# DISTRICT
# ISLAMABAD
## CAPITAL TERRITORY- PAKISTAN

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

# MULTI HAZARD VULNERABILITY & RISK ASSESSMENT (MHVRA)

PAKISTAN National Disaster Management Authority NDMA

UN-HABITAT

ADAPTATION FUND

# DISTRICT ISLAMABAD
# CAPITAL TERRITORY - PAKISTAN

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## MULTI HAZARD VULNERABILITY & RISK ASSESSMENT (MHVRA)

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
Published in Pakistan (2025)

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**We appreciate your feedback**

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# 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

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# A BASELINE INFORMATION

# 1 ISLAMABAD DISTRICT OVERVIEW

Islamabad, the capital city of Pakistan, is a modern, well-planned metropolis known for its scenic beauty, strategic importance, and administrative significance. Situated in the Potohar Plateau, Islamabad is bordered by the Rawalpindi District and the picturesque Margalla Hills, which add to the city's natural charm. As the seat of government, it houses the country's top political, judicial, and administrative institutions, including the Parliament, Supreme Court, and the Presidential Palace.

The city's landscape is a harmonious blend of urban development and natural surroundings, featuring wide tree-lined avenues, lush green parks, and water bodies such as Rawal Lake. Islamabad has a subtropical climate with hot summers, mild winters, and monsoon rains, contributing to its green and vibrant environment. The city is also a hub for education, culture, and international diplomacy, hosting numerous universities, cultural centers, and foreign embassies.

General Yahya with CDA officers visiting site of new capital.

## Histroy

Islamabad was established in the 1960s as a planned city to replace Karachi as the capital of Pakistan. The decision was made to decentralize administrative functions and promote balanced regional development. The city's master plan was designed by the Greek architect Constantinos Apostolou Doxiadis, emphasizing a structured layout divided into sectors and zones for residential, commercial, and governmental activities.

Before its development as the capital, the region was part of the ancient Gandhara civilization, with Taxila, a major center of learning and trade, located nearby. Archaeological remains suggest that the area was inhabited by early civilizations that thrived along the trade routes between Central Asia and the Indian subcontinent. The region came under various rulers, including the Mauryans, Kushans, Hindu Shahis, Ghaznavids, and later the Mughals, before becoming a part of British India and eventually Pakistan after independence in 1947.

Islamabad's development marked a new era in Pakistan's history, symbolizing modernity and progress. Over the years, it has grown into a dynamic city with a high standard of living, serving as the political and diplomatic heart of the nation.

## Land Scape

Islamabad’s landscape is defined by the majestic Margalla Hills to the north, which serve as a natural boundary and provide opportunities for hiking, wildlife conservation, and recreation. The city features a mix of urban and green spaces, with extensive parks, lakes, and forested areas. Rawal Lake, located within the city, is a major water reservoir and a popular recreational spot.

The city's urban design incorporates a grid system with well-maintained roads and green belts, making it one of the most environmentally friendly cities in Pakistan. The presence of the Shakarparian Hills, Daman-e-Koh, and Faisal Mosque adds to its aesthetic appeal, making it a sought-after destination for both residents and tourists.

## Culture

Islamabad is a melting pot of cultures, with residents from all parts of Pakistan and a significant expatriate community. Urdu serves as the lingua franca, while English is widely used in business and education. Due to its cosmopolitan nature, the city hosts diverse cultural events, art exhibitions, music festivals, and theater performances.

Islamabad’s food scene is a blend of traditional Pakistani cuisine and international flavors, with restaurants offering a variety of dishes ranging from Mughlai and Punjabi to Chinese, Middle Eastern, and Western. The city’s marketplaces, such as Jinnah Super, F-6 Markaz, and Itwar Bazaar, offer a mix of modern shopping experiences and traditional handicrafts.

Religious diversity is evident in the city’s places of worship, including mosques, churches, and temples. The Faisal Mosque, an architectural masterpiece, is one of the largest mosques in the world and a symbol of Islamabad.

## Languages

The dominant language spoken in Islamabad is Urdu, serving as a bridge between people from different linguistic backgrounds. English is widely used in official, business, and educational settings. Other languages such as Punjabi, Pashto, Sindhi, and Balochi are spoken by various communities residing in the city.

## Traditional Crafts

Islamabad, while being a modern city, still appreciates traditional craftsmanship. Some notable crafts include:

- Handwoven Textiles
- Pottery and Ceramics
- Jewellery Making
- Wood Carving

## Notable People

Islamabad has been home to many influential figures in politics, academia, and the arts, including:

- Shaukat Aziz – Former Prime Minister of Pakistan
- Nayyar Hussain Bukhari – Former Chairman of the Senate
- Hamza Ali Abbasi – Film Industry
- Osman Khalid Butt – Renowned Actor
- Ahmad Hasan Dani – Globally Recognized Archaeologist
- Sadruddin Hashwani – Business Tycoon
- Julius Salik – Prominent Social Activist andFormer
- MinisterFawzia Arshad – Senator from Islamabad
- Mansha Yaad – Writer
- Imad Wasim – Cricketer

