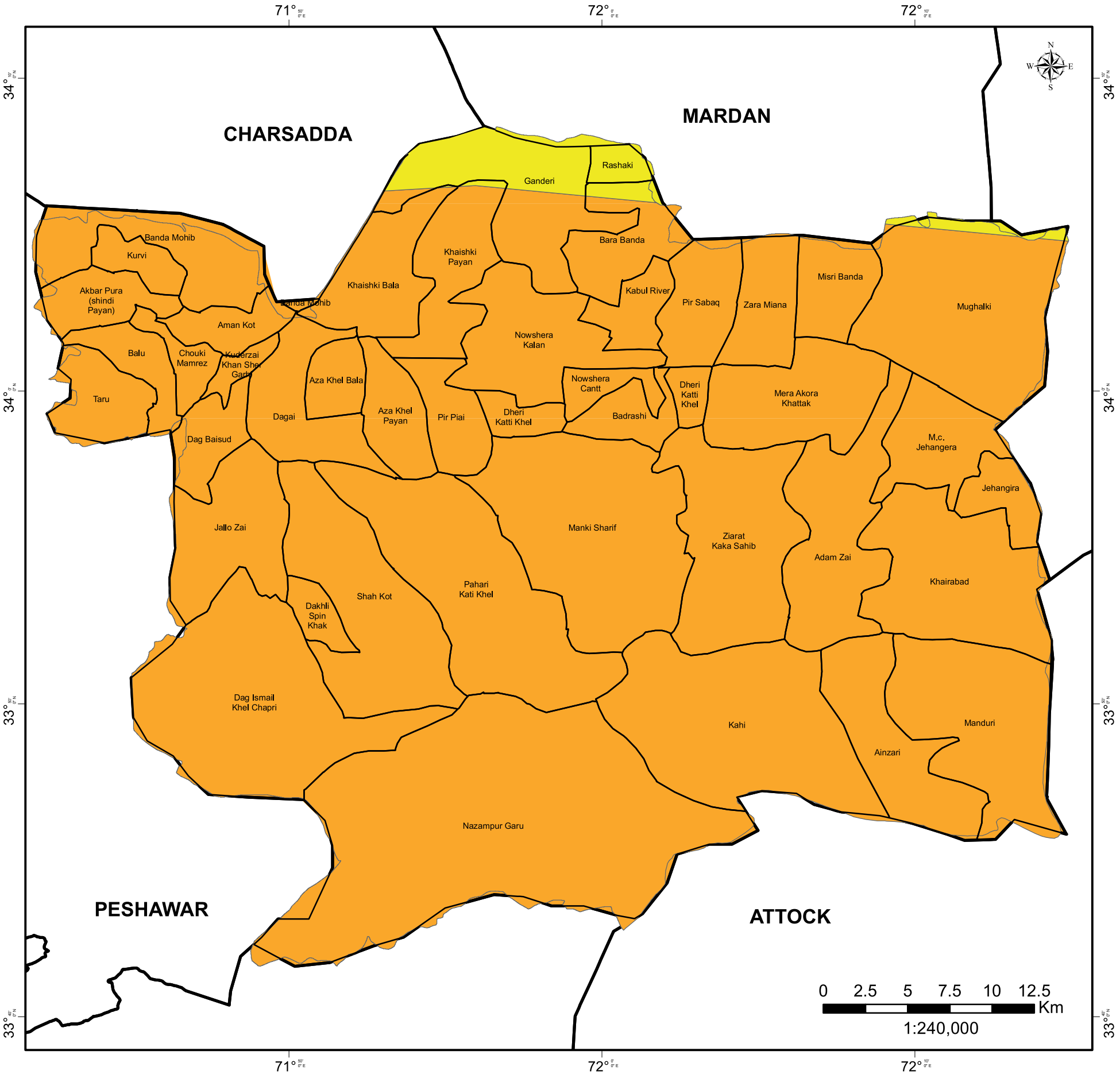
Hazard Zones Classification The seismic hazard zones are classified into five categories based on Peak Ground Acceleration (PGA):

- **Zone 1:** Very Low Hazard (0.01 - 0.08g)
- **Zone 2A:** Low Hazard (0.08 - 0.16g)
- **Zone 2B:** Moderate Hazard (0.16 - 0.24g)
- **Zone 3:** High Hazard (0.24 - 0.32g)
- **Zone 4:** Very High Hazard (>0.32g)



Seismotectonic Model of Pakistan

EARTHQUAKE HAZARD 50 YEARS RETURN PERIOD



Legend

Hazard Zone

- 2B (0.16-0.24g) Meduim
- 3 (0.24-0.32g) High
- Union Council Boundary
- District Boundary

Multi Hazard Vulnerability & Risk Assessment, Nowshera, Khyber Pakhtunkhwa, Pakistan

PAKISTAN National Disaster Management Authority NDMA

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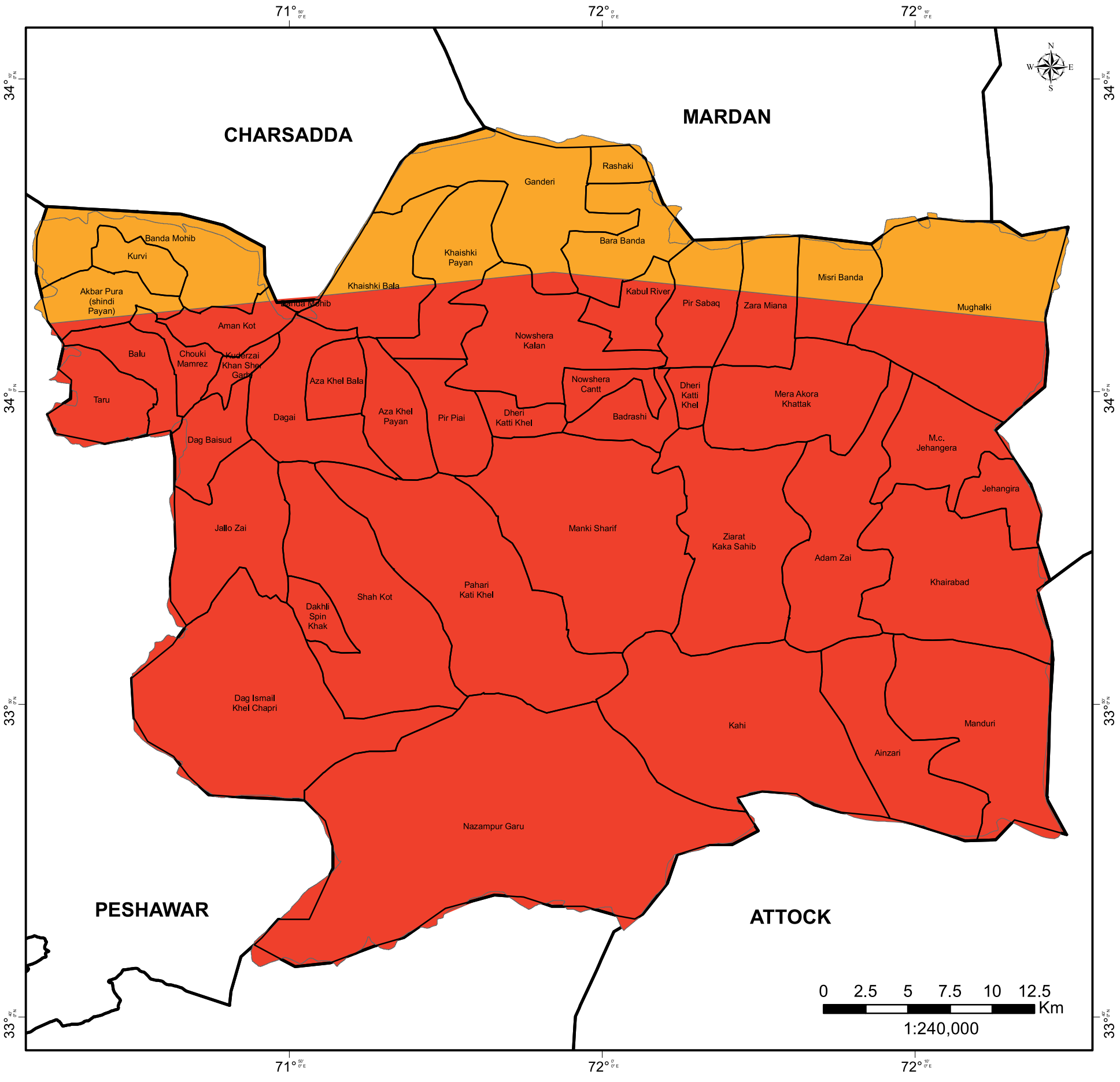
EARTHQUAKE HAZARD 100 YEARS RETURN PERIOD



Legend

Hazard Zone

- 3 (0.24-0.32g) High
- 4 (>0.32g) Very High
- Union Council Boundary
- District Boundary

Multi Hazard Vulnerability & Risk Assessment, Nowshera, Khyber Pakhtunkhwa, Pakistan

PAKISTAN National Disaster Management Authority NDMA

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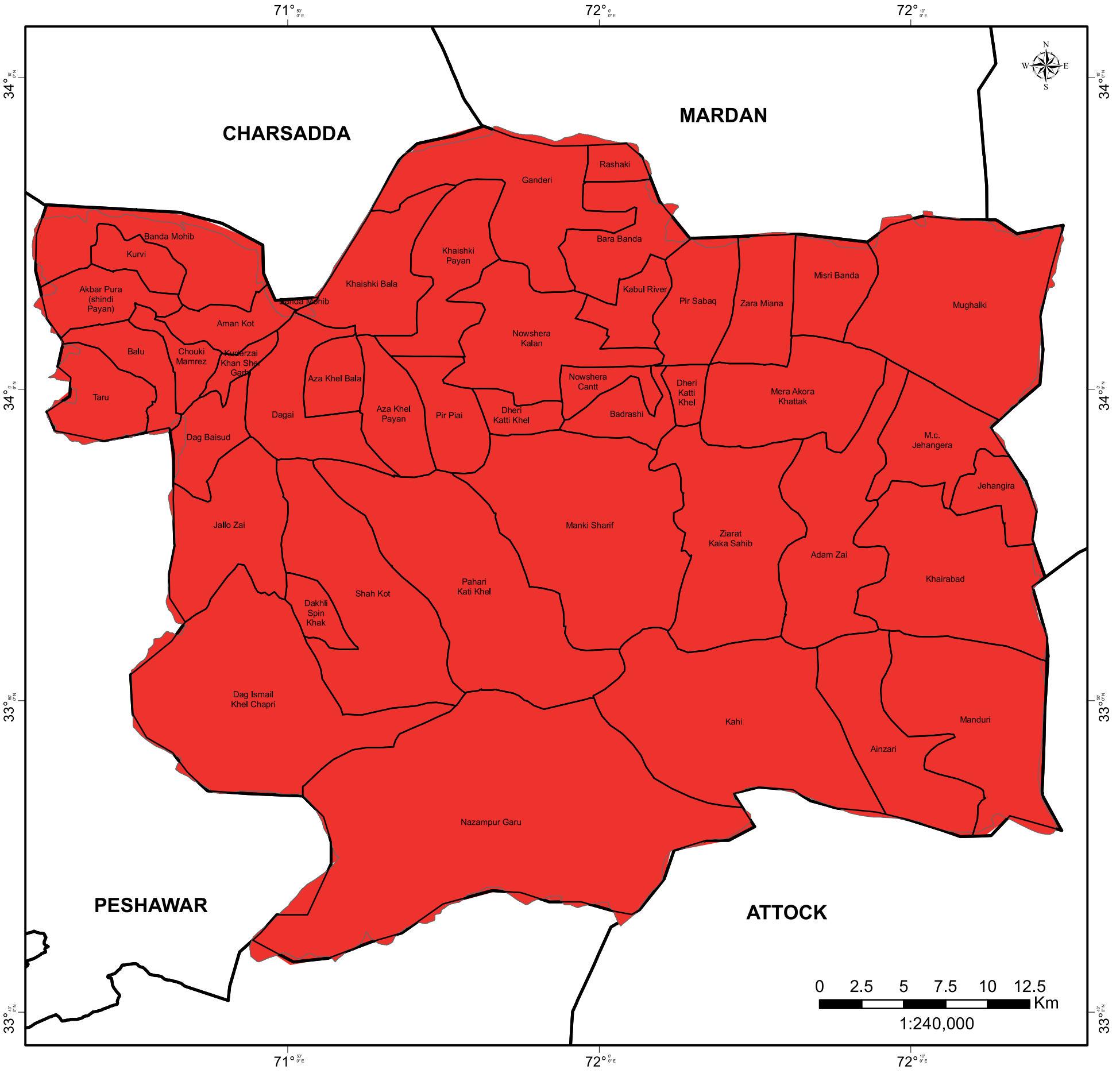
EARTHQUAKE HAZARD 475 YEARS RETURN PERIOD



Legend

Hazard Zone

(>0.32g) Very High

Union Council Boundary

District Boundary

Multi Hazard Vulnerability & Risk Assessment, Nowshera, Khyber Pakhtunkhwa, Pakistan

22 FLOOD HAZARD ASSESSMENT

Introduction

Nowshera District, located in Khyber Pakhtunkhwa, is highly vulnerable to flood hazards due to its proximity to the Kabul River and other tributaries. The district has experienced significant flooding in past years, including the devastating floods of 2010 and subsequent years. Floodwaters affect major urban centers, agricultural land, and critical infrastructure, necessitating the development of flood protection structures and mitigation strategies.

Flood Protection Structures

Drains:

- Jalala Drain
- Pirsabaq Drain
- Aman Garh Drain
- Aza Khel Drain
- Jinnah Drain

Embankments & Flood Protection Bunds:

- Manki Sharif Bund
- Khushal Garh Bund
- Pirsabaq Flood Protection Bund
- Nowshera City Protection Wall
- Taro Jabba Embankment

Assessment Methodology

The flood hazard assessment for Nowshera is based on hydrodynamic modeling using the HEC-RAS and HEC-GeoRAS models. These models utilize:

- Digital Elevation Model (DEM) for terrain analysis.
- Observed peak flow data from Warsak and Nowshera stations.
- GIS-based flood extent mapping to assess the impact zones.
- Assessment of drainage infrastructure and embankments to determine their effectiveness.

Major Flood Events & Historic Peaks

Nowshera has recorded peak discharges from the Kabul River at various times. The 2010 flood was among the most devastating, with peak flows exceeding 500,000 cusecs, causing widespread damage.

Damages & Losses (2010 Floods)

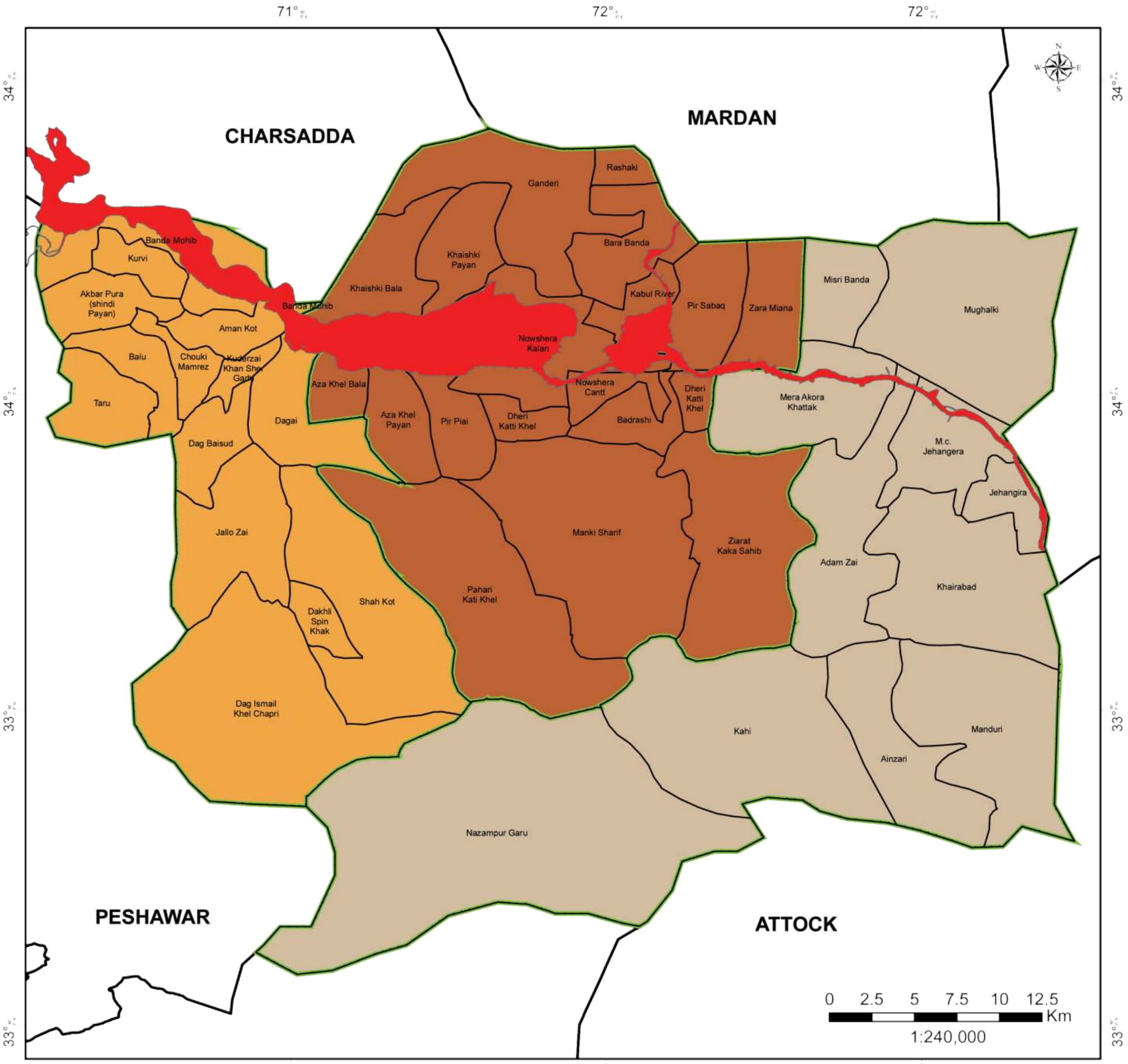
Housing Impact by Building Type and Damage Extent

Union Councils	Kacha	Pacca	Partially Damaged	Completely Damaged	Urban	Rural	Total
Nowshera City	100	250	200	150	250	250	500
Pirsabaq	80	180	120	140	180	220	400
Akora Khattak	90	200	150	140	210	220	430

Agricultural Losses

Union Councils	Crop Damage (Acres
Nowshera City	3,200
Pirsabaq	2,500
Akora Khattak	4,000
Total	9,700

FLOOD HAZARD 10 YEARS RETURN PERIOD



Legend

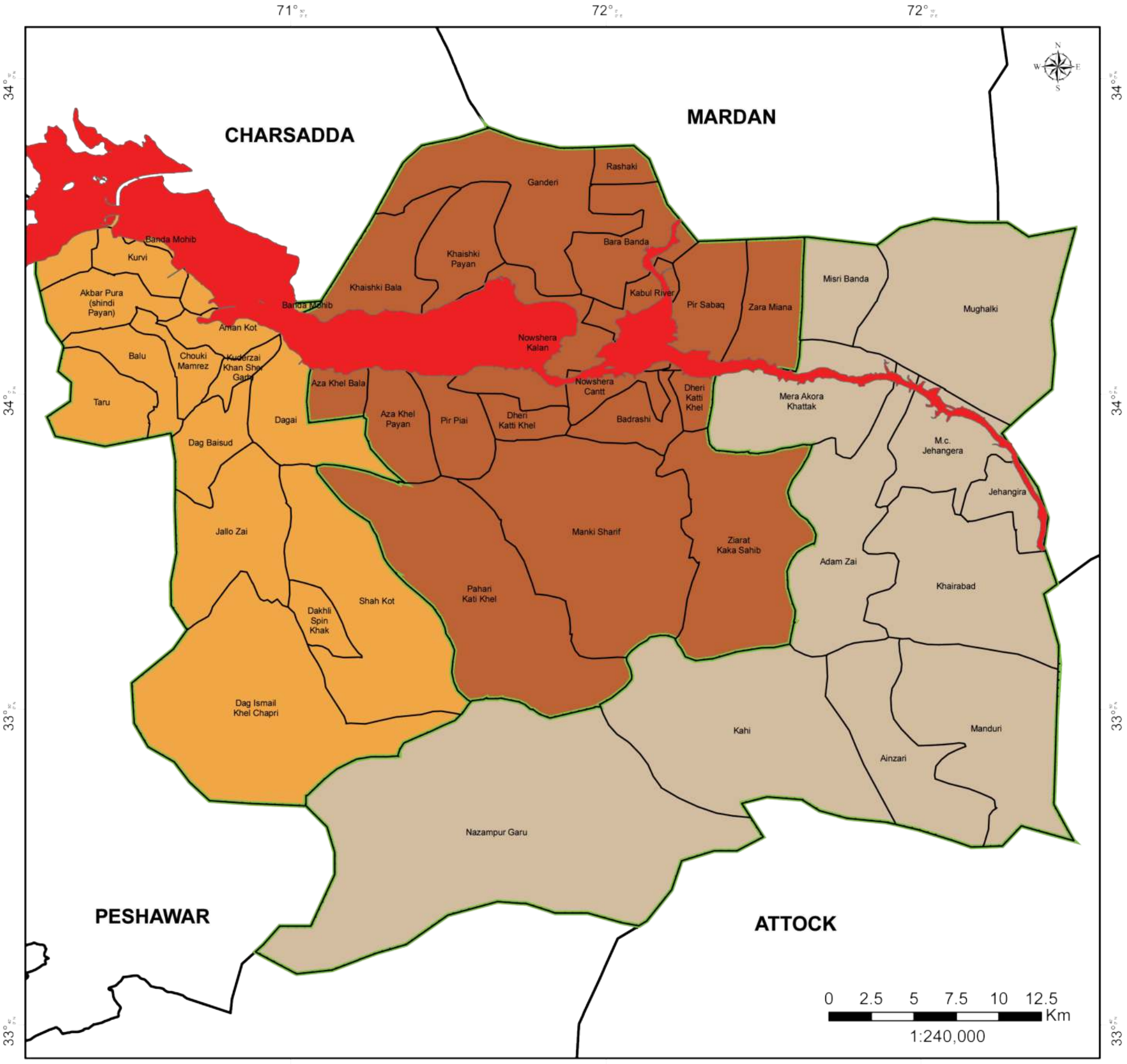
- Flood Hazard 10 Year Return Period

Tehsil Boundary

- Jahangira
- Nowshera
- Pabbi
- Union Council Boundary
- District Boundary

Multi Hazard Vulnerability & Risk Assessment, Nowshera, Khyber Pakhtunkhwa, Pakistan