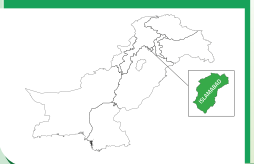
## Tourist Attractions

- Faisal Mosque
- Daman-e-Koh
- Pakistan Monument
- Lok Virsa Museum
- Rawal Lake
- Margalla Hills National Park
- Shakarparian Hills

# DISTRICT ISLAMABAD AT A GLANCE

## Geography

### Location



Lat: 33°44'N
Long: 73°09'E

**Neighbouring Districts**

- **North** — Haripur (Khyber Pakhtunkhwa)
- **East** — Murree (Punjab)
- **West** — Attock (Punjab)
- **South** — Rawalpindi (Punjab)

## Administrative Setup

| | |
|---|---|
| Area | 5,286 sq. km |
| District Capital | Islamabad City |
| Language | Urdu, English, Pashto, Punjabi and Pahari |

- **2** Tehsils
- **62** Union Councils
- **6** Zones

## Population Distribution

### Total Population in District

| | |
|---|---|
| 2,003,368 | 2017 Census |
| 2,363,863 | 2023 Census |

### Population Density (Person per sq.km)

| | |
|---|---|
| 2,609.12 | 2017 Census |
| 2,609.12 | 2023 Census |

### Growth Rate

**2.80 %**
(2023 Census)

## Educational Facilities

| Govt. Schools | Colleges | Universities |
|---|---|---|
| 432 | 5 | 26 |

## Public Health Care Facilites
(Numbers)

**119**

## Tourist Attractions

**Picnic Points**
Lake View, Pakistan Monument, Rose and Jasmine Park, Daman-e-Koh, Saidpur Village, Shahdara Valley, Margala Hills, Trail 3, 5 & 7, Lok Virsa Heritage Museum.

**Shrines**
Bari Imam, Golrah Sharif, Chan Pir Badsah Darbar.

**Lakes**
Rawal Lake, Simly Dam, Sandaymar Dam.

**Historical Sites**
Shah Allah Ditta Caves, Sadhu ka Bagh, Meharabad Buddhist mound and stupas, Pak Monument Museum.

## Agriculture

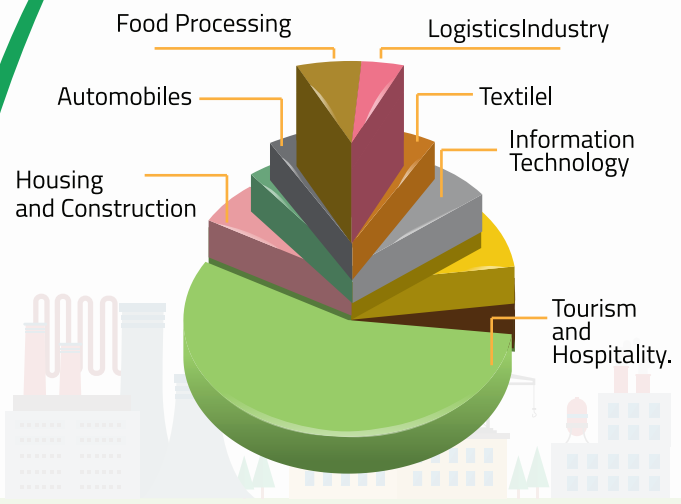
**Major Crops**
Wheat, Rice, Maize, Barley.

**Major Fruits**
Guava, Cherries, Figs, Pears.

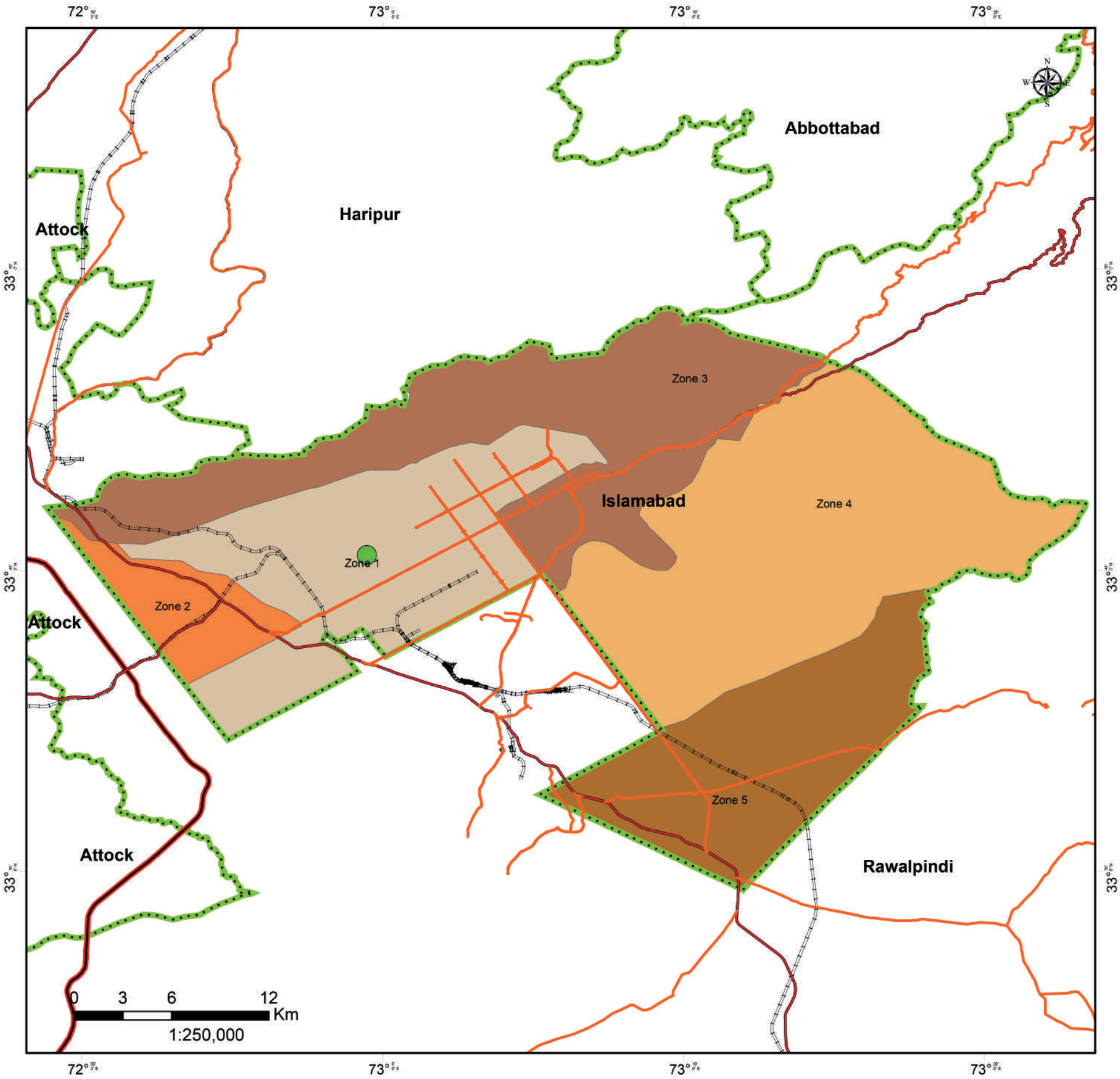
**Major Vegetables**
Potatoes, Onions, Tomatoes.

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

## Major Industries



# DISTRICT ADMINISTRATIVE MAP




## Legend

- District Headquarter
- Major Roads
- National Highway
- Strategic Road
- Motorways
- Railway Tracks

**Islamabad Zones**

- Zone 1
- Zone 2
- Zone 3
- Zone 4
- Zone 5
- DistrictBoundary

**Multi Hazard Vulnerability & Risk Assessment, Islamabad, Pakistan**

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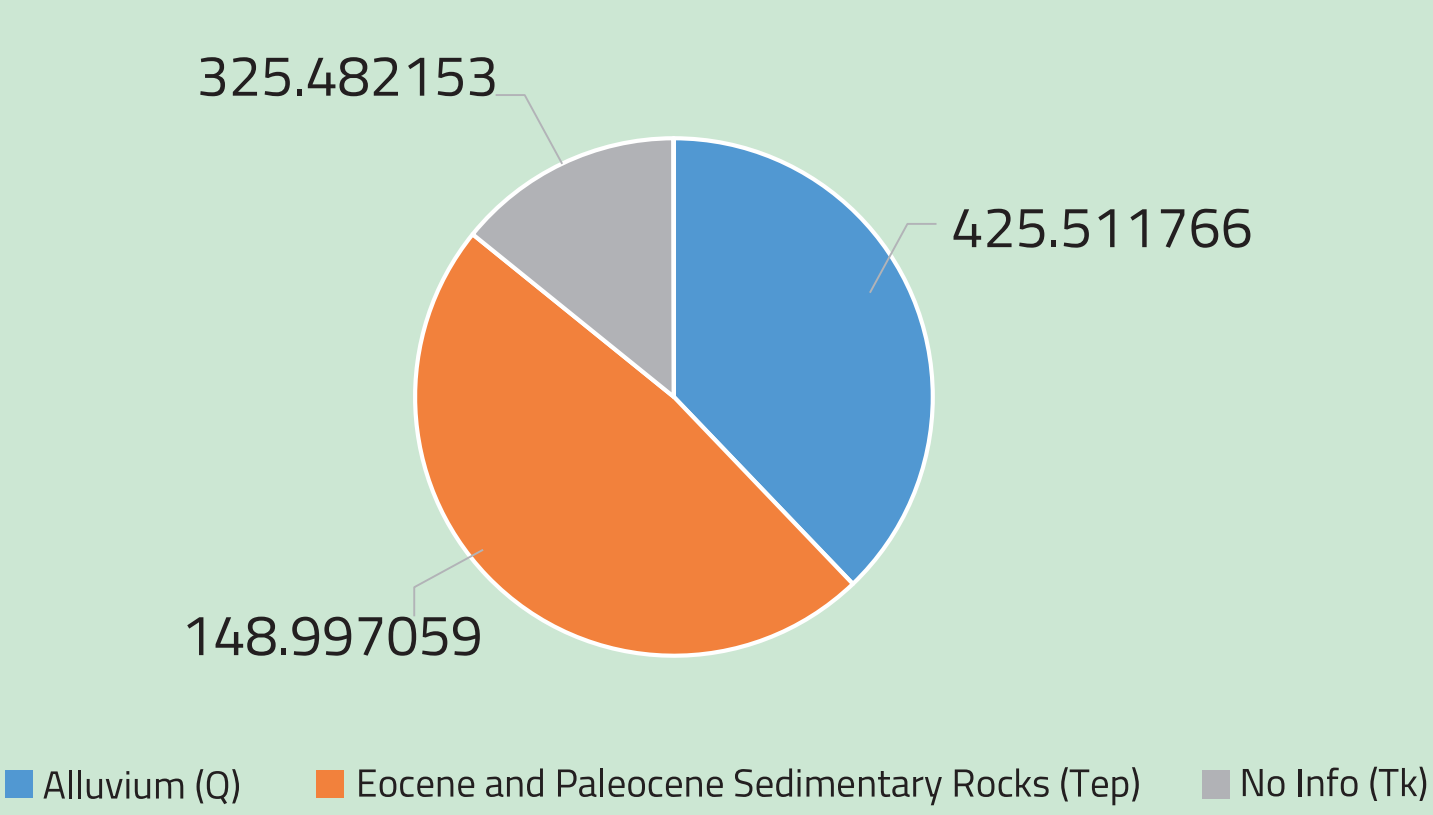
# 2 GEOLOGY