FLOOD HAZARD 50 YEARS RETURN PERIOD



Legend

- Flood Hazard 50 Year Return Period

Tehsil Boundary

- Jahangira
- Nowshera
- Pabbi
- Union Council Boundary
- District Boundary

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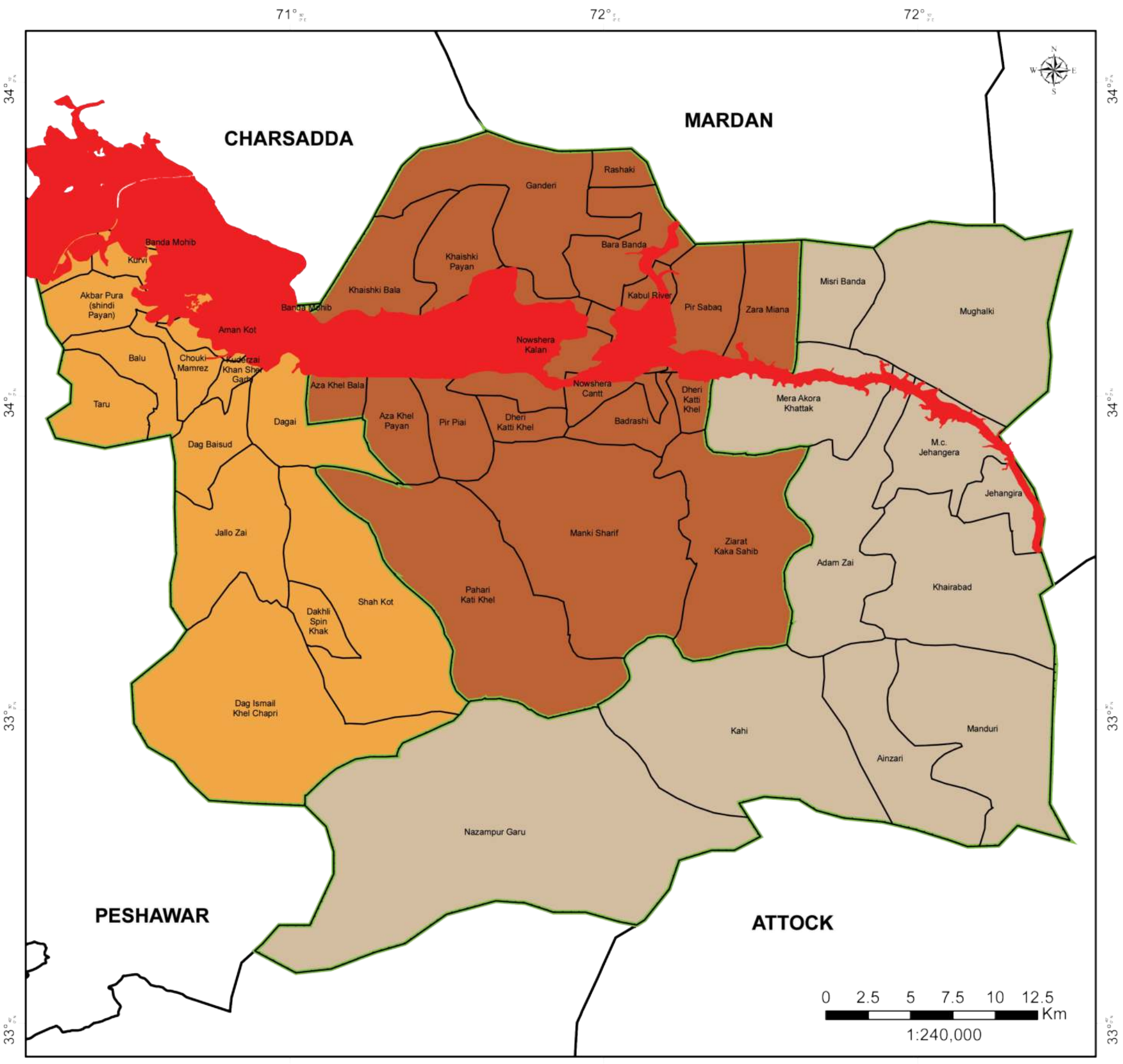
FLOOD HAZARD 100 YEARS RETURN PERIOD



Legend

- Flood Hazard 100 Year Return Period

Tehsil Boundary

- Jahangira
- Nowshera
- Pabbi
- Union Council Boundary
- District Boundary

Multi Hazard Vulnerability & Risk Assessment, Nowshera, Khyber Pakhtunkhwa, Pakistan

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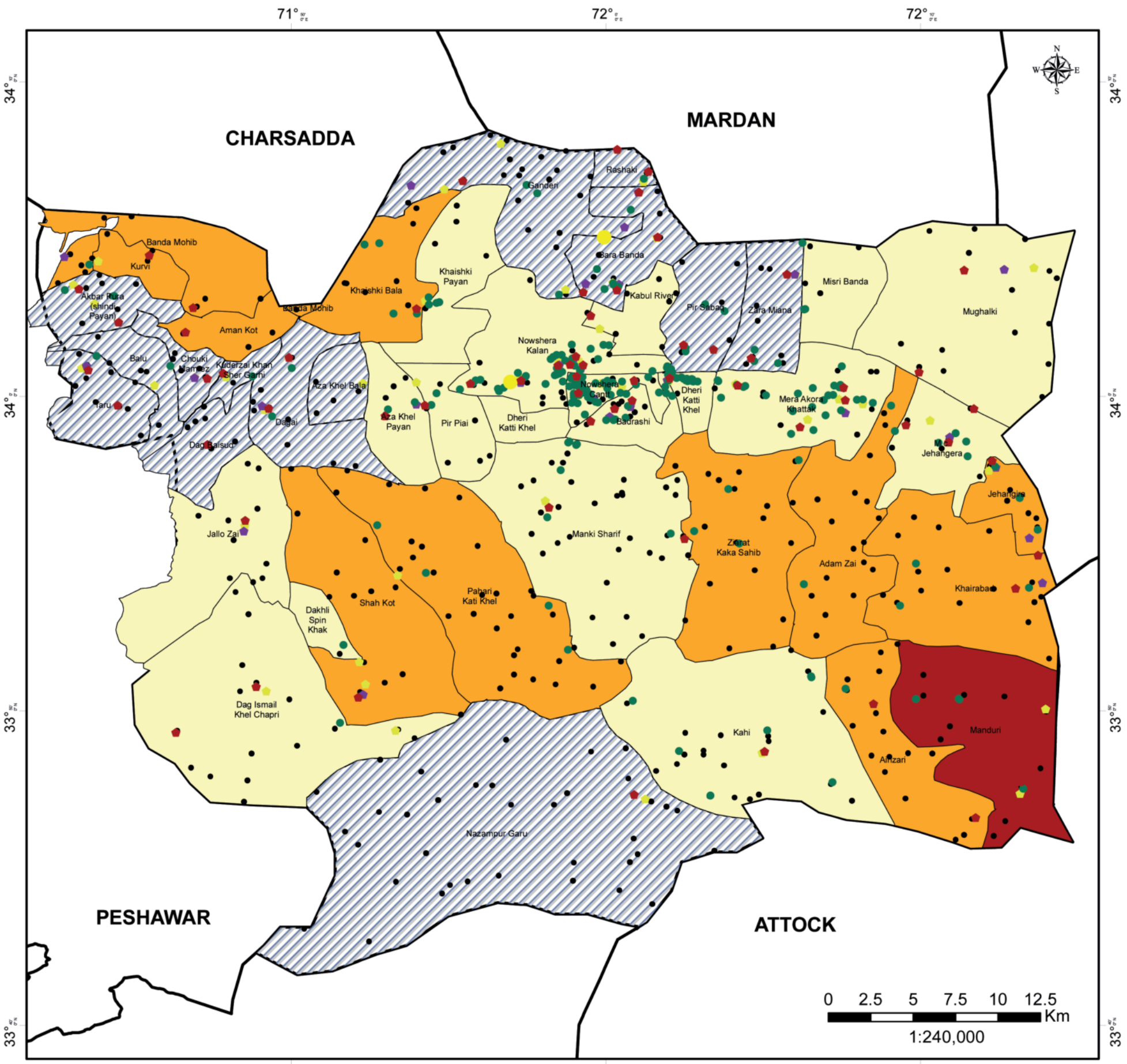
C | EXPOSURE ASSESSMENT

- DROUGHT
- EARTHQUAKE
- FLOOD

23 ELEMENTS EXPOSED TO DROUGHT HAZARD

DISTRICT	TEHSIL	UNION COUNCIL NAME	Area (sq.km)	Health Facilities			Schools			Cell Towers			Settlements			Industries			Railway Stations		
				High	Medium	Low	High	Medium	Low	High	Medium	Low	High	Medium	Low	High	Medium	Low	High	Medium	Low
Nowshera	Nowshera	Adam Zai	54.875472	0	1	0	0	0	32	0	3	0	0	18	0	0	0	0	0	1	0
Nowshera	Nowshera	Ainzari	42.691272	0	1	0	0	0	24	0	5	0	0	17	0	0	0	0	0	0	0
Nowshera	Nowshera	Jehangira	13.482942	0	1	0	0	0	13	0	11	0	0	7	0	0	1	0	0	0	0
Nowshera	Nowshera	Kahi	98.757523	0	3	0	0	0	29	0	6	0	0	20	0	0	0	0	0	0	0
Nowshera	Nowshera	Khairabad	66.474667	0	1	0	0	0	25	0	10	0	0	16	0	0	0	0	0	1	0
Nowshera	Nowshera	M.c. Jehangera	28.523001	0	2	0	0	0	26	0	10	0	0	6	0	0	3	0	0	1	0
Nowshera	Nowshera	Manduri	66.74957	0	0	2	0	24	0	0	0	6	0	0	11	0	0	0	0	0	0
Nowshera	Nowshera	Mera Akora Khattak	45.159373	0	3	0	0	0	50	0	28	0	0	11	0	0	5	0	0	1	0
Nowshera	Nowshera	Mughalki	87.807744	0	3	0	0	0	18	0	9	0	0	15	0	0	0	0	0	0	0
Nowshera	Nowshera	Nazampur Garu	210.066081	0	0	0	0	31	0	0	0	8	0	0	36	0	0	0	0	0	1
Nowshera	Pabbi	Aman Kot	13.723276	0	0	1	0	8	0	0	0	4	0	0	4	0	0	0	0	0	0
Nowshera	Pabbi	Chouki Mamrez	9.496232	0	1	0	0	0	10	0	7	0	0	5	0	0	1	0	0	1	0
Nowshera	Pabbi	Dagai	31.044066	0	2	0	0	0	21	0	8	0	0	9	0	0	0	0	0	0	0
Nowshera	Pabbi	Dakhli Spin Khak	8.34681	0	1	0	0	0	6	0	0	0	0	1	0	0	0	0	0	0	0
Nowshera	Pabbi	Kuderzai Khan Sher Garhi	5.4108	0	1	0	0	0	7	0	10	0	0	2	0	0	2	0	0	0	0
Nowshera	Pabbi	Shah Kot	69.344179	0	2	0	0	0	41	0	6	0	0	13	0	0	0	0	0	0	0
Nowshera	Pabbi	AKBAR PURA (SHINDI PAYAN)	18.602252	0	3	0	0	0	29	0	10	0	0	9	0	0	1	0	0	0	0
Nowshera	Pabbi	BALU	16.263919	0	1	0	0	0	20	0	9	0	0	5	0	0	0	0	0	0	0
Nowshera	Pabbi	BANDA MOHIB	33.738234	0	0	2	0	24	0	0	0	5	0	0	10	0	0	0	0	0	0
Nowshera	Pabbi	DAG BAISUD	19.109583	0	1	0	0	0	13	0	6	0	0	6	0	0	0	0	0	0	0
Nowshera	Pabbi	DAG ISMAIL KHEL CHAPRI	103.389289	0	2	0	0	0	45	0	8	0	0	16	0	0	1	0	0	0	0
Nowshera	Pabbi	JALLO ZAI	53.622134	0	3	0	0	0	24	0	8	0	0	10	0	0	0	0	0	0	0
Nowshera	Pabbi	KURVI	10.572111	0	0	1	0	13	0	0	0	4	0	0	3	0	0	0	0	0	0
Nowshera	Pabbi	TARU	22.117266	0	0	1	0	25	0	0	0	11	0	0	11	0	0	3	0	0	0
Nowshera	Jenghera	Aza Khel Bala	12.157245	0	1	0	0	0	6	0	10	0	0	4	0	0	2	0	0	0	0
Nowshera	Jenghera	Aza Khel Payan	20.164183	0	0	0	0	0	16	0	9	0	0	5	0	0	1	0	0	0	0
Nowshera	Jenghera	Badrashi	13.854481	0	1	0	0	0	15	0	22	0	0	7	0	0	3	0	0	0	0
Nowshera	Jenghera	Bara Banda	25.539716	0	0	0	0	29	0	0	0	20	0	0	7	0	0	7	0	0	0
Nowshera	Jenghera	Dheri Katti Khel	14.534758	0	0	0	0	0	2	0	1	0	0	1	0	0	0	0	0	0	0
Nowshera	Jenghera	Ganderi	51.939687	0	0	3	0	54	0	0	0	17	0	0	21	0	0	8	0	0	0
Nowshera	Jenghera	Kabul River	13.744768	0	0	0	0	0	4	0	4	0	0	7	0	0	0	0	0	0	0
Nowshera	Jenghera	Khaishki Bala	32.446218	0	2	0	0	0	58	0	12	0	0	7	0	0	1	0	0	0	0
Nowshera	Jenghera	Khaishki Payan	32.602049	0	0	0	0	0	33	0	1	0	0	5	0	0	0	0	0	0	0
Nowshera	Jenghera	Manki Sharif	97.858004	0	2	0	0	0	46	0	11	0	0	33	0	0	3	0	0	0	0
Nowshera	Jenghera	Misri Banda	21.095533	0	0	0	0	0	21	0	21	0	0	4	0	0	0	0	0	0	0
Nowshera	Jenghera	Nowshera Cantt	8.920236	0	2	0	0	0	21	0	15	0	0	9	0	0	17	0	0	1	0
Nowshera	Jenghera	Nowshera Kalan	44.918533	0	2	0	0	0	46	0	33	0	0	15	0	0	14	0	0	1	0
Nowshera	Jenghera	Pahari Kati Khel	92.765435	0	0	6	0	34	0	0	0	6	0	0	30	0	0	1	0	0	0
Nowshera	Jenghera	Pir Piai	18.583808	0	1	0	0	0	3	0	2	0	0	5	0	0	2	0	0	1	0
Nowshera	Jenghera	Pir Sabaq	24.744161	0	0	2	0	25	0	0	0	9	0	0	6	0	0	0	0	0	0
Nowshera	Jenghera	Rashaki	6.044267	0	0	1	0	14	0	0	0	6	0	0	1	0	0	0	0	0	0
Nowshera	Jenghera	Zara Miana	23.235762	0	0	0	0	26	0	0	0	8	0	0	8	0	0	0	0	0	0
Nowshera	Jenghera	Ziarat Kaka Sahib	67.047559	0	3	0	0	0	36	0	3	0	0	17	0	0	0	0	0	0	0

COMMUNICATION TOWERS, MAJOR INDUSTRIES,EDUCATION FACILITIES AND SETTELMENTS EXPOSED TO DROUGHT



Legend

- No Drought
- Mild Drought
- Moderate Drought
- Severe Drought
- Communication Towers
- Major Industries
- Education Facilities
- Settelments
- Union Council Boundary
- District Boundary

Multi Hazard Vulnerability & Risk Assessment, Nowshera, Khyber Pakhtunkhwa, Pakistan

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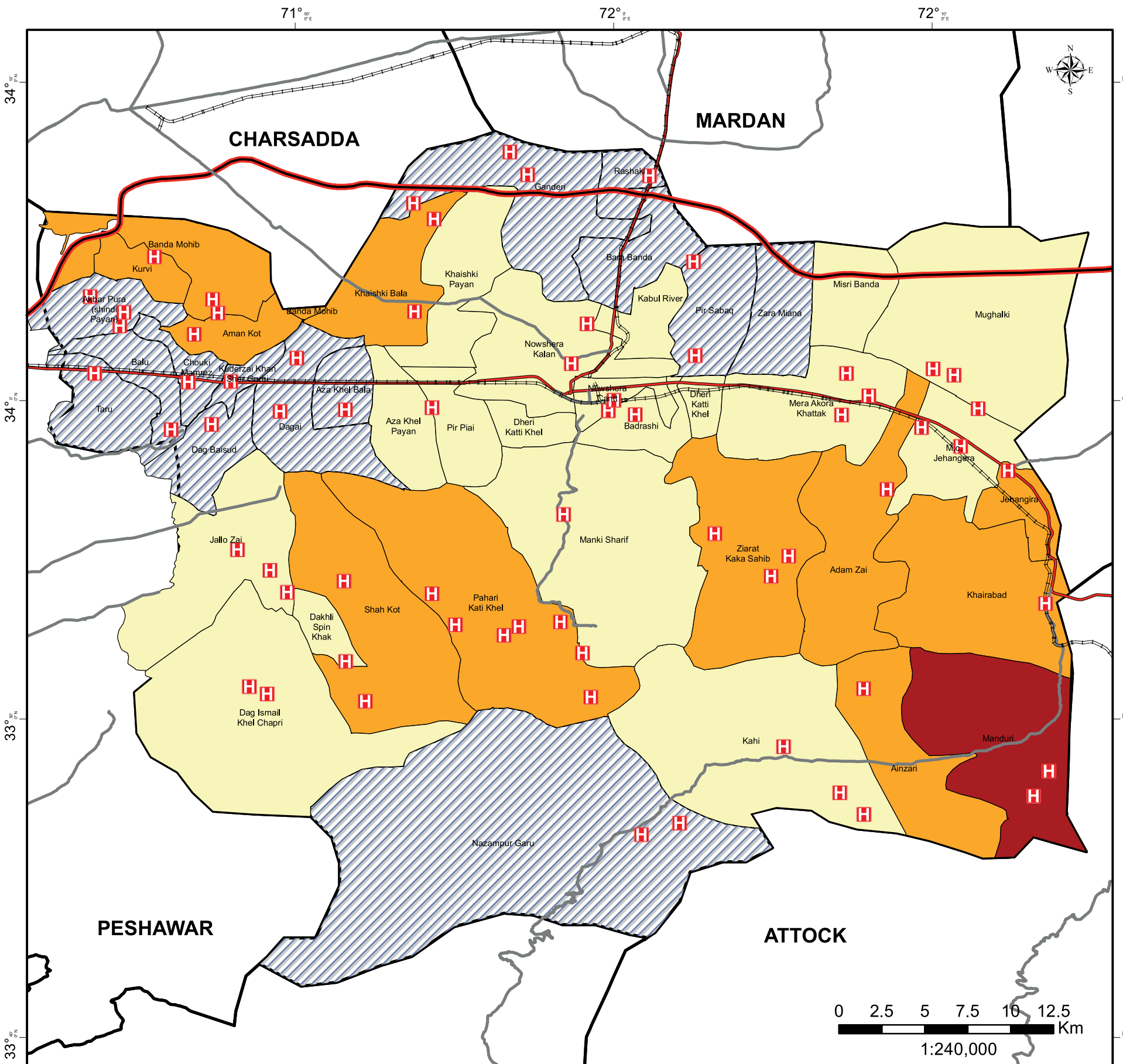
HEALTH FACILITIES AND TRANSPORTATION NETWORK EXPOSED TO DROUGHT



Legend

- No Drought
- Mild Drought
- Moderate Drought
- Severe Drought
- Health Facilities
- Transportation Network
- Union Council Boundary
- District Boundary

Multi Hazard Vulnerability & Risk Assessment, Nowshera, Khyber Pakhtunkhwa, Pakistan