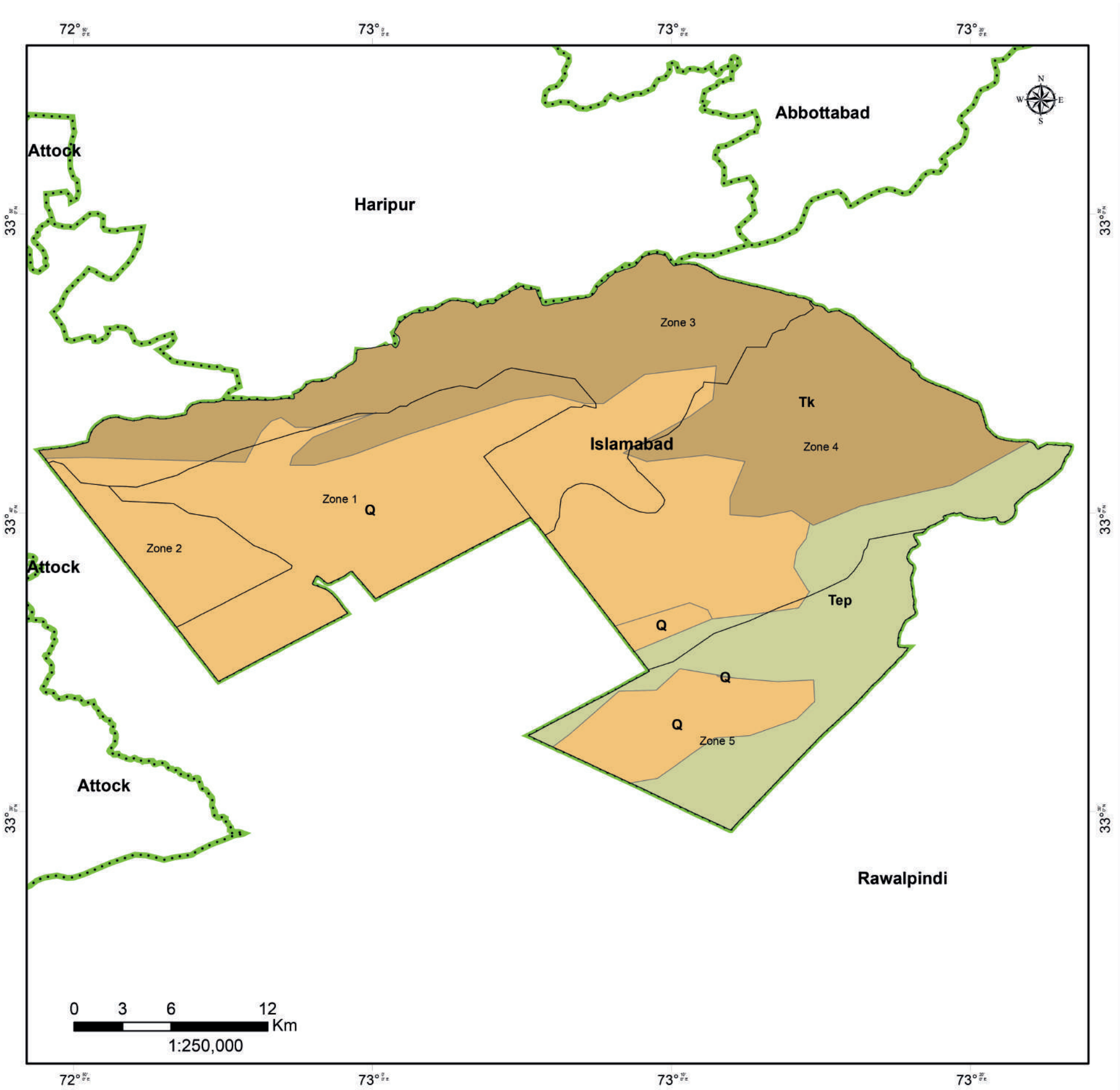
The geology of Islamabad is shaped by the powerful collision of the Indian and Eurasian tectonic plates, which began around 20 million years ago. This ongoing process caused the Margalla Hills, located to the north of the city, to rise up, creating stunning formations of limestone, dolomite, sandstone, and shale. These rocks date back to the Paleocene to Eocene periods (roughly 60 to 45 million years ago). The Margalla Hills are part of the larger Salt Range, where tectonic forces have caused the rocks to fold and crack. To the south, the Pothohar Plateau features a mix of sedimentary rocks like sandstone, shale, and limestone, along with some volcanic material. The region is full of geological complexity, with fault lines, folds, and uplifted landforms that tell the story of millions of years of tectonic activity. Islamabad also sits in a seismically active area, meaning it occasionally experiences mild earthquakes. The land is dotted with fertile soils, especially in the valleys, where alluvial deposits of clay, sand, and silt support local agriculture. The city's water supply, such as Rawal Lake and Simly Dam, is fed in part by groundwater that's stored in the aquifers of the Margalla Hills. All of these geological processes work together to create the rich, diverse landscape that defines Islamabad today.

| Geological Formation | Area (sq.km) | Composition |
|---|---|---|
| Alluvium | 425.5118 | 47.28% |
| Eocene and Paleocene Sedimentary Rocks | 148.9971 | 16.56% |
| No info | 325.4822 | 36.39% |

## Geological Composition



# GEOLOGY MAP




## Legend

### Geology

- Alluvium (Q)
- Eocene and Paleocene Sedimentary Rocks (Tep)
- No (TK)

### Islamabad Zones

- Zone 1
- Zone 2
- Zone 3
- Zone 4
- Zone 5

DistrictBoundary

**Multi Hazard Vulnerability & Risk Assessment, Islamabad, Pakistan**

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# 3 LAND USE & LAND COVER

Land Cover (LC) is defined as the observed (bio) physical features present on the Earth's surface, such as vegetation, water bodies, urban structures, and barren or rocky areas. In contrast, Land Use (LU) refers to the arrangements, activities, and inputs that people undertake in these land cover types to produce, modify, or maintain them—such as farming, urban development, or conservation efforts. Understanding LC/LU distribution is essential for planners and policymakers to devise pragmatic and informed land use strategies.

Monitoring Land Cover and Land Use (LULC) processes is crucial because they directly influence Climate and Ecosystem Change. Changes in LULC, such as urbanization, deforestation, and agricultural expansion, serve as key drivers of biodiversity loss, changes in water cycles, and soil degradation. This monitoring also ensures sustainable development and helps mitigate the adverse effects of environmental challenges.