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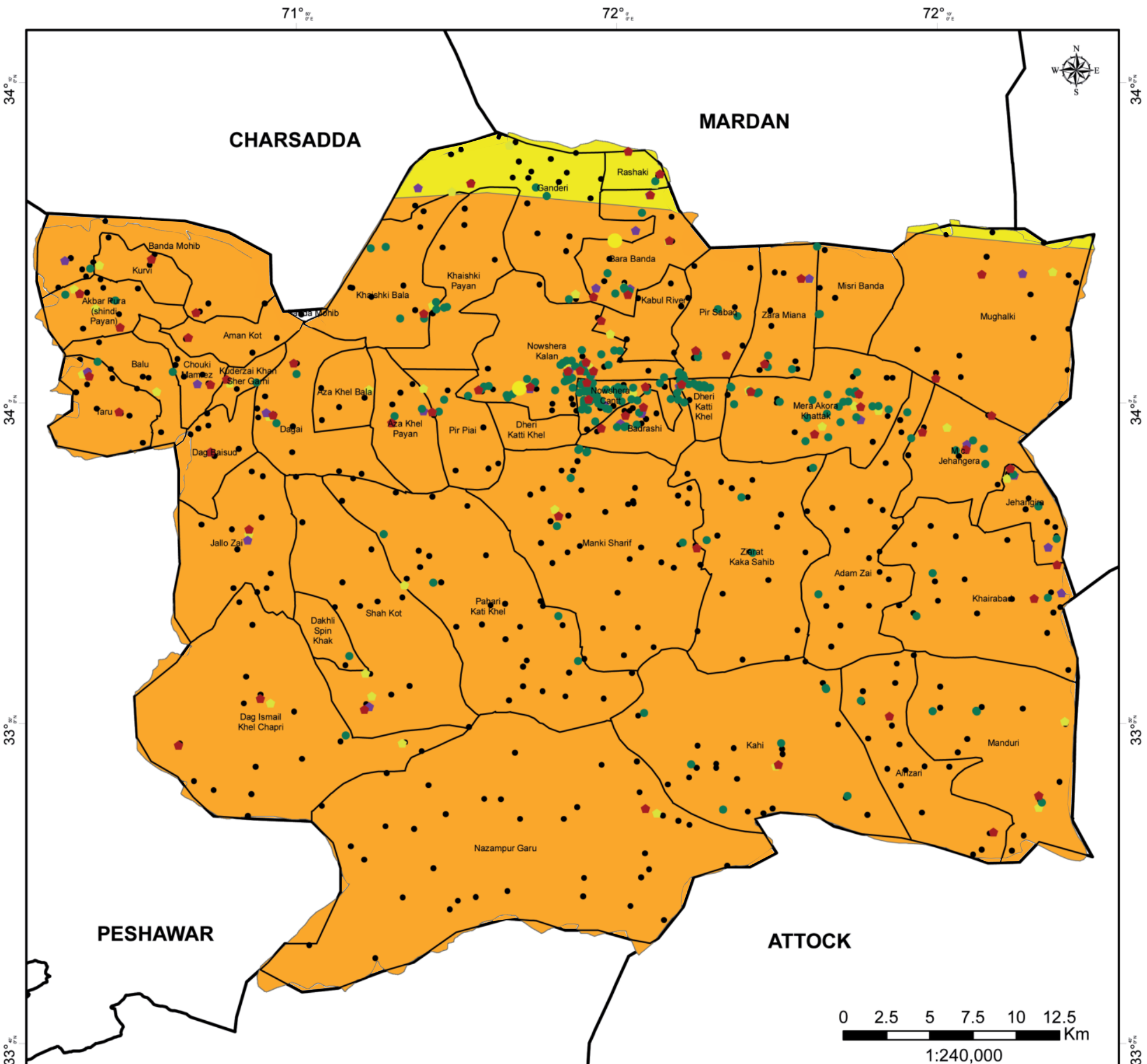
ELEMENTS EXPOSED TO EARTHQUAKE HAZARD

DISTRICT	TEHSIL	UNION COUNCIL NAME	Area sq km	Health Facilities			Education Facilities			Telocommunication Networks			Settlements			Industries			Railway Stations			Rescue Stations		
				High	Medium	Low	High	Medium	Low	High	Medium	Low	High	Medium	Low	High	Medium	Low	High	Medium	Low	High	Medium	Low
Nowshera	Nowshera	Adam Zai	54.875472	1	0	0	32	0	0	3	0	0	18	0	0	0	0	0	1	0	0	0	0	0
Nowshera	Nowshera	Ainzari	42.691272	1	0	0	24	0	0	5	0	0	17	0	0	0	0	0	0	0	0	0	0	0
Nowshera	Nowshera	Jehangira	13.482942	0	0	1	0	0	13	0	0	11	0	0	7	0	0	1	0	0	0	0	0	0
Nowshera	Nowshera	Kahi	98.757523	3	0	0	29	0	0	6	0	0	20	0	0	0	0	0	0	0	0	0	0	0
Nowshera	Nowshera	Khairabad	66.474667	1	0	0	25	0	0	10	0	0	16	0	0	0	0	0	1	0	0	0	0	0
Nowshera	Nowshera	M.c. Jehangera	28.523001	0	0	2	0	0	26	0	0	10	0	0	6	0	0	3	0	0	1	0	0	3
Nowshera	Nowshera	Manduri	66.74957	0	0	2	0	0	24	0	0	6	0	0	11	0	0	0	0	0	0	0	0	0
Nowshera	Nowshera	Mera Akora Khattak	45.159373	0	0	3	0	0	50	0	0	28	0	0	11	0	0	5	0	0	0	0	0	0
Nowshera	Nowshera	Mughalki	87.807744	0	0	3	0	0	18	0	0	9	0	0	15	0	0	0	0	0	0	0	0	0
Nowshera	Nowshera	Nazampur Garu	210.066081	2	0	0	31	0	0	8	0	0	36	0	0	0	0	0	0	0	0	1	0	0
Nowshera	Pabbi	Aman Kot	13.723276	0	0	1	0	0	8	0	0	4	0	0	4	0	0	0	0	0	0	0	0	0
Nowshera	Pabbi	Chouki Mamrez	9.496232	0	0	1	0	0	10	0	0	7	0	0	5	0	0	1	0	0	1	0	0	0
Nowshera	Pabbi	Dagai	31.044066	0	0	2	0	0	21	0	0	8	0	0	9	0	0	0	0	0	0	0	0	0
Nowshera	Pabbi	Dakhli Spin Khak	8.34681	1	0	0	6	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
Nowshera	Pabbi	Kuderzai Khan Sher Garhi	5.4108	0	0	1	0	0	7	0	0	10	0	0	2	0	0	2	0	0	0	0	0	0
Nowshera	Pabbi	Shah Kot	69.344179	0	0	0	41	0	0	6	0	0	13	0	0	0	0	0	0	0	0	0	0	0
Nowshera	Pabbi	AKBAR PURA (SHINDI PAYAN)	18.602252	0	3	0	0	29	0	0	10	0	0	9	0	0	1	0	0	0	0	0	0	0
Nowshera	Pabbi	BALU	16.263919	0	0	1	0	0	20	0	0	9	0	0	5	0	0	0	0	0	0	0	0	2
Nowshera	Pabbi	BANDA MOHIB	33.738234	0	2	0	0	24	0	0	5	0	0	10	0	0	0	0	0	0	0	0	0	0
Nowshera	Pabbi	DAG BAISUD	19.109583	0	0	1	0	0	13	0	0	6	0	0	6	0	0	0	0	0	0	0	0	0
Nowshera	Pabbi	DAG ISMAIL KHEL CHAPRI	103.389289	2	0	0	45	0	0	8	0	0	16	0	0	1	0	0	0	0	0	0	0	0
Nowshera	Pabbi	JALLO ZAI	53.622134	0	0	3	0	0	24	0	0	8	0	0	10	0	0	0	0	0	0	0	0	0
Nowshera	Pabbi	KURVI	10.572111	0	1	0	0	13	0	0	4	0	0	3	0	0	0	0	0	0	0	0	0	0
Nowshera	Pabbi	TARU	22.117266	0	0	1	0	0	25	0	0	11	0	0	11	0	0	3	0	0	1	0	0	0
Nowshera	Jenghera	Aza Khel Bala	12.157245	0	1	0	0	6	0	0	10	0	0	4	0	0	2	0	0	0	0	0	0	0
Nowshera	Jenghera	Aza Khel Payan	20.164183	0	0	0	0	0	16	0	0	9	0	0	5	0	0	1	0	0	0	0	0	0
Nowshera	Jenghera	Badrashi	13.854481	0	0	1	0	0	15	0	0	22	0	0	7	0	0	3	0	0	0	0	0	0
Nowshera	Jenghera	Bara Banda	25.539716	0	0	0	0	0	29	0	0	20	0	0	7	0	0	7	0	0	0	0	0	0
Nowshera	Jenghera	Dheri Katti Khel	14.534758	0	0	0	2	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0
Nowshera	Jenghera	Ganderi	51.939687	0	0	3	0	0	54	0	0	17	0	0	21	0	0	8	0	0	0	0	0	0
Nowshera	Jenghera	Kabul River	13.744768	0	0	0	0	0	4	0	0	4	0	0	7	0	0	0	0	0	0	0	0	0
Nowshera	Jenghera	Khaishki Bala	32.446218	0	0	2	0	0	58	0	0	12	0	0	7	0	0	1	0	0	0	0	0	0
Nowshera	Jenghera	Khaishki Payan	32.602049	0	0	0	0	0	33	0	0	33	0	0	5	0	0	0	0	0	0	0	0	0
Nowshera	Jenghera	Manki Sharif	97.858004	2	0	0	46	0	0	11	0	0	33	0	0	0	3	0	0	0	0	0	0	0
Nowshera	Jenghera	Misri Banda	21.095533	0	0	0	0	21	0	0	4	0	0	4	0	0	0	0	0	0	0	0	0	0
Nowshera	Jenghera	Nowshera Cantt	8.920236	0	0	2	0	0	21	0	0	21	0	0	9	0	0	17	0	0	1	0	0	0
Nowshera	Jenghera	Nowshera Kalan	44.918533	0	0	2	0	0	46	0	0	46	0	0	15	0	0	14	0	0	1	0	0	1
Nowshera	Jenghera	Pahari Kati Khel	92.765435	6	0	0	34	0	0	6	0	0	30	0	0	1	0	0	0	0	0	0	0	0
Nowshera	Jenghera	Pir Piai	18.583808	0	0	1	0	0	3	0	0	2	0	0	5	0	0	2	0	0	1	0	0	0
Nowshera	Jenghera	Pir Sabaq	24.744161	0	0	2	0	0	25	0	0	9	0	0	6	0	0	0	0	0	0	0	0	0
Nowshera	Jenghera	Rashaki	6.044267	0	0	1	0	0	14	0	0	5	0	0	1	0	0	0	0	0	0	0	0	0
Nowshera	Jenghera	Zara Miana	23.235762	0	0	0	0	26	0	0	8	0	0	8	0	0	0	0	0	0	0	0	0	0
Nowshera	Jenghera	Ziarat Kaka Sahib	67.047559	3	0	0	36	0	0	3	0	0	17	0	0	0	0	0	0	0	0	0	0	0

COMMUNATION TOWERS, MAJOR INDUSTRIES, EDUCATION FACILITIES AND SETTELMENTS EXPOSEDTO EARTHQUAKE 50 YEARS RETURN PERIOD



Legend

Hazard Zones

- 2B (0.16-0.24g) Meduim
- 3 (0.24-0.32g) High
- Communication Towers
- Major Industries
- Education Facilities
- Settelments
- Union Council Boundary
- District Boundary

Multi Hazard Vulnerability & Risk Assessment, Nowshera, Khyber Pakhtunkhwa, Pakistan

PAKISTAN National Disaster Management Authority NDMA

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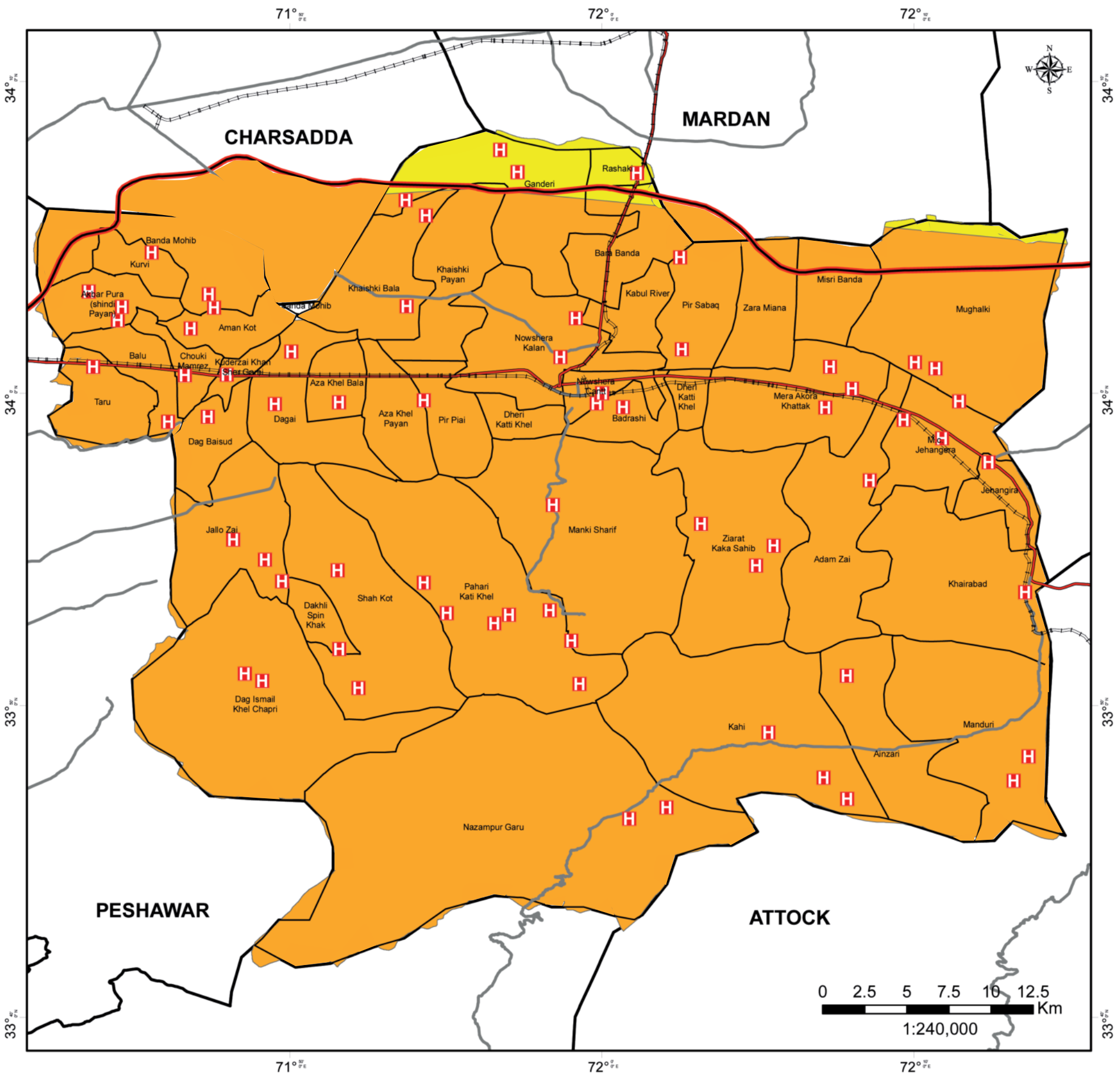
HEALTH FACILITIES AND TRANSPORTATION NETWORK EXPOSED TO EARTHQUAKE 50 YEARS RETURN PERIOD



Legend

Hazard Zones

- 2B (0.16-0.24g) Meduim
- 3 (0.24-0.32g) High
- Health Facilities
- Transportation Network
- Union Council Boundary
- District Boundary

Multi Hazard Vulnerability & Risk Assessment, Nowshera, Khyber Pakhtunkhwa, Pakistan

PAKISTAN National Disaster Management Authority NDMA

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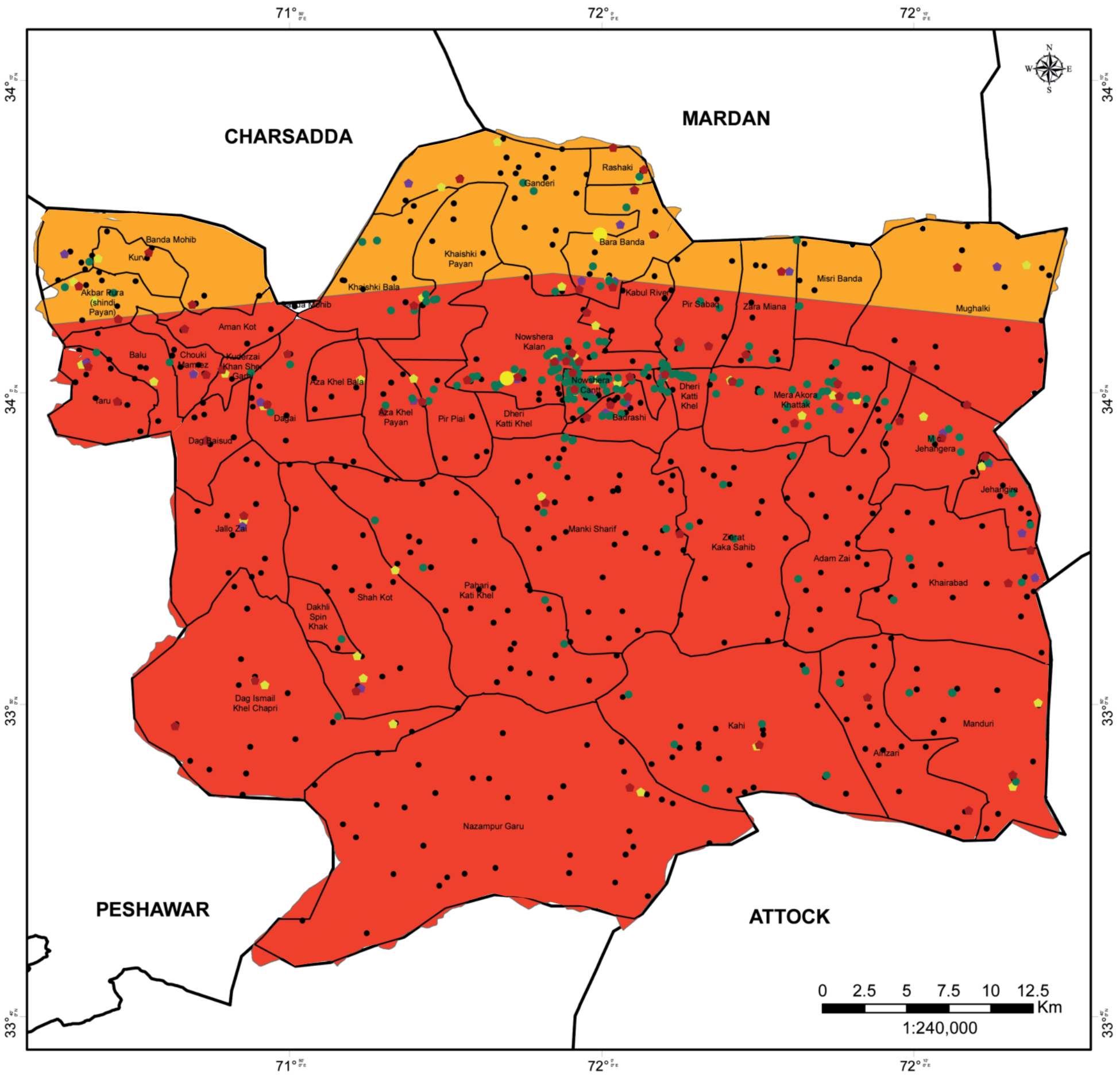
COMMUNATION TOWERS, MAJOR INDUSTRIES, EDUCATION FACILITIES AND SETTELMENTS EXPOSEDTO EARTHQUAKE 100 YEARS RETURN PERIOD



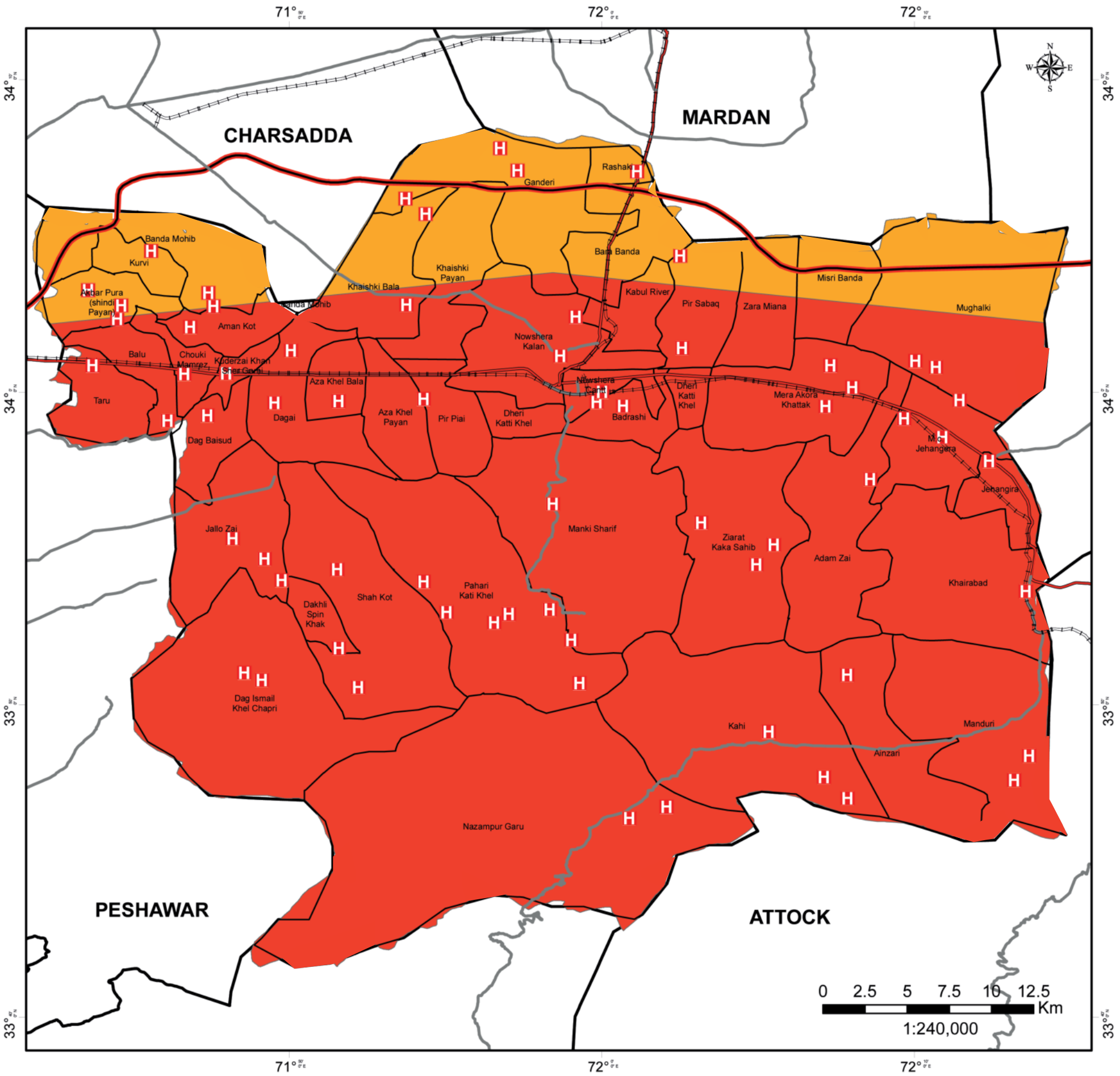
Legend

Hazard Zone

- 3 (0.24-0.32g) High
- 4 (>0.32g) Very High
- Communication Towers
- Major Industries
- Education Facilities
- Settelments
- Union Council Boundary
- District Boundary