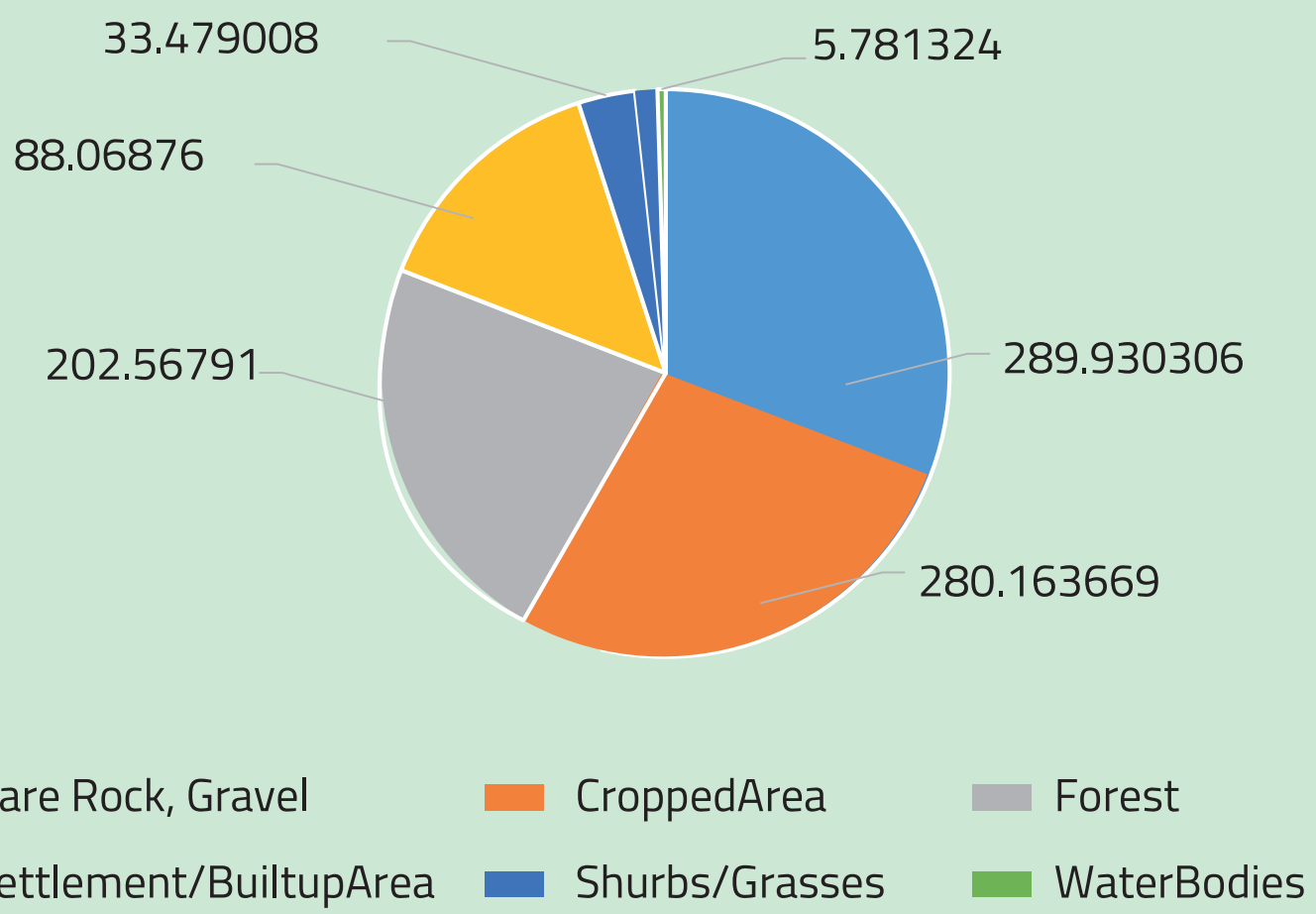
A Land Cover Classification System (LCCS) approach was employed to capture the physiographic characteristics of the study area, right down to a Zone level. This method enhances the understanding of land dynamics, ensuring accuracy and detail in the representation of land cover types.

The study classified the region into different land cover classes using high-resolution satellite imagery, the land cover was analyzed, interpreted, and validated. Satellite images were segmented into homogeneous polygons and labeled following the LCCS classification system, ensuring precision and reliability in the mapping process.

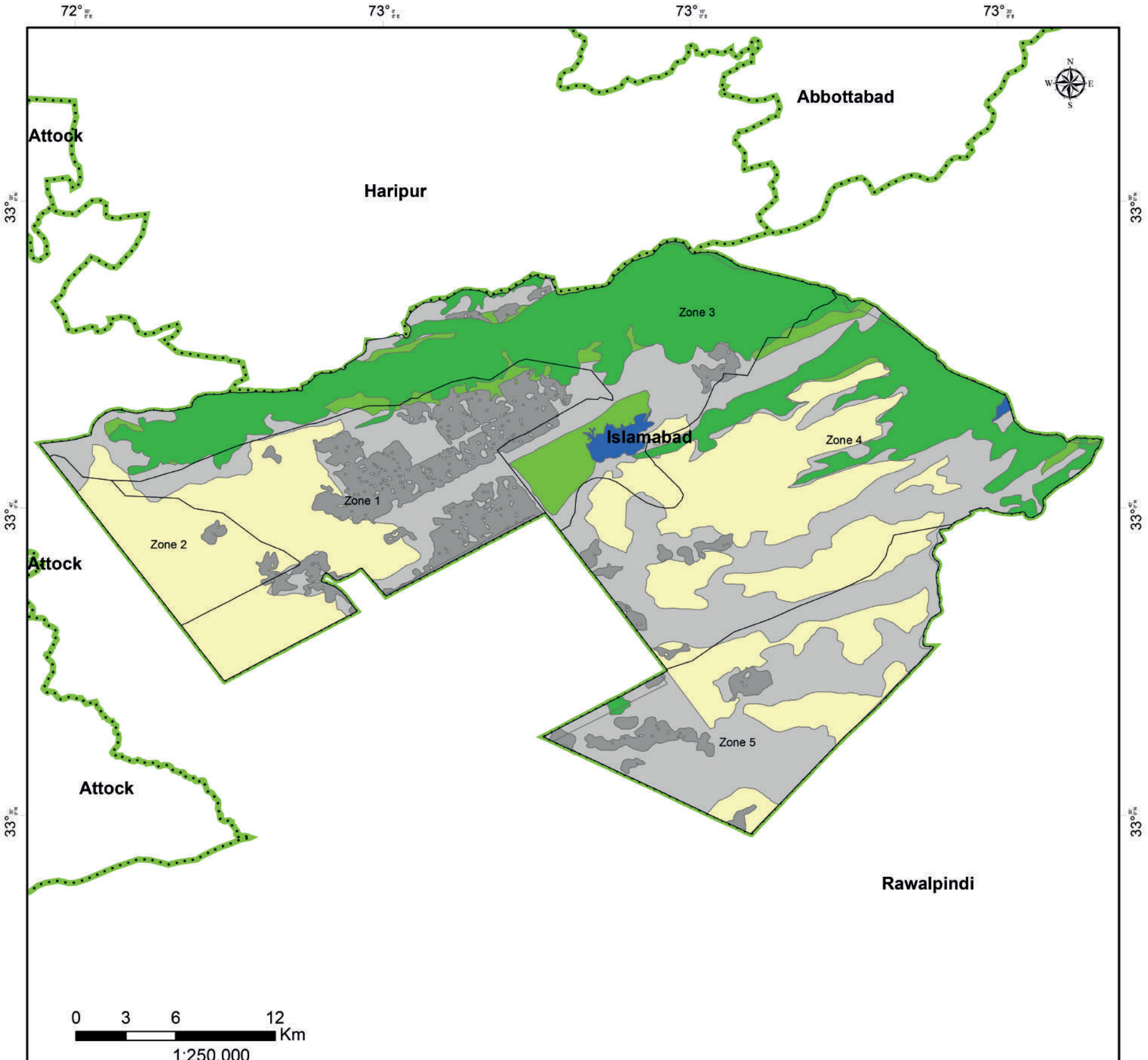
This comprehensive LULC assessment provides a valuable tool for urban planners, environmentalists, and policymakers to address resource management, climate resilience, and sustainable growth challenges effectively.