Multi Hazard Vulnerability & Risk Assessment, Nowshera, Khyber Pakhtunkhwa, Pakistan

HEALTH FACILITIES AND TRANSPORTATION NETWORK EXPOSED TO EARTHQUAKE 100 YEARS RETURN PERIOD



Legend

Hazard Zone

- 3 (0.24-0.32g) High
- 4 (>0.32g) Very High
- Health Facilities
- Transportation Network
- Union Council Boundary
- District Boundary

Multi Hazard Vulnerability & Risk Assessment, Nowshera, Khyber Pakhtunkhwa, Pakistan

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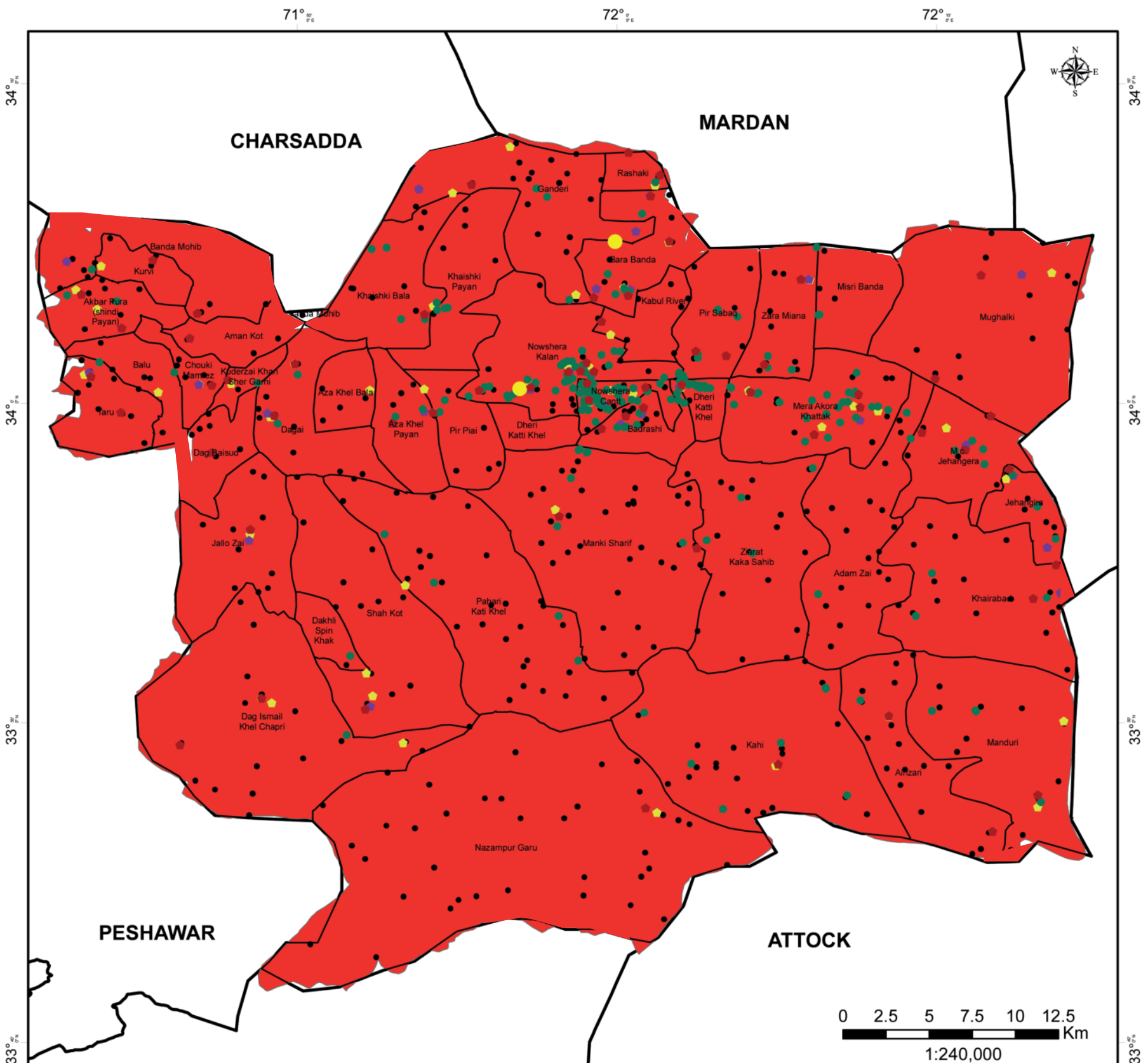
COMMUNATION TOWERS, MAJOR INDUSTRIES, EDUCATION FACILITIES AND SETTELMENTS EXPOSEDTO EARTHQUAKE 475 YEARS RETURN PERIOD



Legend

Hazard Zone

- (>0.32g) Very High
- Communication Towers
- Major Industries
- Education Facilities
- Settelments
- Union Council Boundary
- District Boundary

Multi Hazard Vulnerability & Risk Assessment, Nowshera, Khyber Pakhtunkhwa, Pakistan

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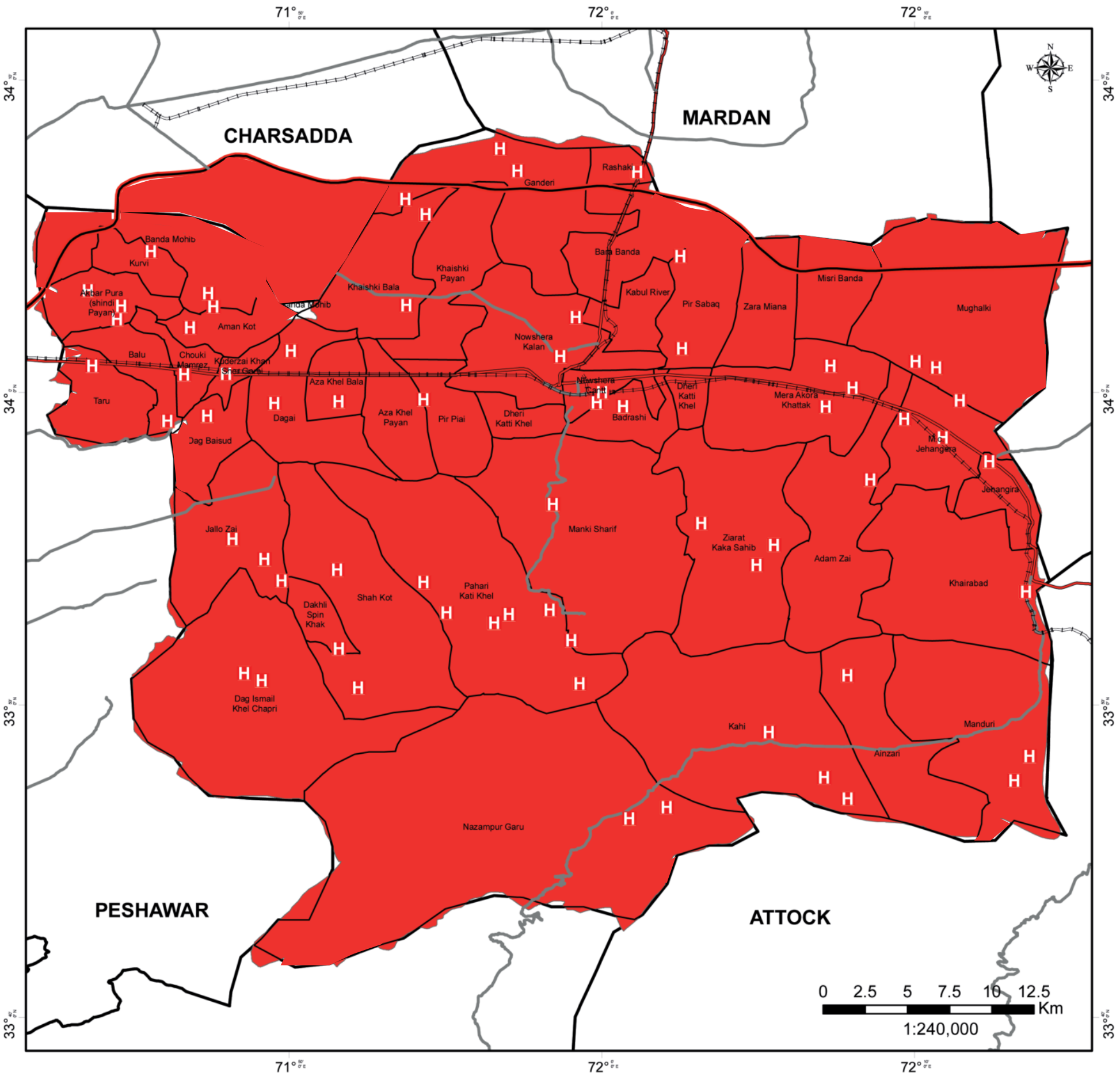
HEALTH FACILITIES AND TRANSPORTATION NETWORK EXPOSED TO EARTHQUAKE 475 YEARS RETURN PERIOD



Legend

Hazard Zone

- (>0.32g) Very High
- Health Facilities
- Transportation Network
- Union Council Boundary
- District Boundary

Multi Hazard Vulnerability & Risk Assessment, Nowshera, Khyber Pakhtunkhwa, Pakistan

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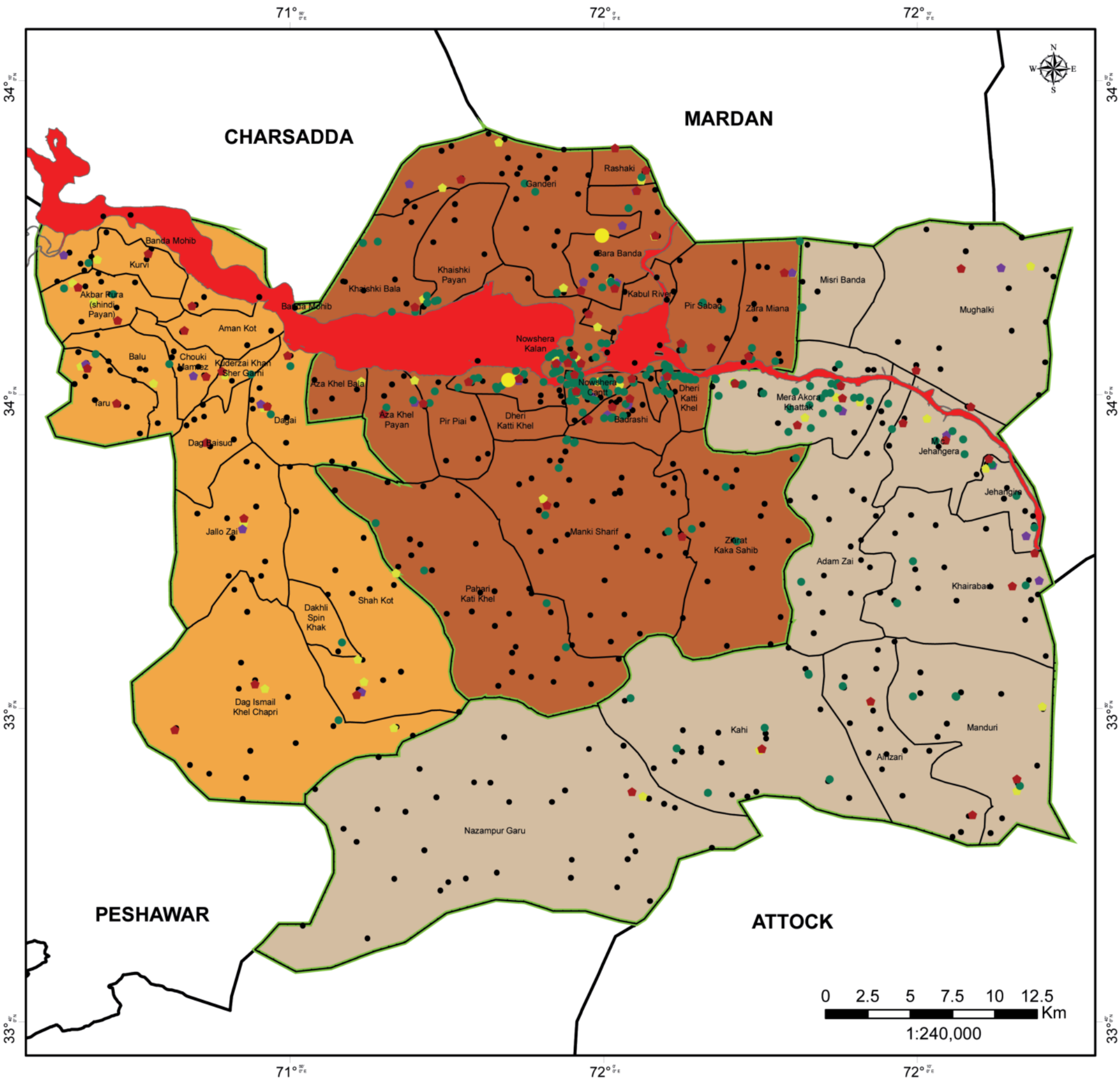
25 ELEMENTS EXPOSED TO FLOOD HAZARD

DISTRICT	TEHSIL	UNION COUNCIL NAME	Area sq km	Health Facilities			Education Facilities			Telecommunication Networks			Settlements			Industries			Railway Stations			Rescue Stations		
				High	Medium	Low	High	Medium	Low	High	Medium	Low	High	Medium	Low	High	Medium	Low	High	Medium	Low	High	Medium	Low
Nowshera	Nowshera	Adam Zai	54.875472	0	0	1	0	0	32	0	0	3	0	0	18	0	0	0	0	0	1	0	0	0
Nowshera	Nowshera	Ainzari	42.691272	0	0	1	0	0	24	0	0	5	0	0	17	0	0	0	0	0	0	0	0	0
Nowshera	Nowshera	Jehangira	13.482942	0	0	1	0	0	13	0	0	11	0	0	7	0	0	1	0	0	0	0	0	0
Nowshera	Nowshera	Kahi	98.757523	0	0	3	0	0	29	0	0	6	0	0	20	0	0	0	0	0	0	0	0	0
Nowshera	Nowshera	Khairabad	66.474667	0	0	1	0	0	25	0	0	10	0	0	16	0	0	0	0	0	1	0	0	0
Nowshera	Nowshera	M.c. Jehangera	28.523001	0	2	0	0	26	0	0	10	0	0	6	0	0	3	0	0	1	0	0	3	0
Nowshera	Nowshera	Manduri	66.74957	0	0	2	0	0	24	0	0	6	0	0	11	0	0	0	0	0	0	0	0	0
Nowshera	Nowshera	Mera Akora Khattak	45.159373	0	3	0	0	50	0	0	28	0	0	11	0	0	5	0	0	1	0	0	0	0
Nowshera	Nowshera	Mughalki	87.807744	0	0	3	0	0	18	0	0	9	0	0	15	0	0	0	0	0	0	0	0	0
Nowshera	Nowshera	Nazampur Garu	210.066081	0	0	2	0	0	31	0	0	8	0	0	36	0	0	0	0	0	0	0	0	1
Nowshera	Pabbi	Aman Kot	13.723276	1	0	0	8	0	0	4	0	0	4	0	0	0	0	0	0	0	0	0	0	0
Nowshera	Pabbi	Chouki Mamrez	9.496232	0	0	1	0	0	10	0	0	7	0	0	5	0	0	1	0	0	1	0	0	0
Nowshera	Pabbi	Dagai	31.044066	0	2	0	0	21	0	0	8	0	0	9	0	0	0	0	0	0	0	0	0	0
Nowshera	Pabbi	Dakhli Spin Khak	8.34681	0	0	1	0	0	6	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
Nowshera	Pabbi	Kuderzai Khan Sher Garhi	5.4108	0	1	0	0	7	0	0	10	0	0	2	0	0	2	0	0	0	0	0	0	0
Nowshera	Pabbi	Shah Kot	69.344179	0	0	2	0	0	41	0	0	6	0	0	13	0	0	0	0	0	0	0	0	0
Nowshera	Pabbi	AKBAR PURA (SHINDI PAYAN)	18.602252	0	3	0	0	29	0	0	10	0	0	9	0	0	1	0	0	0	0	0	0	0
Nowshera	Pabbi	BALU	16.263919	0	0	1	0	0	20	0	0	9	0	0	5	0	0	0	0	0	0	0	0	2
Nowshera	Pabbi	BANDA MOHIB	33.738234	2	0	0	24	0	0	5	0	0	10	0	0	0	0	0	0	0	0	0	0	0
Nowshera	Pabbi	DAG BAISUD	19.109583	0	0	1	0	0	13	0	0	6	0	0	6	0	0	0	0	0	0	0	0	0
Nowshera	Pabbi	DAG ISMAIL KHEL CHAPRI	103.389289	0	0	2	0	0	45	0	0	8	0	0	16	0	0	1	0	0	0	0	0	0
Nowshera	Pabbi	JALLO ZAI	53.622134	0	0	3	0	0	24	0	0	8	0	0	10	0	0	0	0	0	0	0	0	0
Nowshera	Pabbi	KURVI	10.572111	0	1	0	0	13	0	0	4	0	0	3	0	0	0	0	0	0	0	0	0	0
Nowshera	Pabbi	TARU	22.117266	0	0	1	0	0	25	0	0	11	0	0	13	0	0	3	0	0	1	0	0	0
Nowshera	Janghera	Aza Khel Bala	12.157245	1	0	0	6	0	0	10	0	0	4	0	0	2	0	0	0	0	0	0	0	0
Nowshera	Janghera	Aza Khel Payan	20.164183	0	0	0	16	0	0	9	0	0	5	0	0	1	0	0	0	0	0	0	0	0
Nowshera	Janghera	Badrashi	13.854481	0	0	1	0	0	15	0	0	22	0	0	7	0	0	3	0	0	0	0	0	0
Nowshera	Janghera	Bara Banda	25.539716	0	0	0	0	0	29	0	0	20	0	0	7	0	0	7	0	0	0	0	0	0
Nowshera	Janghera	Dheri Katti Khel	14.534758	0	0	0	0	0	2	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0
Nowshera	Janghera	Ganderi	51.939687	0	0	3	0	0	54	0	0	17	0	0	21	0	0	8	0	0	0	0	0	0
Nowshera	Janghera	Kabul River	13.744768	0	0	0	4	0	0	4	0	0	7	0	0	0	0	0	0	0	0	0	0	0
Nowshera	Janghera	Khaishki Bala	32.446218	2	0	0	58	0	0	12	0	0	7	0	0	1	0	0	0	0	0	0	0	0
Nowshera	Janghera	Khaishki Payan	32.602049	0	0	0	33	0	0	1	0	0	5	0	0	0	0	0	0	0	0	0	0	0
Nowshera	Janghera	Manki Sharif	97.858004	0	0	2	0	0	46	0	0	11	0	0	33	0	0	3	0	0	0	0	0	0
Nowshera	Janghera	Misri Banda	21.095533	0	0	0	0	0	21	0	0	4	0	0	4	0	0	0	0	0	0	0	0	0
Nowshera	Janghera	Nowshera Cantt	8.920236	2	0	0	21	0	0	15	0	0	9	0	0	17	0	0	1	0	0	0	0	0
Nowshera	Janghera	Nowshera Kalan	44.918533	2	0	0	46	0	0	33	0	0	15	0	0	14	0	0	1	0	0	1	0	0
Nowshera	Janghera	Pahari Kati Khel	92.765435	0	0	6	0	0	34	0	0	6	0	0	30	0	0	1	0	0	0	0	0	0
Nowshera	Janghera	Pir Piai	18.583808	0	1	0	0	3	0	0	2	0	0	5	0	0	2	0	0	1	0	0	0	0
Nowshera	Janghera	Pir Sabaq	24.744161	2	0	0	25	0	0	9	0	0	6	0	0	0	0	0	0	0	0	0	0	0
Nowshera	Janghera	Rashaki	6.044267	0	0	1	0	0	14	0	0	5	0	0	1	0	0	0	0	0	0	0	0	0
Nowshera	Janghera	Zara Miana	23.235762	0	0	0	0	26	0	0	8	0	0	8	0	0	0	0	0	0	0	0	0	0
Nowshera	Janghera	Ziarat Kaka Sahib	67.047559	0	0	3	0	0	36	0	0	3	0	0	17	0	0	0	0	0	0	0	0	0

COMMUNICATION TOWER, MAJOR INDUSTRIES, EDUCATION FACILITIES AND SETTELMENTS EXPOSED TO FLOOD 10 YEARS RETURN PERIOD



Legend

- Flood Hazard 10 Year Return Period
- Communication Towers
- Major Industries
- Education Facilities
- Settelments
- Union Council Boundary
- District Boundary

Tehsil Boundary

- Jahangira
- Nowshera
- Pabbi

Multi Hazard Vulnerability & Risk Assessment, Nowshera, Khyber Pakhtunkhwa, Pakistan

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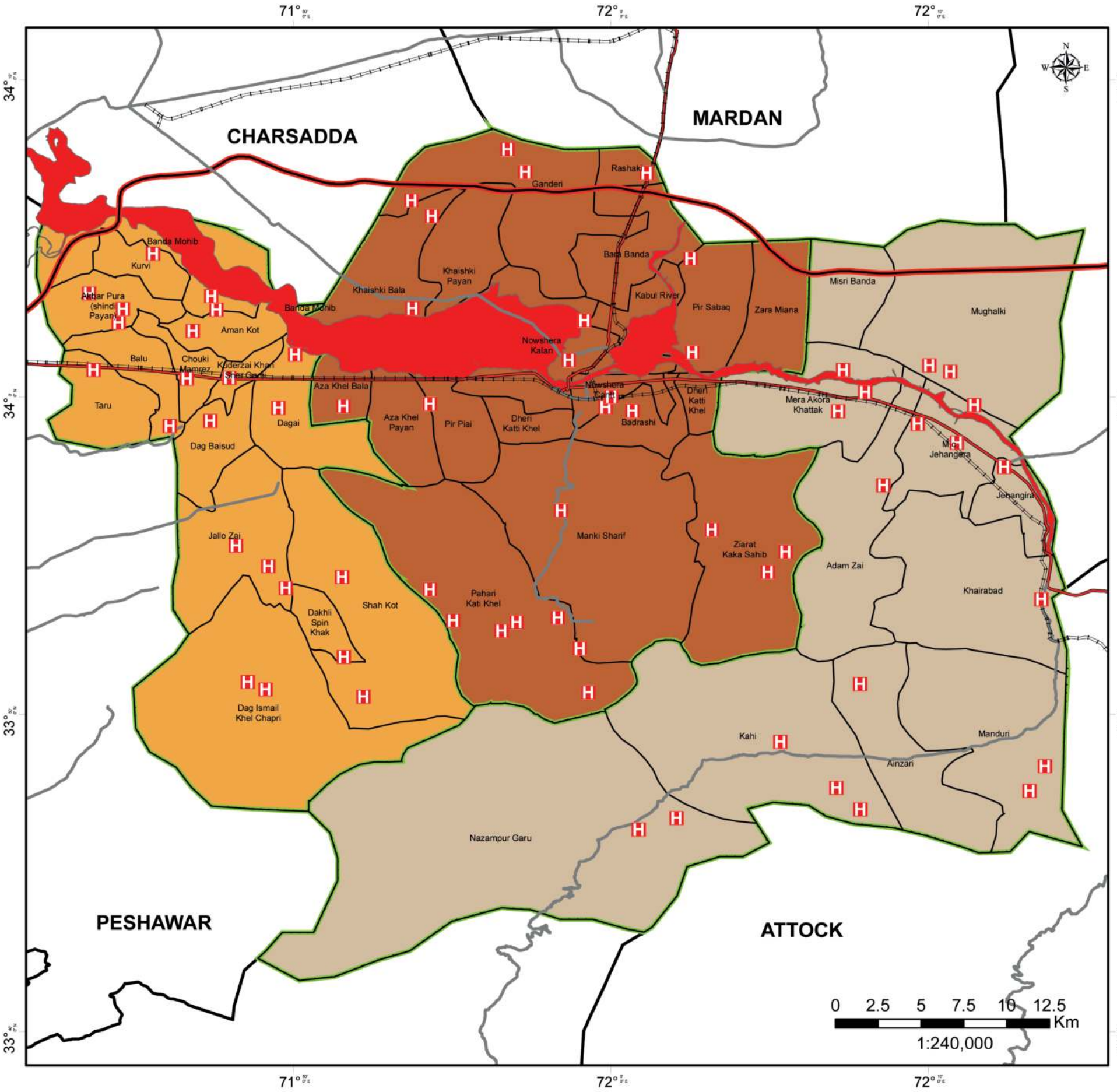
HEALTH FACILITIES AND TRANSPORTATION NETWORK EXPOSED TO FLOOD 10 YEARS RETURN PERIOD



Legend

- Flood Hazard 10 Year Return Period
- Health Facilities
- Transportation Network
- Union Council Boundary
- District Boundary

Tehsil Boundary

- Jahangira
- Nowshera
- Pabbi

Multi Hazard Vulnerability & Risk Assessment, Nowshera, Khyber Pakhtunkhwa, Pakistan

PAKISTAN National Disaster Management Authority NDMA

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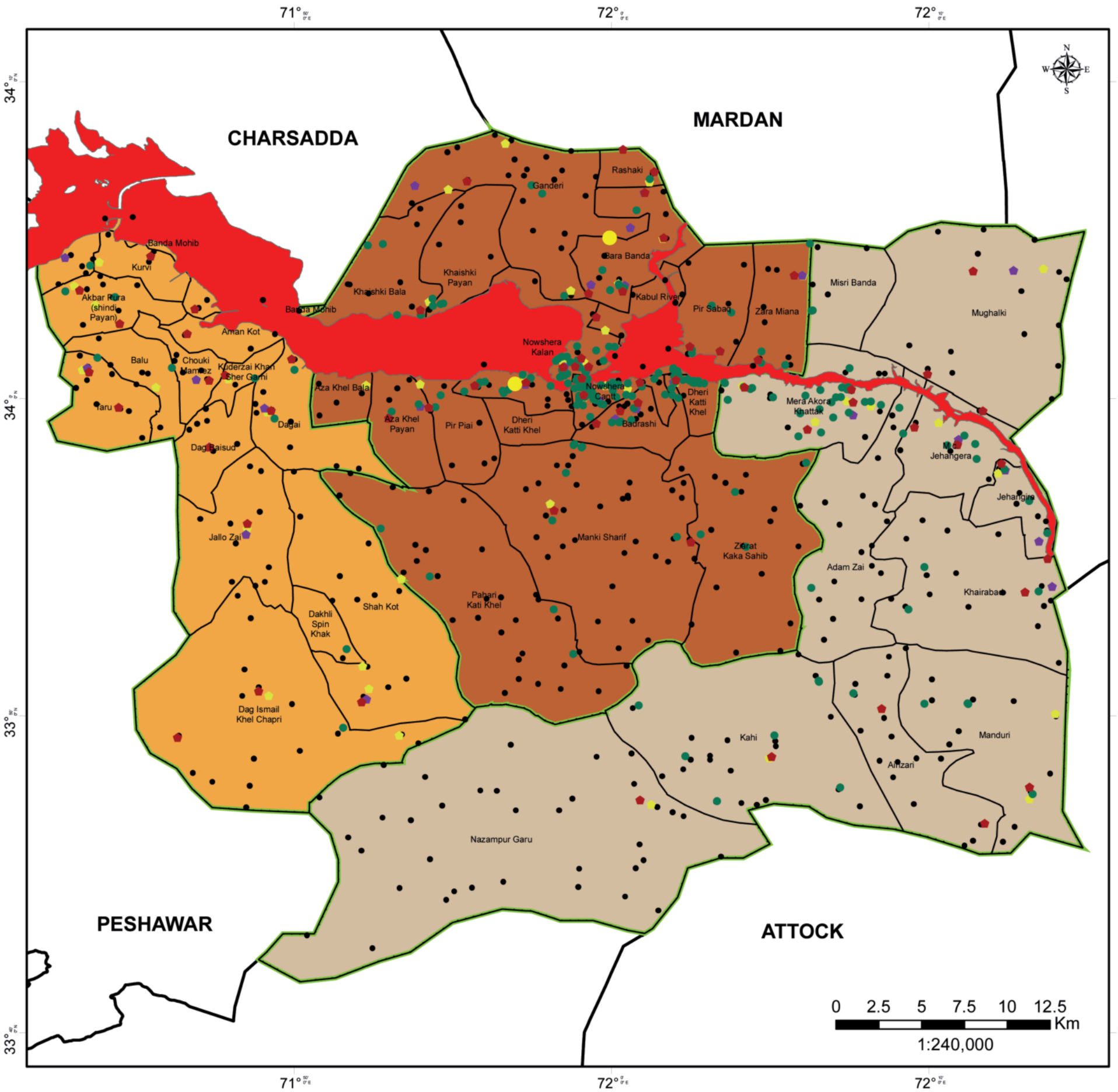
COMMUNICATION TOWER, MAJOR INDUSTRIES, EDUCATION FACILITIES AND SETTELMENTS EXPOSED TO FLOOD 50 YEARS RETURN PERIOD



Legend

- Flood Hazard 50 Year Return Period
- Communication Towers
- Major Industries
- Education Facilities
- Settelments
- Union Council Boundary
- District Boundary

Tehsil Boundary

- Jahangira
- Nowshera
- Pabbi

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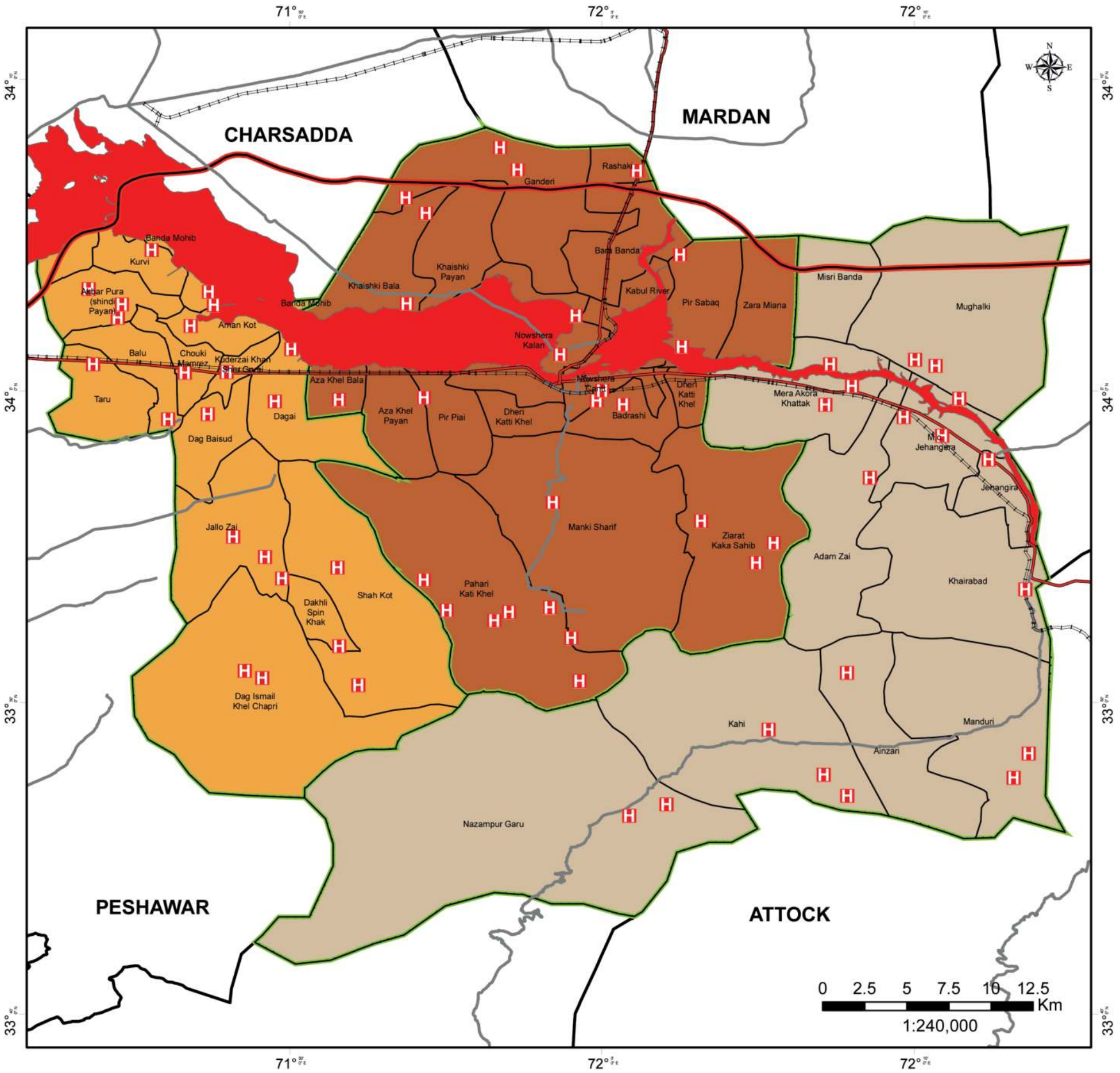
HEALTH FACILITIES AND TRANSPORTATION NETWORK EXPOSED TO FLOOD 50 YEARS RETURN PERIOD



Legend

- Flood Hazard 50 Year Return Period
- Health Facilities
- Transportation Network
- Union Council Boundary
- District Boundary

Tehsil Boundary

- Jahangira
- Nowshera
- Pabbi

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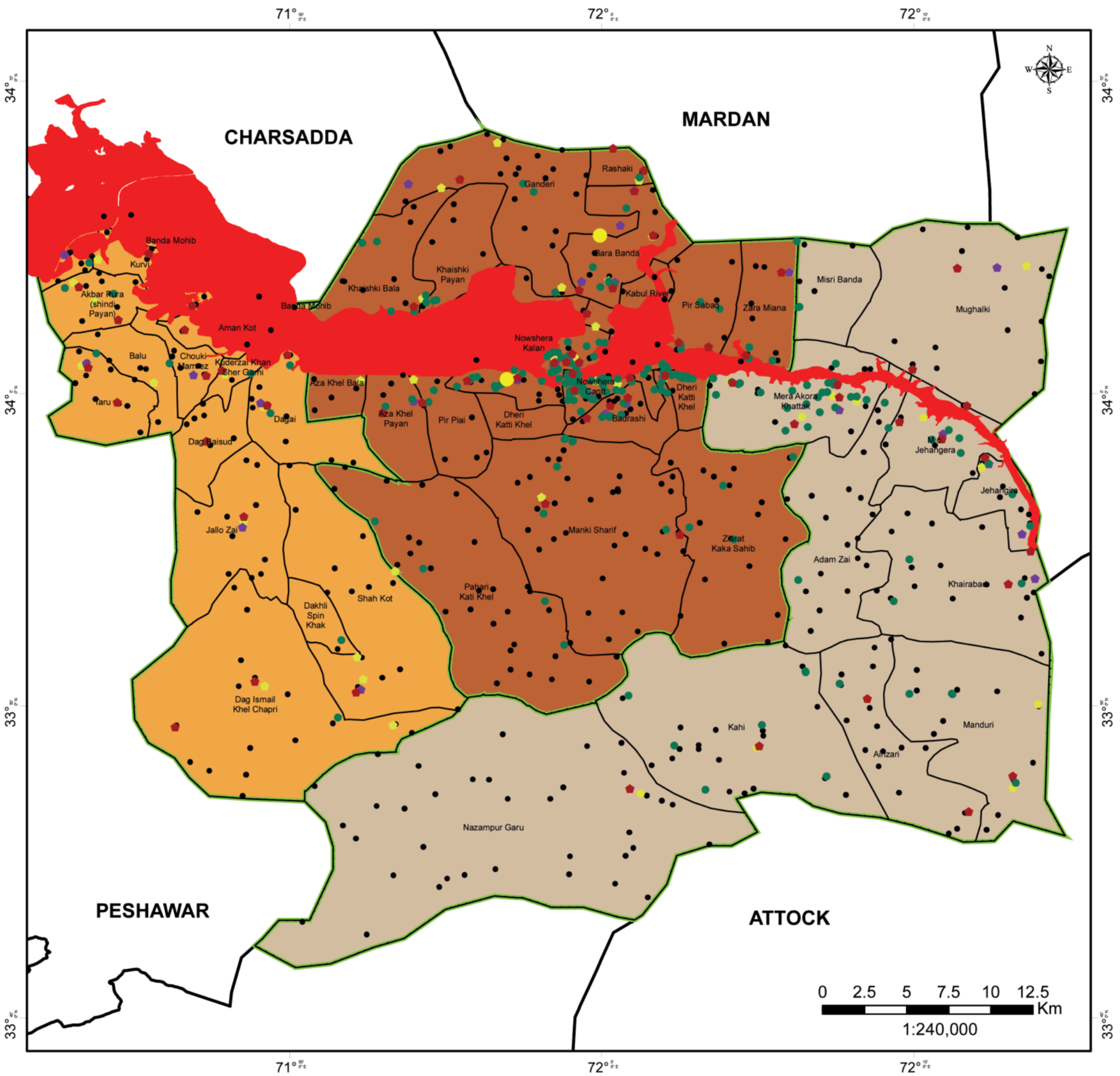
COMMUNICATION TOWER, MAJOR INDUSTRIES, EDUCATION FACILITIES AND SETTELMENTS EXPOSED TO FLOOD 100 YEARS RETURN PERIOD



Legend

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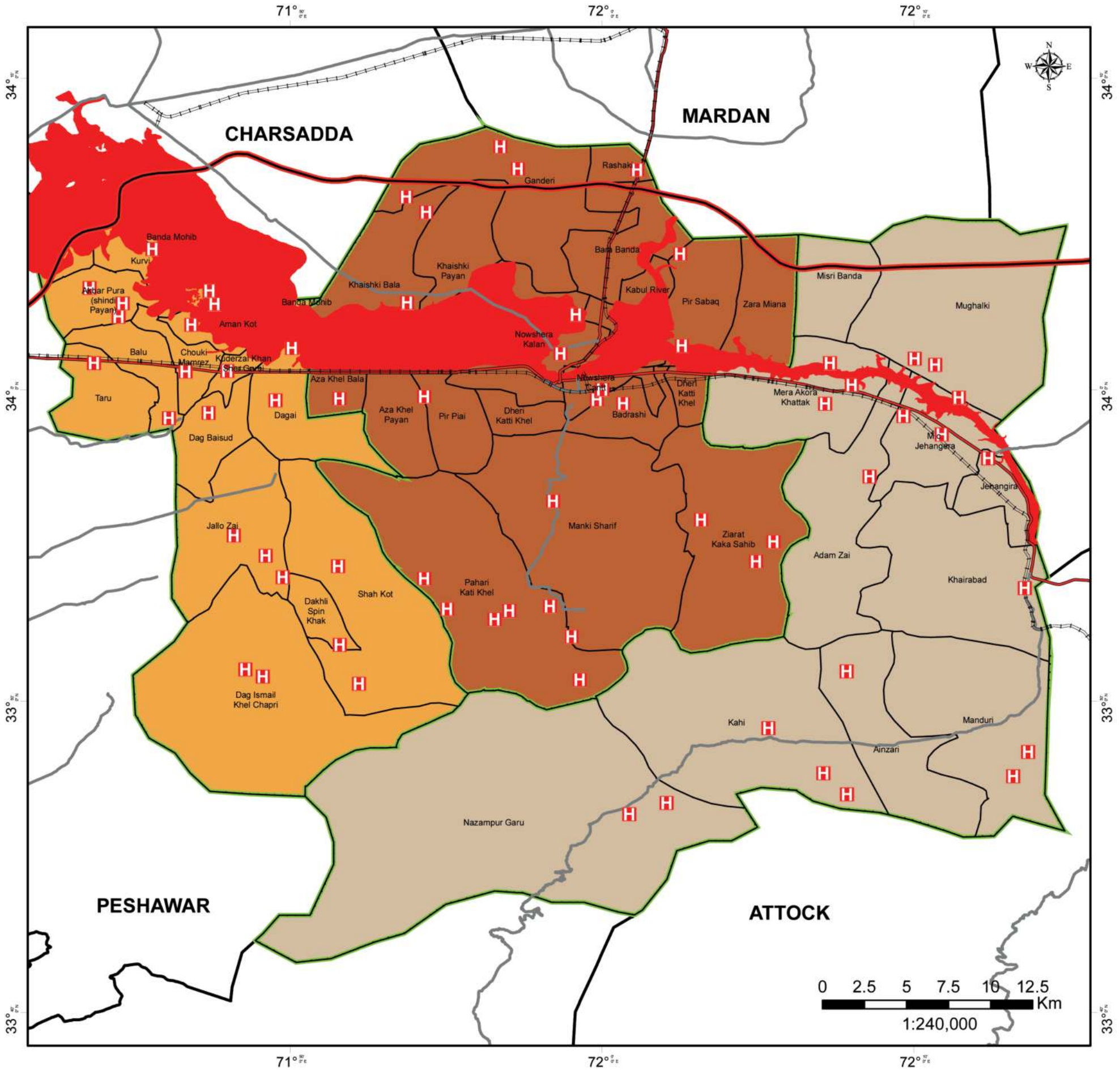
HEALTH FACILITIES AND TRANSPORTATION NETWORK EXPOSED TO FLOOD 100 YEARS RETURN PERIOD



Legend

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Tehsil Boundary

- Jahangira
- Nowshera
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D | VULNERABILITY ASSESSMENT

- PHYSICAL VULNERABILITY
- SOCIAL VULNERABILITY
- FOOD SECURITY

26 SOCIAL VULNERABILITY ASSESSMENT

Vulnerability Assessment has been undertaken in terms of:

(a) Physical Dimension (b) Social Aspects (c) Agro based Food Security

Exposure is defined as the interaction of element at risk and hazard. The hazard severity, extent or magnitude of various return periods indicates the degree to which the elements at risk are exposed to a particular hazard. Primary and secondary sources were used for exposure analysis and it was performed by overlaying hazard information with elements at risk. Elements at risks were considered in the dimensions of population, building, essential & critical infrastructures and livelihood.

Physical Vulnerability Analysis (PVA)

For fragility analysis of buildings the structures are classified into engineered and non-engineered constructions. The engineered structured are analyzed by conducting laboratory experiments on building constituent materials such as brick units, mortar, brick assemblages, brick panels and brick walls for masonry structures and concrete cylinders, reinforcing steel bars, structural beam-column members for reinforced concrete structures. However, the complexity of non-engineered buildings, that depend solely on material properties are not reliable owing to the complexity of structure for modeling On National scale the construction typologies in Pakistan are primarily based on the type of material used in the construction of walls, floors and roof, and the overall construction quality of a structure typology.

Based on the type used according to EMS-98 the building vulnerability scoring for earthquake and flood hazard are given below where fragility against earthquake is calculated using shake table test and numerical analysis approach, while flood vulnerabilty scoring is based on historical damage statistics.