| LULC Types | Area (sq.km) | Composition |
|---|---|---|
| Bare Rock, Gravel | 289.9303 | 32.18% |
| CroppedArea | 280.1637 | 31.10% |
| Forest | 202.5679 | 22.48% |
| Settlement/BuiltupArea | 88.06876 | 9.78% |
| Shurbs/Grasses | 33.47901 | 3.72% |
| WaterBodies | 5.781324 | 0.64% |

## Land Cover Distribution of Distrcit



# LAND USE & LAND COVER MAP




## Legend

**LULC**

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

**Islamabad Zones**

- Zone 1
- Zone 2
- Zone 3
- Zone 4
- Zone 5

DistrictBoundary

**Multi Hazard Vulnerability & Risk Assessment, Islamabad, Pakistan**

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# 4 ELEVATION

Islamabad, the capital of Pakistan, is situated within the Islamabad Capital Territory (ICT). The district features an elevation range from approximately 500 meters to over 1,600 meters above sea level. The city's southern and central regions, including the urbanized sectors and surrounding rural plains, lie at elevations between 500 and 700 meters, forming part of the Potohar Plateau. The northern regions, particularly the Margalla Hills, rise significantly, reaching heights of 1,600 meters and above, contributing to Islamabad's diverse topography.

The Potohar Plateau characterizes much of Islamabad's terrain, featuring undulating plains, rocky outcrops, and seasonal water channels (nullahs). Meanwhile, the Margalla Hills, part of the Himalayan foothills, are covered in dense forests, providing an essential ecological buffer and a popular destination for tourism and recreation. This elevation diversity influences Islamabad's climate, water availability, and land use patterns, supporting a mix of urban development, agriculture, and conservation zones.