Building Vulnerability Scoring

Building Types	EMS-98	Vulnerability Score	
		Floods	Earthquakes
Reinforced Concrete	RC1	2.5	4.19
Stone Masonry	M1	5.4	4.45
Mud/Adobe Masonry	M2	7.14	8.52
Brick Masonry	M5	3.66	2.89
Wood/Bamboo Traditional	M7	4.82	3.20
Block Masonry	M8	4.24	4.00
Others Undefined	00	5	5.50

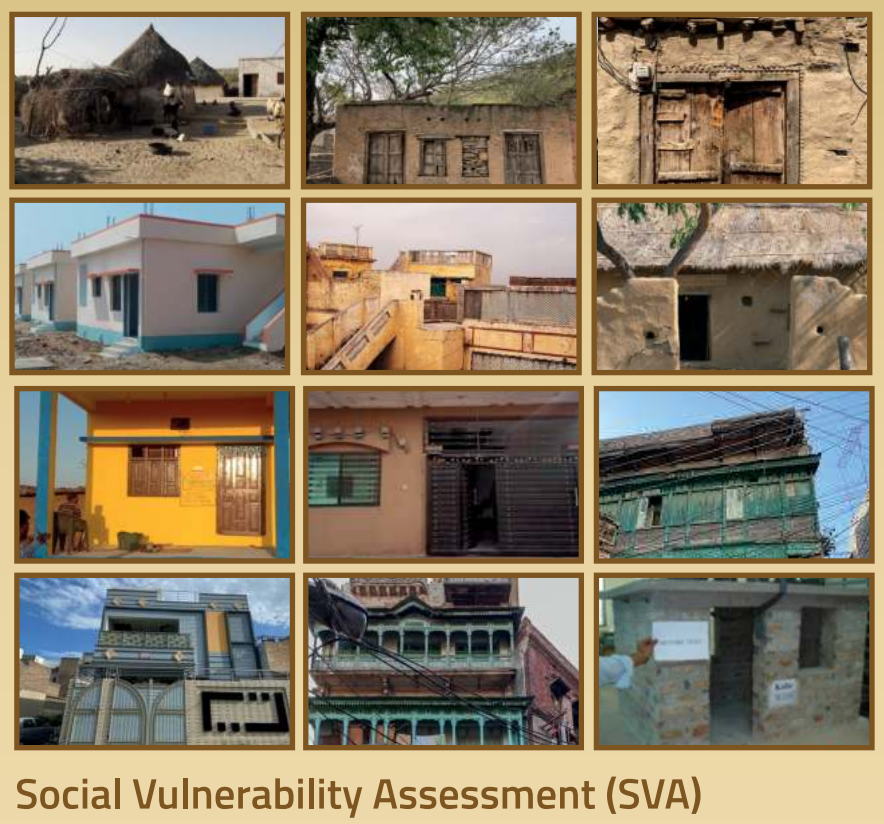
Building Vulnerability Scoring as per PBS Classification

Building Types	Floods	Earthquakes
Kaccha	6.5	5
Semi-Pacca	5.0	4
Pacca	2.5	1

The damage state of building material based on the repair cost ratio i.e. the ratio of the cost of repair to the total building cost is given below.

Damage State	Repair Cost Ratio
Slight	1 - 3%
Moderate	3 - 15%
Heavy	22 - 25%
Severe	40 - 100%

Buildings Surveyed for Physical Vulnerability Assessment



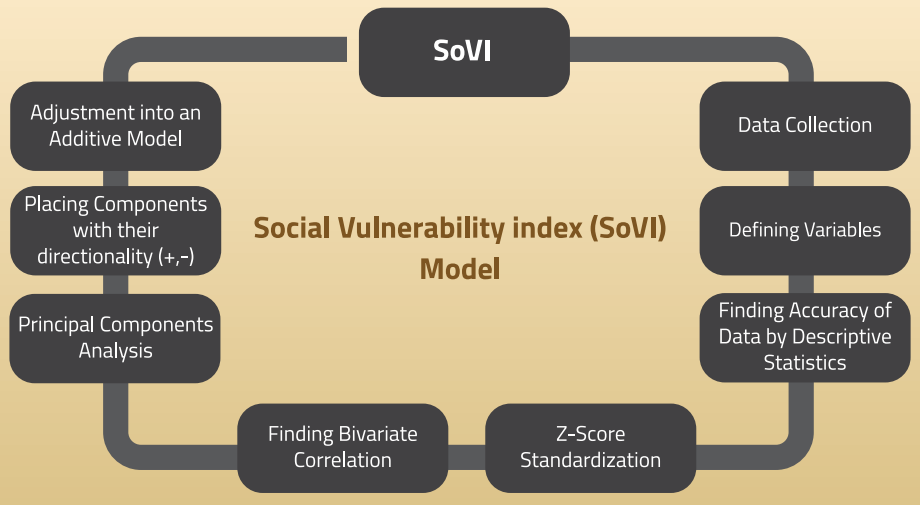
Social Vulnerability Assessment (SVA)

The Social Vulnerability Assessment focuses on the vulnerability characterization of communities, considering both the vulnerabilities of physical systems and the social conditions that can increase or decrease the impact of disasters in the considered area. The assessment is based on susceptibility of populations to loss, which is quantified using the methodology known as Social Vulnerability Index (SoVI). The SoVI for District Khushab is given in the table below.

Factors	Component	Directionality	Variance Observed(%)
1	Age, Education, Health Outcome, Socioeconomic Status	Positive	30.25%
2	Rural Farm Populations	Positive	11.55%
3	Information Access	Negative	7.9%
4	Children with Disabilities	Positive	6.80%
5	Social Benefits	Negative	4.43%
6	Infant safety	Negative	4.55%
7	Low income laborers	Positive	3.41%
8	Poverty/Need for External Income Source	Positive	4.32%
9	Preventative Health Measures	Negative	3%

To obtain a final composite score of social vulnerability, the factors were added to obtain the aggregated factor i.e. the Social Vulnerability Index for each of the District:

SoVI Score = Factor 1 + Factor 2 + Factor 3 + Factor 4 + Factor 5 + Factor 6 + Factor 7 + Factor 8 + Factor 9



27 FOOD SECURITY

Distrcit	Tehsil	UC	Food Insecurity Ranking
Nowshera	Nowshera	Adam Zai	3
Nowshera	Nowshera	Ainzari	3
Nowshera	Jehangira	Aza Khel Bala	3
Nowshera	Jehangira	Aza Khel Payan	3
Nowshera	Jehangira	Badrashi	3
Nowshera	Jehangira	Bara Banda	3
Nowshera	Jehangira	Dheri Katti Khel	3
Nowshera	Jehangira	Ganderi	3
Nowshera	Jehangira	Jehangira	3
Nowshera	Jehangira	Kabul River	3
Nowshera	Nowshera	Kahi	3
Nowshera	Nowshera	Khairabad	3
Nowshera	Jehangira	Khaishki Bala	3
Nowshera	Jehangira	Khaishki Payan	3
Nowshera	Nowshera	M.c. Jehangera	3
Nowshera	Nowshera	Manduri	3
Nowshera	Nowshera	Manki Sharif	3
Nowshera	Nowshera	Mera Akora	3
Nowshera	Jehangira	Khattak	3
Nowshera	Nowshera	Misri Banda	3
Nowshera	Nowshera	Mughalki	3
Nowshera	Jehangira	Nazampur Garu	3
Nowshera	Jehangira	Nowshera Cantt	3
Nowshera	Nowshera	Nowshera Kalan	3
Nowshera	Jehangira	Pahari Kati Khel	3
Nowshera	Jehangira	Pir Piai	3
Nowshera	Jehangira	Pir Sabaq	3
Nowshera	Jehangira	Rashaki	3
Nowshera	Jehangira	Zara Miana	3
Nowshera	Pabbi	Ziarat Kaka Sahib	3
Nowshera	Pabbi	Aman Kot	3
Nowshera	Pabbi	Chouki Mamrez	3
Nowshera	Pabbi	Dagai	3
Nowshera	Pabbi	Dakhli Spin Khak	3
Nowshera	Pabbi	Kuderzai Khan Sher	3
Nowshera	Pabbi	Garhi	3
Nowshera	Pabbi	Shah Kot	3
Nowshera	Pabbi	AKBAR PURA	3
Nowshera	Pabbi	(SHINDI PAYAN)	3
Nowshera	Pabbi	BALU	3
Nowshera	Pabbi	BANDA MOHIB	3
Nowshera	Pabbi	DAG BAISUD	3
Nowshera	Pabbi	DAG ISMAIL KHEL	3
Nowshera	Pabbi	CHAPRI	3
Nowshera	Pabbi	JALLO ZAI	3
Nowshera	Pabbi	KURVI	3
Nowshera	Pabbi	TARU	3

E | RISK ASSESSMENT

Population Density

Building Density

Health Facilities

Communication Towers

Major Industries

Roads

Education Facilities

Railway

Critical Infrastructure

28 INTEGRATED RISK ASSESSMENT

The given study has employed Integrated Risk Assessment Model, as shown in the figure below, for the cumulative risk assessment of study district. The Model takes into account both quantitative and qualitative risk assessment approaches. The methodology is based on multi criteria evaluation as well as analytical hierarchy process. For this purpose, set of indicators for each risk factors have been carefully taken based on the availability as well as the specific context of the study district. In the given methodology four separate dimensions of risk are considered as "factor Components" i.e. hazard, exposure, vulnerability and capacity. To analyze the value of factor components, a combination of quantitative, qualitative and contextual indicators have be assigned to each factor component. Each factor consists of a sets of indicators which cover several aspects of risk. The Risk Index considered a total of 52 indicators to cover physical, economic, demographic, social, environmental and economic dimensions of risk. Specific weights have been assigned to each indicator in order to acutely calculate its impact on risk. The maximum sum of all the elements of weights and indicators can have minimize value of 100, whereas the minimum sum is 0. The risk formula used in the Study is given below:

Risk= (Hazard x Vulnerability x Exposure / Capacity)

Five classes have been devised to categorize risk between "No to Very Low" Risk to "Very High Risk".

Risk Score	Risk State
>4.1	Extremely High
3.1-4.0	High to very High
2.1-3.0	Moderate to High
1.1-2.0	Low to moderate
0-1.0	No to very Low

Earthquake Hazard Severity Score		
3.0 - 3.9 Richter Scale	1	Very Low
4.0 - 4.9 Richter Scale	2	Low
5.0 - 5.9 Richter Scale	3	Moderate
6.0 - 6.9 Richter Scale	4	High
7 more Richter Scale	5	Very High
0 represents **No Hazard**		

Flood Hazard Severity Score		
0.3	1	Very Low
3.1 - 6	2	Low
6.1 - 9	3	Moderate
9.1 - 12t	4	High
> 12	5	Very High
0 represents **No Hazard**		

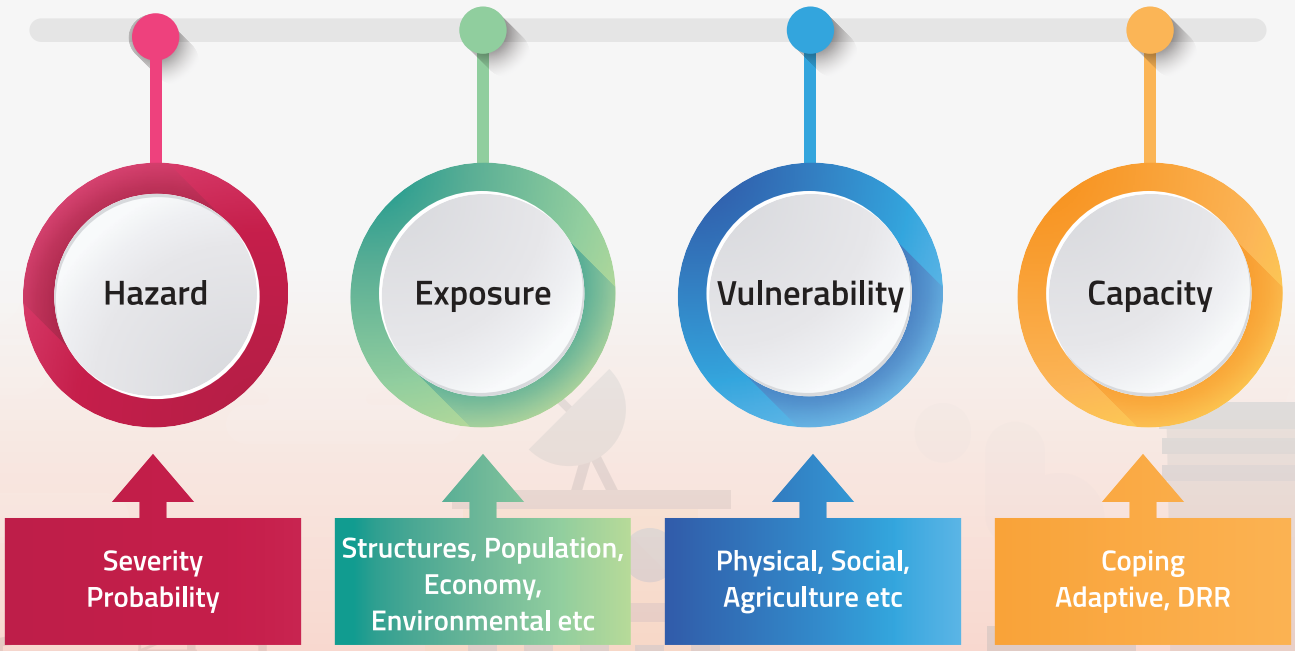
Drought Hazard Severity Score		
No Drought	1	Very Low
Mild	2	Low
Moderate	3	Medium
Severe	4	High
Extreme	5	Very High
0 represents **No Hazard**		

Exposure Scoring Scale	
1	No to Negligible
2	Low
3	Medium
4	High
5	Extremely High

Vulnerabilty Scoring Scale	
1	No to Negligible
2	Low
3	Medium
4	High
5	Extremely High

Capacity Scoring Scale	
1	No to Negligible
2	Low
3	Medium
4	High
5	Extremely High

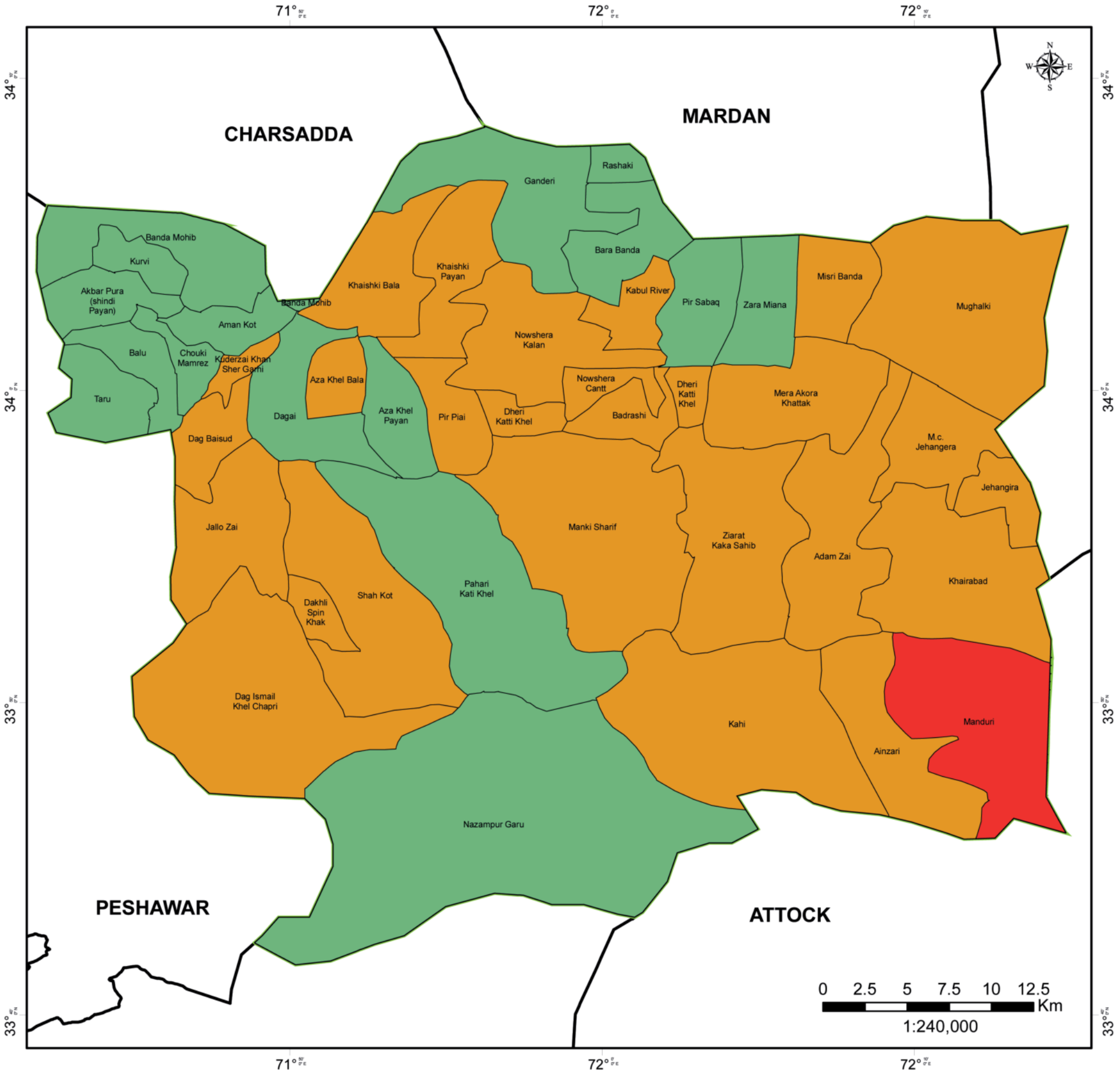
Disaster Risk Impact Factor



29 RISK ASSESSMENT BY HAZARD TYPE

Union Council	Hazard	Exposure	Vulnerability	Capacity	Risk			Overall
					Earthquake	Flood	Drought	
Adam Zai	1	3	3	2	3	1	2	2
Ainzari	2	3	3	2	3	1	2	2
AKBAR PURA (SHINDI PAYAN)	1	3	3	2	2	2	1	1
Aman Kot	3	3	3	2	1	3	1	2
Aza Khel Bala	3	3	3	2	2	3	2	2
Aza Khel Payan	3	3	3	2	1	3	1	2
Badrashi	1	3	3	2	1	1	2	1
BALU	2	3	3	2	1	1	1	1
BANDA MOHIB	2	3	3	2	2	3	1	2
Bara Banda	1	3	3	2	1	1	1	1
Chouki Mamrez	1	3	3	2	1	1	1	1
DAG BAISUD	1	3	3	2	1	1	2	1
DAG ISMAIL KHEL CHAPRI	1	3	3	2	3	1	2	2
Dagai	2	3	3	2	1	2	1	1
Dakhli Spin Khak	1	3	3	2	3	1	2	2
Dheri Katti Khel	1	3	3	2	3	1	2	2
Ganderi	2	3	3	2	1	1	1	1
JALLO ZAI	1	3	3	2	1	1	2	1
Jehangira	2	3	3	2	1	3	2	2
Kabul River	1	3	3	2	3	1	2	2
Kahi	1	3	3	2	3	1	2	2
Khairabad	2	3	3	2	1	3	2	2
Khaishki Bala	3	3	3	2	1	3	2	2
Khaishki Payan	2	3	3	2	1	2	2	2
Kuderzai Khan Sher Garhi	2	3	3	2	2	2	1	2
KURVI	2	3	3	2	1	2	2	2
M.c. Jehangera	1	3	3	2	1	1	3	2
Manduri	1	3	3	2	3	1	2	2
Manki Sharif	2	3	3	2	1	2	2	2
Mera Akora Khattak	1	3	3	2	2	1	2	2
Misri Banda	1	3	3	2	1	1	2	1
Mughalki	1	3	3	2	3	1	1	2
Nazampur Garu	3	3	3	2	1	3	2	2
Nowshera Cantt	3	3	3	2	1	3	2	2
Nowshera Kalan	1	3	3	2	3	1	1	2
Pahari Kati Khel	2	3	3	2	1	2	2	2
Pir Piai	3	3	3	2	1	3	1	2
Pir Sabaq	1	3	3	2	1	1	1	1
Rashaki	1	3	3	2	3	1	2	2
Shah Kot	2	3	3	2	1	1	1	1
Taru	3	3	3	2	2	2	1	2
Zara Miana	1	3	3	2	3	1	2	2
Ziarat Kaka Sahib	1	3	3	2	1	1	2	1

DROUGHT RISK



Legend

Drought Risk

- Low
- Medium
- Very High
- Tehsil Boundary
- Union Council Boundary
- District Boundary

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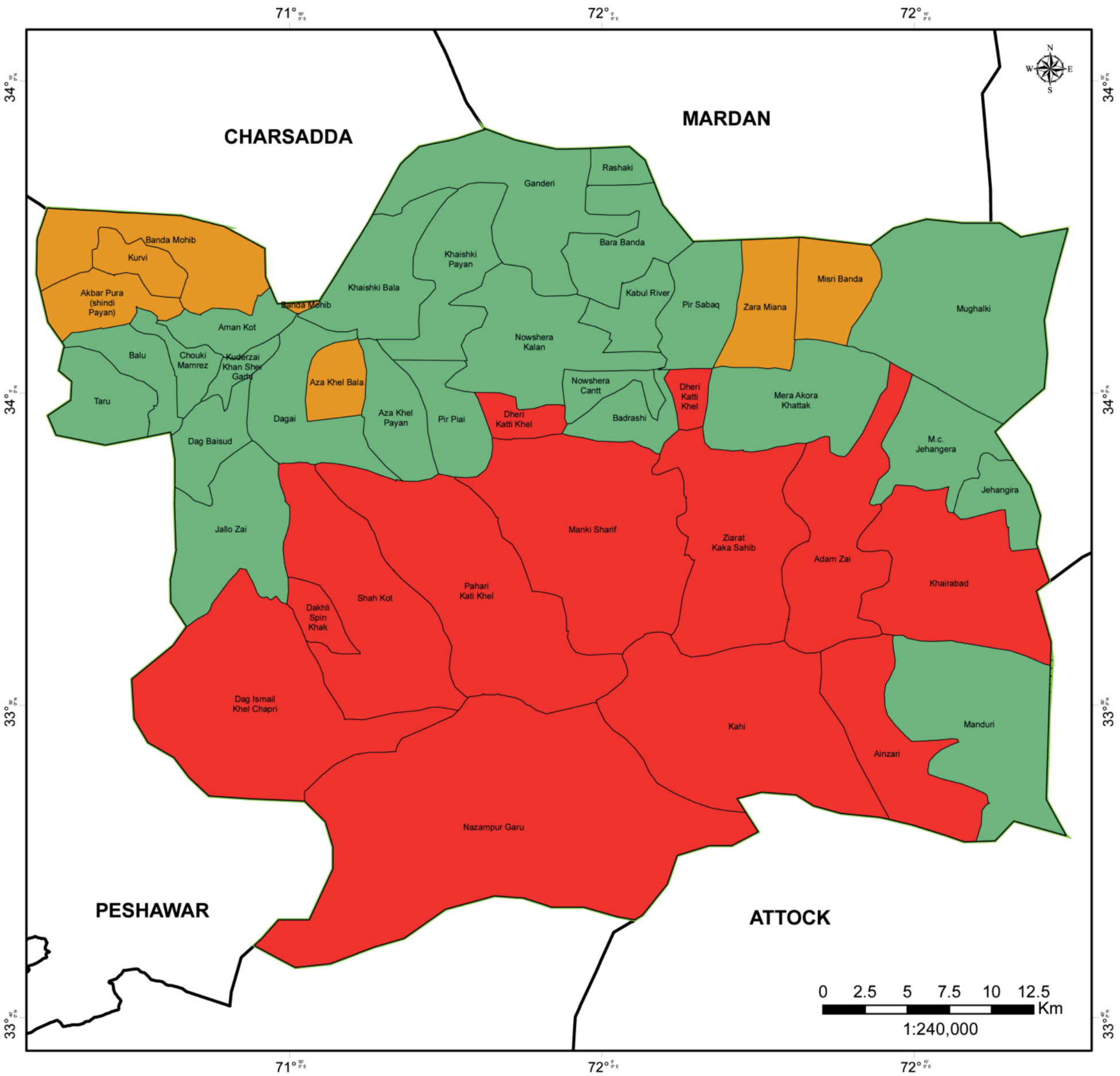
PAKISTAN National Disaster Management Authority NDMA

UN-HABITAT

EARTHQUAKE RISK



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Earthquake Risk

- Low
- Medium
- Very High
- Tehsil Boundary
- Union Council Boundary
- District Boundary

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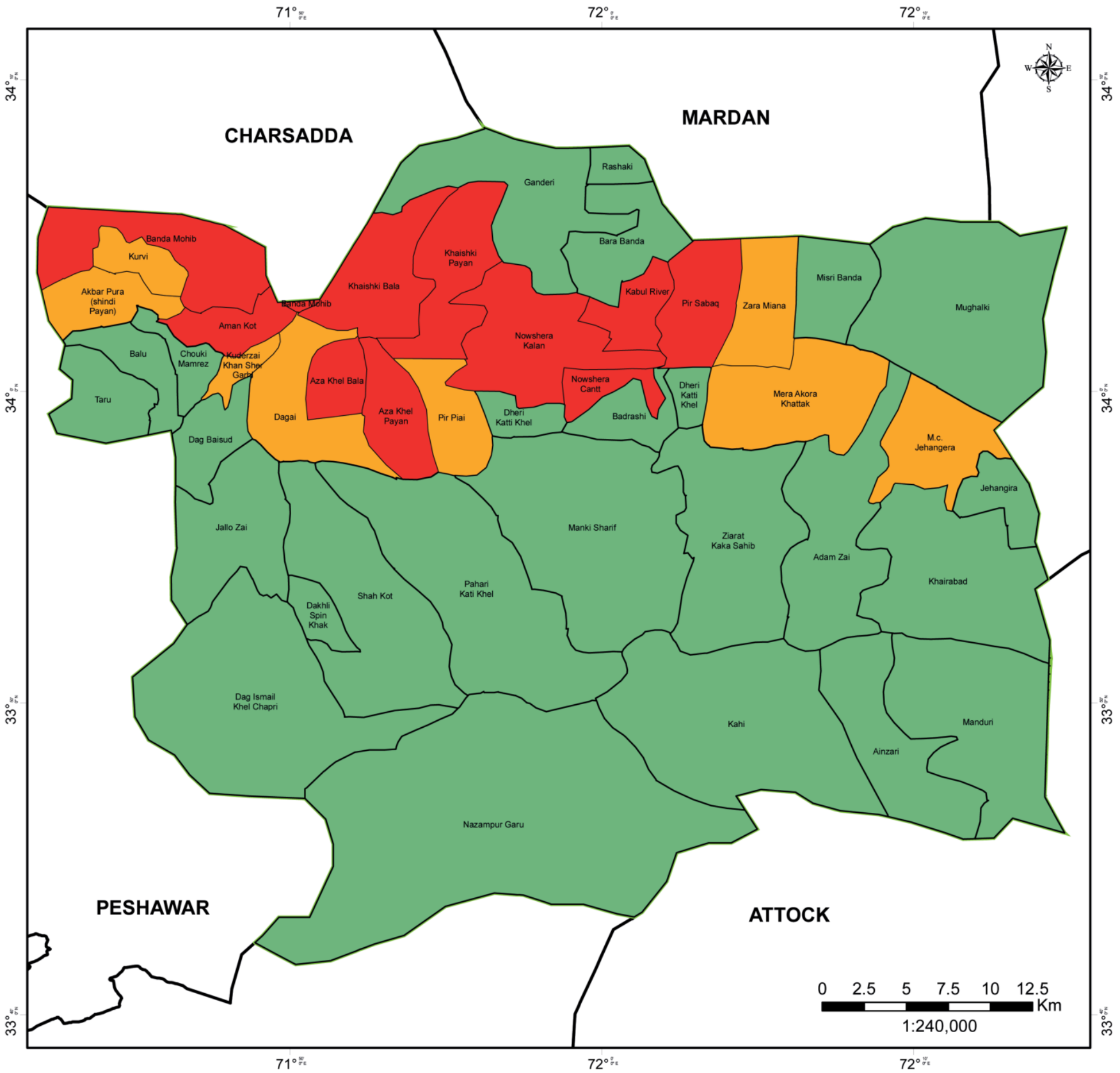
UN-HABITAT

FLOOD RISK



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Flood Risk

- Low
- Medium
- Very High
- Tehsil Boundary
- Union Council Boundary
- District Boundary

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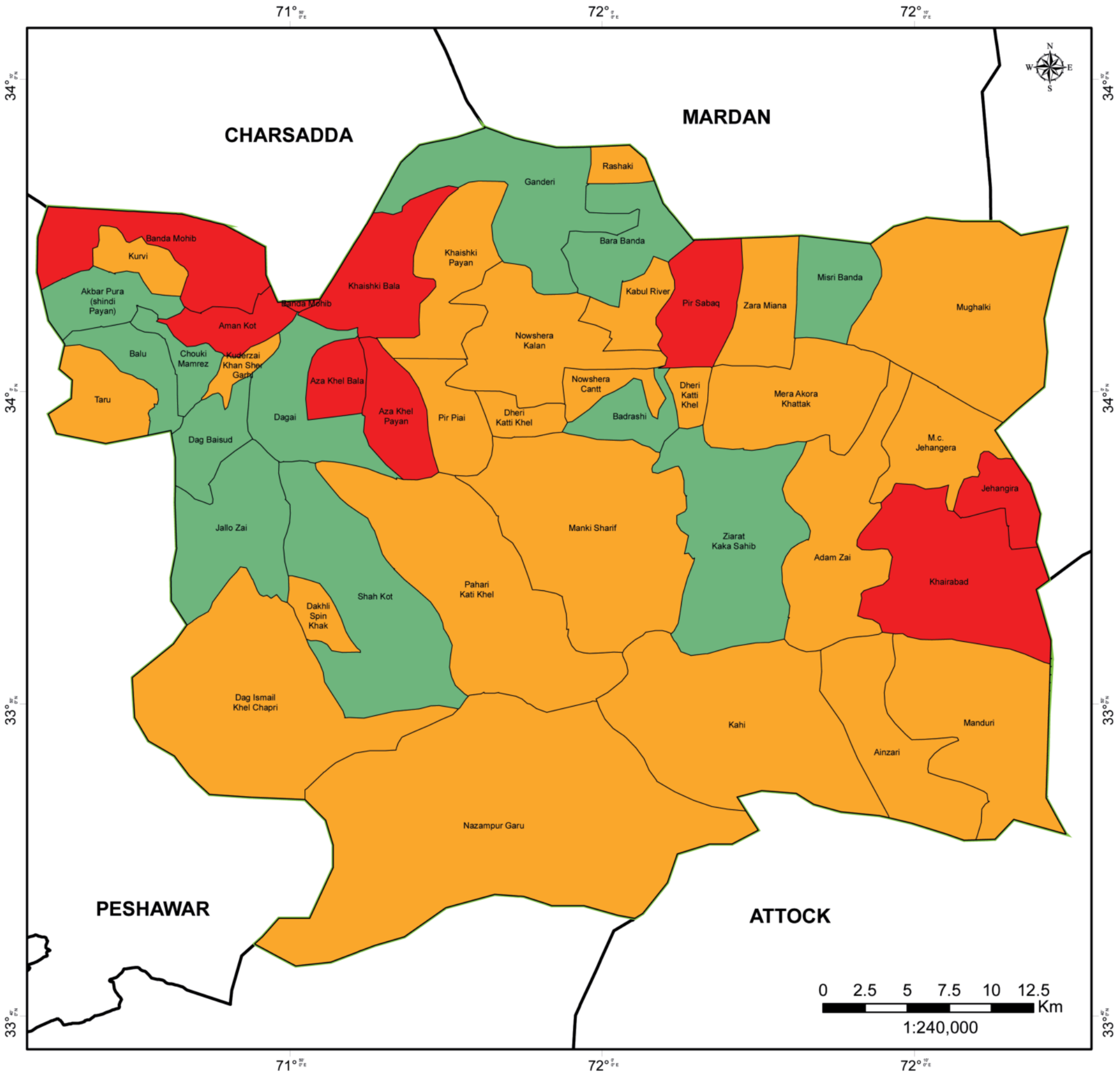
PAKISTAN National Disaster Management Authority NDMA

UN-HABITAT

COMPOSITE RISK



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Composite Risk

Composite

- Low
- Medium
- High
- Tehsil Boundary
- Union Council Boundary
- District Boundary

Multi Hazard Vulnerability & Risk Assessment, Nowshera, Khyber Pakhtunkhwa, Pakistan

GLOSSARY OF TERMS

Acceptable Risk	The level of potential losses that a society or community considers acceptable given existing social, economic, political, cultural, technical and environmental conditions.
Accountability	Obligation to demonstrate that work has been conducted in compliance with agreed rules and standards or to report fairly and accurately on performance results vis a vis mandated roles and/or plans. This may require a careful, even legally defensible, demonstration that the work is consistent with the contract terms.
Activity	Actions taken or work performed through which inputs, such as funds, technical assistance and other types of resources.
Adaptation	The adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities.
Affected Area	An area or part of country affected by disaster.
Alluvium Deposits	A deposit of clay, silt, and sand left by flowing floodwater in a river valley or delta, typically producing fertile soil.
Avalanche	An avalanche (also called a snow slide) is a rapid flow of snow down a sloping surface of a mountain. Avalanches are triggered due to mechanical failure of the snow when the forces on the snow exceed its cohesion strength.
Average Household Size	Average Number of persons per household.
Bare Area with Sparse Natural Vegetation	Sand Dunes with natural vegetation, bare rocks (with sparse vegetation) and desert flat pains are included in this class.
Bare Areas	This class describes areas that have very less natural and manmade vegetation cover which include sand dunes and barren land.
Base-Line Study	An analysis describing the situation prior to a development intervention, against which progress can be assessed or comparisons made.
Basic Health Unit (BHU)	The BHU is located at a Union Council and serves a catchment population of up to 25,000. Services provided at BHU are promotive, preventive, curative and referral. BHU provides all PHC services along with in tegral services that include basic medical and surgical care. MCH services are also part of the services package being provided at BHU. BHU provides first level referral to patients referred by LHWs. BHU refers patients to higher level facilities as and when necessary.
Built-up Area	It defines all built areas (urban, industrial, airport etc.) with all vegetated areas linked to the built-ups such as gardens, golf courses, urban recreation parks, plots devoted to urban expansion etc.
Capacity	The combination of all the strengths, attributes and resources available within a community, society or organization that can be used to achieve agreed goals.
Capacity Building	Efforts aimed to develop human skills or societal infrastructure within a community or organization needed to reduce the level of risk. In extended understanding, capacity building also includes development of institutional, financial, political and other resources, at different levels of the society.
Census	Census is an official count or a survey, especially of a population.
Climate Change	(a) The Inter-governmental Panel on Climate Change (IPCC) defines climate change as: "a change in the state of the climate that can be identified (e.g., by using statistical tests) by changes in the mean and/or the variability of its properties, and that persists for an extended period, typically decades or longer. Climate change may be due to natural internal processes or external force or to persistent anthropogenic changes in the composition of the atmosphere or in land use". (b) The United Nations Framework Convention on Climate Change (UNFCCC) defines climate change as "a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods".
Climatology	Climatology or climate science is the scientific study of climate, scientifically defined as weather conditions averaged over a period of time.
Coping Capacity	The means by which people or organizations use available resources and abilities to face a disaster. In general, this involves managing resources, both in normal times as well as during crises or adverse conditions.
Craton	The term craton is used to distinguish the stable portion of the continental crust from regions that are more geologically active and unstable. Cratons can be described as shields, in which the basement rock crops out at the surface, and platforms, in which the

	basement is overlaid by sediments and sedimentary rock.
Critical Facilities	The primary physical structures, technical facilities and systems which are socially, economically or operationally essential to the functioning of a society or community, both in routine circumstances and in the extreme circumstances of an emergency.
Crop Irrigated	Areas used for the production of annual crops, such as corn, vegetables, soybeans, tobacco and cotton. This class also includes all land being actively tilled.
Crop Marginal and Irrigated Saline	Crop marginal and irrigated saline are identified as those areas which are currently used for agriculture with low and unstable rainfall or higher rainfall areas intensively used, relative to user capability, under existing population densities, traditional technologies and institutional structures.
Crop Rainfed	The term rainfed agriculture is used to describe farming practicesthat rely only on rainfall for water.
Cyclone	A large-scale system of winds that spiral in toward a region of low atmospheric pressure. Because low-pressure systems generally produce clouds and precipitation, cyclones are often simply referred to as storms. A tropical cyclone is one that forms over warm tropical waters. Such a system is characterized by a warm, well-defined core and can range in intensity from a tropical depression to a tropical cyclone. While tropical cyclones can produce extremely powerful winds and torrential rain, they are also able to produce high waves and damaging storm surge.
Debris Flow	This is a phenomenon in which soil and rock on the hillside or in the riverbed are carried downward at a dash under the influence of continuous rain or torrential rain.
Demographics	It is the statistical data relating to the population and particular groups within it.
Density	Density refers to number of elements (population, buildings, roads etc.) per unit area.
Disaster	A catastrophe or a calamity in an affected area arising from natural or man-made causes or by accident which results in substantial loss of life or human suffering or damage to, and destruction of property. A serious disruption of the functioning of a community or a society involving widespread human, material, economic or environmental losses and impacts, which exceeds the ability of the affected community or society to cope using its own resources.
Disaster Management	Managing the complete spectrum of disaster including preparedness, mitigation, response, recovery, relief and rehabilitation.
Disaster Risk	The potential disaster losses, in lives, health status, livelihoods, assets and services, which could occur to a particular community or a society over some specified future time period.
Disaster Risk Management (DRM)	The systematic process of using administrative directives, organizations, and operational skills and capacities to implement strategies, policies and improved coping capacities in order to lessen the adverse impacts of hazards and the possibility of disaster.
Disaster Risk Reduction (DRR)	The concept and practice of reducing disaster risks through systematic efforts to analyses and manage the causal factors of disasters, including through reduced exposure to hazards, lessened vulnerability of people and property, wise management of land and the environment, and improved preparedness for adverse events.
District Head Quarter (DHQ)	The District Head Quarters (DHQ) Hospital is located at District headquarters level and serves a population of 1 to 3 million, depending upon the category of the hospital. The DHQ hospital provides promotive, preventive, curative, advance diagnostics, inpatient services, advance specialist and referral services. All DHQ hospitals are supposed to provide basic and comprehensive care.
Drought	A drought is an extended period when an area notes a deficiency in its water supply when the demand for water exceeds the supply. Generally, this occurs when an area receives consistently below average precipitation. It can have a substantial impact on the ecosystem and agriculture of the affected region.
Early Warning	The provision of timely and effective information, through identified institutions, to communities and individuals so that they could take action to reduce their risks and prepare for effective response.
Earthquake	Earthquake is defined as shaking and vibration at the surface of the earth resulting from underground movement along a fault plane of from volcanic activity or due to movement of plate boundaries of the Earth. The scale of earthquakes is measured by moment magnitude and the shaking intensity at each location is usually reported by Mercalli intensity scale.
Effectiveness	The extent to which the development intervention's objectives were achieved, or are expected to be achieved, taking into account their relative importance.
Efficiency	A measure of how economically resources/inputs (funds, expertise, time, etc.) are converted to results.
Element at Risks	Elements at Risk include all tangible (population, essential and critical infrastructure, building, crops and so on) and intangible elements (monetary values) that are at risk to any potential damage during extreme events.
Elevation	The measurement of height of a surface above sea level or ground level.

Emergency Management	The management and deployment of resources for dealing with all aspects of emergencies, in particularly preparedness, response and rehabilitation.
Employment	The "employed" comprises all persons ten years of age and above who worked at least one hour during the reference period and were either "paid employed" or "self-employed". Persons, employed on permanent/regular footings, who have not worked for any reason during the reference period are however, treated as employed.
Entity	Any government or non-government organization, national or international stakeholders including Federal, Provincial and District agencies and United Nations' agencies relevant to Disaster Management as described in Section 23-2 [(a) and (d)] of NDM Act 2010, which is interested in the execution of MHVRA activity hereinafter referred to as Entity.
Eolian Deposits	Eolian Deposits are the Wind-blown deposits on Planetary surface.
Evaluation	The systematic and objective assessment of an on-going or completed project, program or policy, its design, implementation and results. The aim is to determine the relevance and fulfillment of objectives, development efficiency, effectiveness, impact and sustainability. An evaluation should provide information that is credible and useful, enabling the incorporation of lessons learned into the decision making process of both recipients and donors.
Evaporites	Evaporites are individual minerals found in the sedimentary deposit of soluble salts that results from the evaporation of water.
Exposure	People, property, systems, or other elements present in hazard zones that are subject to potential losses.
Flash Flood	A flash flood is a phenomenon of rapid flooding (mostly less than 6 hours) of geomorphic low-lying areas due to downpour or heavy rains caused by low depression, climate front line (thunderstorm) or cyclone.
Flood	Flood is a phenomenon of inundation by water coming from a direct rainfall or river, drainage or other water bodies, such as lakes or seas due to overflowing from ordinary boundary between land and water or water surging.
Flood Plain Deposits	Floodplain deposits are also called as Alluvial Plain, flat land area adjacent to a stream, composed of unconsolidated sedimentary deposits (alluvium) and subject to periodic inundation by the stream.
Food Insecurity	The state of being without reliable access to a sufficient quantity of affordable and nutritious food.
Forecast	Estimate of the occurrence of a future event (UNESCO, WMO). The term is used with different meanings in different disciplines.
Geography	Geography is the study of the Earth and its features, its inhabitants, and its phenomena.
Geological Composition	Geological composition is the fundamental unit of lithostratigraphy that contain certain amount of rock strata that have a comparable lithology, facies or other similar properties.
Geology	Geology is an earth science concerned with the solid Earth, the rocks of which it is composed and the processes by which they change over time.
Geospatial Data Bank	Spatial Data and Geographic Information Management System (GIS) data relevant to disaster and the corresponding data integration in the form of geospatial data bank. In the context of disaster management, following types of data is required: i. Data on the disastrous phenomena (e.g. landslides, floods, earthquakes), their location, frequency, magnitude etc. ii. Data on the environment in which the disastrous events might take place: topography, geology, geomorphology, soils, hydrology, land use, vegetation etc. iii. Data on the elements that might be destroyed if the event takes place: infrastructure, settlements, population, socioeconomic data etc. iv. Data on the emergency relief resources, such as hospitals, fire brigades, police stations, warehouses etc.
GLOF	"GLOF" refers to a Glacial Lake Outburst Flood that occurs when water in a glacier lake suddenly discharges due to a breach of a moraine dam (glacier lake). The results can be catastrophic to the downstream riparian area. (Richardson and Reynolds 2000).
Hazard	A dangerous phenomenon, substance, human activity or condition that may cause loss of life, injury or other health impacts, property damage, loss of livelihoods and services, social and economic disruption, or environmental damage.
Hazard Analysis	Identification, studies and monitoring of any hazard to determine its potential, origin, characteristics and behavior.
Hill Torrent (Flood)	Hill torrent floods are basically a rapid flooding of geomorphic steep surface areas at alluvial cones or floodplain areas caused by overflowing water from channels due to rapid velocity and any amount of flow quantity.
Household	A household is defined to be constituted of all those persons who usually live together and share their meals. A household may consist of one person or more than one person who may or may not be related to each other.
Human-Induced Disasters	Natural disasters that are accelerated/ aggravated by human influence. A landslide, for example, may be purely natural, as a result of a heavy rainfall or earthquake, but it may also be human induced, as a result of an over steepened road-cut.

Human-Made Disasters	Events which are caused by human activities (such as atmospheric pollution, industrial chemical accidents, major armed conflicts, nuclear accidents, oil spills etc.)
Impacts	Positive and negative, primary and secondary long-term effects produced by a development intervention, directly or indirectly, intended or unintended.
Indicators	Indicators are variables or parameters used to describe drought conditions. Examples include precipitation, temperature, streamflow, groundwater and reservoir levels, soil moisture, snowpack, etc.
Indices	Indices are typically a computed numerical representation of drought severity, assessed using climatic or hydro-meteorological inputs including the indicators listed above. In short, they aim to measure the qualitative state of drought on the landscape for a given time period. Indices are technically indicators as well. Monitoring the climate at various timescales allows identification of short-term wet periods within long-term droughts or short-term dry spells within long-term wet periods.
Infant Mortality Rate	The number of deaths of infants under one year of age per 1000 live births in a given year.
Irrigated Area	Irrigated agricultural area refers to the area in which the moisture of soil is controlled for the better growth of seeds and better crop production by providing water through different mode of water supply such as rivers, major, minor or distributary canals, tube wells, wells, spraying or other water to the crops.
Irrigation Sources	It refers to the source(s) by means of which the cultivated area is irrigated partially or wholly.
Land Cover	Land Cover is defined as the observed (bio) physical cover on the earth's surface.
Land Use	Land Use is characterized by the arrangements, activities and inputs that people undertake in a certain type of land in order to produce, change or maintain it.
Land Use Planning	The process undertaken by public authorities to identify, evaluate and decide on different options for the use of land, including consideration of long term economic, social and environmental objectives and the implications for different communities and interest groups, and the subsequent formulation and promulgation of plans that describe the permitted or acceptable uses. Land-use planning can help to mitigate disasters and reduce risks by discouraging high-density settlements and construction of key installations in hazard-prone areas, control of population density and expansion Mitigation Structural and non-structural measures undertaken to limit the adverse impact of natural hazards, environmental degradation and technological hazards.
Landslide	A landslide is a phenomenon in which the movement of a mass of rock, debris, or earth down a slope due to gravity. The materials may move by falling, toppling, sliding, spreading, or flowing. Since a large amount of soil mass usually moves, serious damage can occur.
Latitude	Latitude is a geographic coordinate that specifies the north–south position of a point on the Earth's surface. Latitude is an angle (defined below) which ranges from 0° at the Equator to 90° (North or South) at the poles.
Longitude	Longitude is a geographic coordinate that specifies the east-west position of a point on the Earth's surface. It is an angular measurement, usually expressed in degrees
Meander-Belt	The part of a valley bottom across which a stream shifts its channel from time to time especially in flood.
Middle Schools	Middle Schools are the schools that provide education from 5th to 8th grade.
Mitigation	The lessening or limitation of the adverse impacts of hazards and related disasters.
Monitoring & Evaluation (M&E)	A continuing function that uses systematic collection of data on specified indicators to provide management and the main stakeholders of an ongoing development intervention with indications of the extent of progress and achievement of objectives and progress in the use of allocated funds.
Mortality Rate	Number of deaths recorded in a population of particular region in a year.
Mouza / Deh	It is a territorial unit with a separate name, definite boundaries, and area precisely measured and divided into plots / khasras / survey numbers. Each mouza is a revenue estate and has a cadastral map maintained in the land revenue record with a Hadbast Number except Sindh Province. Mouza, Deh, Village, Killi and Chak are the names commonly used for it. The term mouza / deh is widely used in the settled areas while the term village and or killi are used in the unsettled areas. There may be one or more settlements, abadies, basties, dhokes, goths, etc. in the territory of a mouza / deh. The mouzas / dehs may also have scattered inhabitation while there may be some mouzas without population as well.
Multi Hazard Vulnerability and Risk Assessment (MHVRA)	Multi Hazard Vulnerability and Risk Assessment is a comprehensive study which intends to evaluate the expected vulnerabilities, risks and losses due to different hazardous events; both natural or man-induced.
Multi Hazards	The term Multi Hazards, as the name would suggest, are the hazards evolved from multiple sources, either inter-related or independent phenomena, and are subject to joint probability theory and analysis.

National Authority	National Authority means National Disaster Management Authority (NDMA).
Natural Disasters	Events which are caused purely by natural phenomena such as earthquakes, floods, cyclones etc.
Nullah	A Pakistani term, used for small rivers a streams carrying fresh water or sewerage disposal.
Performance Indicator	A variable that allows the verification of changes in the development intervention or shows results relative to what was planned.
Physical / Structural Vulnerability	The measure of the fragility structure, engineered or non-engineered, and its associated susceptibility to the natural stresses such as earthquake, flood etc.
Piedmont	Piedmont, in geology, landform created at the foot of a mountain or mountains by debris deposited by shifting streams.
Population Growth Rate	The growth rate is the rate at which a population is increasing (or decreasing) in a given year.
Population Projections	Population Projections are estimates of population number typically based on an estimated population consistent with most recent decennial census and are produced using cohort-component method.
Precipitation	Precipitation is the water that falls from the clouds towards the ground, especially as rain or snow.
Preparedness	Activities and measures taken in advance to ensure effective response to the impact of hazards, including the issuance of timely and effective early warnings and the temporary evacuation of people and property from threatened locations.
Prevention	Activities to ensure complete avoidance of the adverse impact of hazards.
Primary Healthcare	The primary care facilities include Basic Health Units (BHUs) and Rural Health Centers (RHCs) mainly preventive, outpatient and basic inpatient care.
Primary School	. A primary school is an education facility in which children receive primary or elementary education, coming after preschool and before secondary school.
Quality Assurance	Quality assurance encompasses any activity that is concerned with assessing and improving the merit or the worth of a development intervention or its compliance with given standards. Note: examples of quality assurance activities include appraisal, RBM, reviews during implementation, evaluations, etc.
Range Lands	Range Lands are vast natural landscapes grasslands, shrub lands and wood lands.
Recovery	Decisions and actions taken after a disaster with a view to restoring or improving the pre-disaster living conditions of the stricken community, while encouraging and facilitating necessary adjustments to reduce disaster risk.
Relative Humidity	The amount of water vapour present in air expressed as a percentage of the amount needed for saturation at the same temperature.
Reliability	Consistency or dependability of data and evaluation judgments, with reference to the quality of the instruments, procedures and analyses used to collect and interpret evaluation data.
Relief / Response	The provision of assistance during or immediately after a disaster to meet the life preservation and basic subsistence needs of those people affected. It can be of an immediate, short-term, or protracted duration.
Residual Risk	The risk that remains in unmanaged form, even when effective disaster risk reduction measures are in place, and for which emergency response and recovery capacities must be maintained.
Resilience	The ability of a system, community or society exposed to hazards to resist, absorb, accommodate to and recover from the effects of a hazard in a timely and efficient manner, including through the preservation and restoration of its essential basic structures and functions.
Retrofitting	Reinforcement of existing buildings and structures to become more resistant and resilient to the forces of natural hazards.
Risk	The combination of the probability of an event and its negative consequences.
Risk Assessment	A methodology to determine the nature and extent of risk by analyzing potential hazards and evaluating existing conditions of vulnerability that together could potentially harm exposed people, property, services, livelihoods and the environment on which they depend.
Risk Management	The systematic approach and practice of managing uncertainty to minimize potential harm and loss.
Risk Transfer	The process of formally or informally shifting the financial consequences of particular risks from one party to another whereby a household, community, enterprise or state authority will obtain resources from the other party after a disaster occurs, in exchange for ongoing or compensatory social or financial benefits provided to that other party.

River	A river is a natural waterway, usually freshwater, flowing toward lower level of water surface such as a lake, a sea, or another river.
Riverine Flood	Flood is a phenomenon of inundation by water coming from a river, drainage or other water bodies, such as lakes or seas due to overflowing from ordinary boundary between land and water or water surging.
Rural Area	A rural area is an open area that has very low population and building density. Generally rural areas are away from cities/towns and its inhabitants are mostly linked with agriculture based livelihood.
Rural Health Centre (RHC)	The RHCs have 10-20 inpatients beds and each serves a catchment population of up to 100,000 people. The RHC provides promotive, preventive, curative, diagnostics and referral services along with inpatient services. The RHC also provides clinical, logistical and managerial support to the BHUs, LHWs, MCH Centers, and Dispensaries that fall within its geographical limits. RHC also provides medico-legal, basic surgical, dental and ambulance services.
Secondary Health Care	It is an intermediate level of health care that is concerned with the provision of specific technical, therapeutic or diagnostic services. It is the first referral level serving a district or a tehsil. Specialist consultation procedures and hospital admissions fall into this category of care. The role of a district hospital in primary health care has been expanded beyond being dominantly curative and rehabilitative to include promotional, preventive and educational roles as part of a primary health care approach.
Secondary School or Higher School	Secondary Schools are the schools which provide education from grade 8 till Intermediate Level, i.e. 12th Grade or FSc.
Sedimentary Rocks	Sedimentary rocks are types of rock that are formed by the deposition and subsequent cementation of that material at the Earth's surface and within bodies of water.
Slope Failure	In this phenomenon, a slope abruptly collapses when the soil that has already been weakened by moisture in the ground loses its self-cohesiveness under the influence of rain or an earthquake. Due to sudden collapse, many people fail to escape if it occurs near a residential area, thus leading to a higher rate of fatalities.
Social Vulnerability	Characteristics of social systems that create the potential for harm or loss to it
Steppe Climate	A semi-arid climate or steppe climate is the climate of a region that receives precipitation below potential evapotranspiration, but not as low as a desert climate.
Storm Surge	A Storm Surge is phenomena of sea level rise associated with a low-pressure weather system, typically a tropical cyclone. Therefore, an early warning plan for “storm surge” should be incorporated with that of “cyclone”.
Streambed	A stream bed is the channel bottom of a stream or river, the physical confine of the normal water flow
Structural / Non-Structural Measures	Structural measures refer to any physical construction to reduce or avoid possible impacts of hazards, which include engineering measures and construction of hazard-resistant and protective structures and infrastructure. Non-structural measures refer to policies, awareness, knowledge development, public commitment, and methods and operating practices, including participatory mechanisms and the provision of information, which can reduce risk and related impacts.
Sustainable Development	Development that meets the needs of the present without compromising the ability of future generations to meet their own needs. It contains within it two key concepts: the concept of "needs", in particular the essential needs of the world's poor, to which overriding priority should be given; and the idea of limitations imposed by the state of technology and social organization on the environment's ability to meet present and the future needs. (Brundtland Commission, 1987)
Tehsil Head Quarter (THQ)	These hospitals are located at each THQ and serves a population of 0.5 to 1.0 million. At present majority of THQ hospitals have 40 to 60 beds. The THQ hospital provides promotive, preventive, curative, diagnostics, in patients, referral services and also specialist care. THQ hospitals are supposed to provide basic and comprehensive Emergency Obstetric and New born Care (EmONC). THQ hospital provides referral care to the patients including those referred by the Rural Health Centers, Basic Health Units, Lady Health Workers and other primary care facilities.
Tertiary Healthcare	Tertiary care hospitals are located in the major cities for more specialized inpatient care. Tertiary care is specialized consultative health care, usually for inpatients and on referral from a primary or secondary health professional.
Tsunami	A tsunami is a series of waves in a water body caused by the displacement of a large volume of water, generally in an ocean or a large lake. Earthquakes, volcanic eruptions and other underwater explosions, landslides, avalanche, meteorite impacts and other disturbances above or below water all have the potential to generate a tsunami.
Unemployment	The “unemployed” comprises all the persons ten years of age and above who during the reference period were without work, currently available for work and are seeking work.
Urban Area	An Urban area is human settlement with high population density and infrastructure of built environment. Urban areas are created through urbanization and are categorized by urban morphology as cities, towns, conurbations and suburbs.
Urban Flood	Flood and inundation phenomena occurring in the city or built-up areas.

Veterinary Facility	It refers to the availability of veterinary facilities for livestock with qualified veterinarian (Doctor / Assistant) for provision of medical facilities for farm animals.
Vulnerability	The characteristics and circumstances of a community, system or asset that make it susceptible to the damaging effects of a hazard.
Wet Areas	Areas which are naturally covered with fresh or saline water such as river and lakes are grouped in this class.
Wheat Procurement Centre	These centres are established every year at the time of wheat harvest in surplus wheat producing areas particularly of the Punjab and Sindh provinces by the Provincial Food Departments and or Pakistan Agricultural Services and Storage Corporation (PASSCO) at appropriate locations. These centres are not permanent in nature and their number in a tehsil / district varies on year to year basis depending upon the procurement policy.

LIST OF ACRONYMS

AMS	Assistant Medical Superintendent
APWMO	Assistant Principal Women Medical Officer
AWO	Automatic Weather Observation
AWS	Automatic Weather Station
C&W	Communication & Works
CBDRM	Community Based Disaster Risk Management
CBEWS	Community-Based Early Warning System
CMO	Casualty Medical Officer
CRI	Composite Risk Index
DC	Deputy Commissioner
DCO	District Coordination Officer
DDMA	District Disaster Management Authority
DDRMP	District Disaster Risk Management Plan
DEWS	Disease Early Warning System
DHQ	District Headquarter Hospital
DM	Disaster Management
DMS	Deputy Medical Superintendent
DRR	Disaster Risk Reduction
DSHA	Deterministic Seismic Hazard Assessment
ENT	Ear, Nose, Throat
EPI	Expanded Program on Immunization
EWS	Early Warning System
PDMA	Provincial Disaster Management Authority
FFC	Federal Flood Commission
FGD	Focus Group Discussion
GIS	Geographic Information System
GLOF	Glacial Lake Outburst Flood
GMPE	Ground Motion Prediction Equation
GOERE	Government Officer Emergency Response Exercise
GPS	Global Positioning System
GSP	Geological Survey of Pakistan
HFA	Hyogo Framework for Action
HTC	Hydro-Thermal Coefficient
INGOs	International Non-governmental Organizations
LSWI	Land Surface Water Index
M&E	Monitoring and Evaluation
MBT	Main Boundary Thrust
MCE	Maximum Considered Earthquake
MGDs	Millennium Development Goals
MHVRA	Multi Hazard Vulnerability and Risk Assessment
MKT	Main Karakorum Thrust
MMT	Main Mantle Thrust
MO	Medical Officer
MOVERE	Mobilization of Volunteer for Emergency Response Exercise
MPE	Most Probable Earthquake
MS	Medical Superintendent
MSSP	Micro Seismic Study Program (Pakistan Atomic Energy Commission)
MM	Moment Magnitude
NARC	National Agricultural Research Center
NCEG	National Center of Excellence in Geology
NDI	NOAA Drought Index
NDMA	National Disaster Management Authority
NDMC	National Disaster Management Commission
NDMP	National Disaster Management Plan
NDMP-SC	Steering Committee for National Disaster Management Plan
NDRIS	National Disaster Risk Information System
NDVI	Normalized Difference Vegetation Index
NDWI	Normalized Difference Water Index
NEOC	National Emergency Operations Centre
NFPP	National Flood Protection Plan
NHA	National Highway Authority
NHEPRN	National Health Emergency Preparedness and Response Network
NIDM	National Institute of Disaster Management
PARC	Pakistan Agricultural Research Council
PASSCO	Pakistan Agricultural Services and Storage Corporation
PBC	Pakistan Broadcasting Corporation
PBS	Pakistan Bureau of Statistics
PCIW	Pakistan Commissioner for Indus Waters
PCRWR	Pakistan Center for Research on Water Resources
PDMA	Provincial Disaster Management Authority
PDSI	Palmer Drought Severity Index
PGA	Peak Ground Acceleration
PHDI	Palmer Hydrological Drought Severity Index
PIPD	Provincial Irrigation and Power Department
PMD	Pakistan Meteorological Department
PMO	Principal Medical Officer
PMU	Project Management Unit
PRA	Participatory Risk Assessment
PSC	Project Steering Committee
PSHA	Probabilistic Seismic Hazard Assessment
PTA	Pakistan Telecommunication Authority
PTCL	Pakistan Telecommunication Company Limited
PTWC	Pacific Tsunami Warning Center
PWMO	Principal Women Medical Officer

R&D	Research and Development
RDMC	Regional Drought Monitoring Centre
RP	Return Period
SFDRR	Sendai Framework for Disaster Risk Reduction
SMA	Soil Moisture Anomaly
SMDI	Soil Moisture Deficit Index
SMO	Senior Medical Officer
SMRFC	Specialized Medium Range Forecasting Centre
SOP	Survey of Pakistan
SoVI	Social Vulnerability Index
SPEI	Standardized Precipitation Evapotranspiration
SPI	Standard Precipitation Index
SPI	Stream Power Index
SPT	Standard Penetration Test
SRSI	Standardized Reservoir Supply Index
SSFI	Standardized Stream Flow Index
SSI	Semi Structured Interviews
SUPARCO	Pakistan Space and Upper Atmospheric Research Commission
SWI	Standardized Water-Level Index
SWMO	Senior Women Medical Officer
SWS	Soil Water Storage
SWSI	Surface Water Severity Index
SWSI	Surface Water Supply Index
TCI	Temperature Condition Index
THQ	Tehsil Headquarter Hospital
TMA	Tehsil Municipal Administration
UC	Union Council
UN	United Nations
VCI	Vegetation Condition Index
VegDRI	Vegetation Drought Response Index
VIC	Variable Infiltration Capacity
WAPDA	Water and Power Development Authority
WASA	Water and Sanitation Agency
WFP	World Food Program
WHO	World Health Organization
WMO	World Meteorological Organization
WMO	Women Medical Officer
WOE	Weight of Evidence (Statistical Model)
WRF	Weather Research and Forecast (Name of Numerical Calculation Model)

DATA SOURCES

DATA TYPE	DATA SOURCE
Agriculture Based Industries	Directorate of Agriculture, Crop Reporting Service, Punjab, Lahore x(Development Statistics-2015)
Animals Slaughtered in Recognized and Un-recognized Slaughter Houses by Type in the District	Directorate of Livestock and Dairy Development (Ext.) Punjab,Lahore
Annual Cellular Subscribers	Pakistan Telecommunication Authority (PTA)
Area Sown under Wheat, Rice, Cotton and Sugarcane in the District	Directorate of Agriculture, Crop Reporting Service, Punjab, Lahore.
Area Sown by Mode of Irrigation	Bureau of Statistics, Punjab, Lahore (2013-2014)
Birth Registration	Multiple Indicator Cluster Survey (MICS) Punjab: 2011
Broadband Subscribers by Technology	Pakistan Telecommunication Authority (PTA)
Building Distribution	PBS
Canal System	Agriculture Department Punjab
Cellular Communication Towers	Pakistan Telecommunication Authority (PTA)
Child Delivery - Location and Type of Assistance	Pakistan Social and Living Standard Measurement (PSLM): 2013-2014
Child Statistics	Multiple Indicator Cluster Survey (MICS) Punjab: 2011
Climatology	http://www.Myweather2.Com/City-Town/Pakistan/Khushab/Climate-Profile.Aspx http://en.Climate-Data.Org/Location/3077/
Diesel and Electric Tube wells Installed by Ownership	Directorate of Agriculture Crop Reporting Service, Punjab, Lahore.
Distribution Of Land Use/ Land Cover (LU/LC)	Space and Upper Atmosphere Research Commission (SUPARCO)
Education Facilities	School Education Department, Government of Punjab
Elevation Bands	National Aeronautics and Space Administration (NASA)
Establishment of Private Poultry Farms in the District (2013-14)	Directorate of Poultry Research Institute, Punjab, Rawalpindi
Flood Inundation Frequency	National Disaster Management Authority (NDMA)
Geology	Geological Survey of Pakistan (GSP)
Health Facilities	Health Department Punjab/ District Health Information System Punjab (Government Of Punjab)
Household Characteristics	Multiple Indicator Cluster Survey (MICS) Punjab: 2011
Industries	District Officer (E&IP), Khushab
Key Indicators - Child Mortality Statistics	Multiple Indicator Cluster Survey (MICS) Punjab: 2011
Khushab City Land Use Map 2013	NDMA
Landline Service	District Pre-Investment Study – 2012, Directorate Of Industries, Punjab Poonch House, Multan Road, Lahore.
Literacy Rate- 2015	2015 Projected

DATA TYPE	DATA SOURCE
Literacy Ratio	Pakistan Social and Living Standard Measurement (PSLM): 2014-2015
Major Industries	District Officer(E&IP), Khushab
Metaled Roads Length By Type Zone and District	Planning & Design Directorate, Punjab Highway Department, Lahore.
Mineral Productions	Directorate General, Mines and Minerals, Punjab, Lahore. (Development Statistics-2015)
Motor Vehicles 'Registered' By Type	Additional Director General, Excise & Taxation, Punjab, Lahore.
Number of Cattle, Sheep and Buffaloes in the District	Source:-Census of Agriculture 2000 & 2010- Census of Livestock 1996 & 2006
Number of Registered Factories & Employment Level	Bureau of Statistics, Punjab, Lahore
Number of Work Animals by Type in the District (2006)	2006 Census of Livestock, Agricultural Census Organization, Pakistan Bureau of Statistics
Percentage of children that have been immunized by Type of Antigen- Based on record and recall	Pakistan Social And Living Standard Measurement Survey (PSLM) 2013-2014
Population	Population Census 1998, Population Census Organization, Government of Pakistan. Projections were calculated on the basis of the Inter-Census Growth Rate for the two Censuses Of 1981 And 1998, and do not factor in changing Fertility And Migration Patterns.
Population by Age Group, Gender and Rural /Urban	Population Census 1998
Population by Mother Tongue- 2015	2015 Projected
Population Distribution	Pakistan Bureau Of Statistics (Population Census 1998, Population Census Organization, Government Of Pakistan. Projections Were Calculated On The Basis Of The Inter-Census Growth Rate For The Two Censuses Of 1981 And 1998, And Do Not Factor In Changing Fertility Patterns)
Population on Basis of Religion-1998	1998 Census
Post-Natal consultations of the District	Pakistan Social and Living Standard Measurement (PSLM): 2013-2014
Railway Network	Punjab Development Statistics 2011 / Respective District Offices
Sales of Fertilizer by year 2013-2014	Director General Agriculture, Punjab, Lahore
Socio-Economic Statistics of The District Khushab (In Percentage)	Multiple Indicator Cluster Survey (MICS) Punjab: 2011
Threshers and Harvesters in the District (2012-13)	Directorate of Agriculture Crop Reporting Service, Punjab, Lahore.
Total tractors in the District by 2004 Census	2004 Agricultural Census Wing & Pakistan Bureau of Statistics, Government of Pakistan, Lahore)
Tractors by Make in District (2012-13)	Directorate of Agriculture Crop Reporting Service, Punjab, Lahore
Types Of Health Facility	Health Department Punjab
Veterinary Institution in the District	Department Of Livestock & Dairy Development, Khushab

National Disaster Management Authority (HQ),
Main Murree Road Near ITP Office, Islamabad
www.ndma.gov.pk

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ADAPTATION FUND