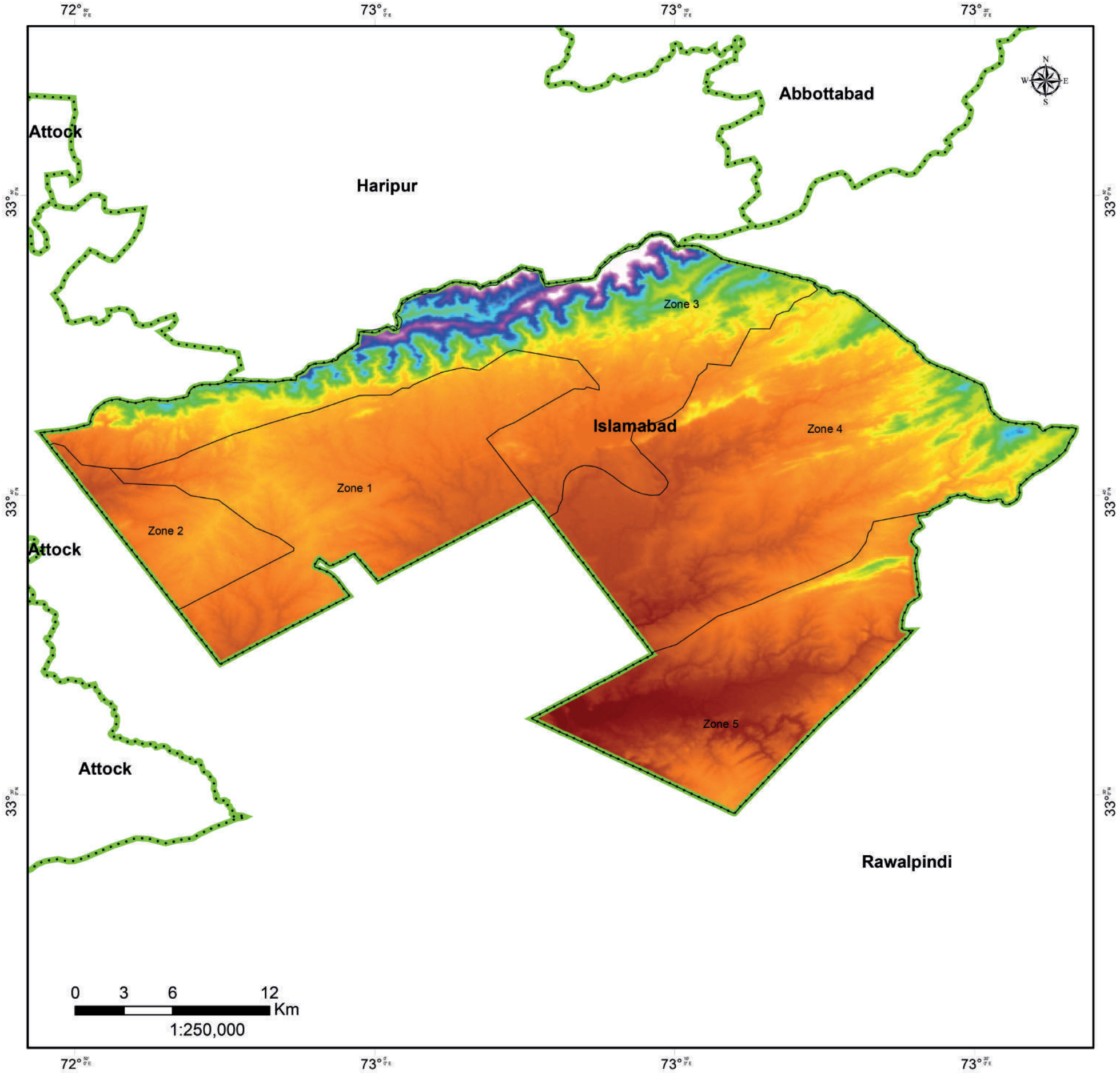
## Zone-wise Elevation

| Zone | Elevation Range (meters above sea level) | Terrain Type |
|---|---|---|
| Zone I (Urban Sectors) | 500 – 700 | Planned urban areas, residential & commercial sectors, part of the Potohar Plateau |
| Zone II (New Urban Development) | 500 – 750 | Expanding urban developments, housing societies, agricultural land |
| Zone III (Margalla Hills National Park & Forested Areas) | 700 – 1,600+ | Hilly and mountainous terrain, dense forests, conservation zone |
| Zone IV (Rural & Agro-Forestry Area) | 500 – 1,200 | Mixed land use, agricultural settlements, scattered villages |
| Zone V (Industrial & Future Urban Expansion Area) | 500 – 700 | Flat plains, industrial zones, suburban residential areas |

## Elevation Distribution

| Elevation Range (meters) | Area Coverage (%) | Description |
|---|---|---|
| 500 – 700 | 65% | Urban areas, agricultural land, mixed settlements |
| 700 – 1,200 | 25% | Margalla foothills, forested areas, rural settlements |
| 1,200 – 1,600+ | 10% | Steep mountain terrain, conservation zones |

# ELEVATION MAP




## Legend

### Elevation (m)

Value

High : 1589

Low : 417

### Islamabad Zones

- Zone 1
- Zone 2
- Zone 3
- Zone 4
- Zone 5

DistrictBoundary

**Multi Hazard Vulnerability & Risk Assessment, Islamabad, Pakistan**

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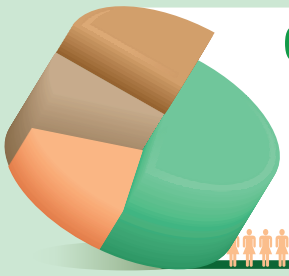
# 5 POPULATION DISTRIBUTION

According to the 2023 census, Islamabad has a total of 398,281 households and a population of 2,363,863. The city's sex ratio stands at 104.3 males for every 100 females. Additionally, Islamabad has experienced a population growth rate of approximately 2.7%, reflecting a notable increase in its population over recent years.



## Gender Wise Population

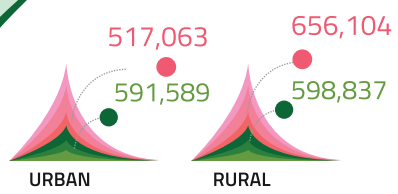
Male 1,247,693

Noorpur 1,115,900

Trans Gender 270

**Total Population (2023)** 2,363,863

## Urban & Rural Population Distribution




| | | |
|---|---|---|
| Total | MALE | 1,190,426 |
| | FEMALE | 1,173,167 |

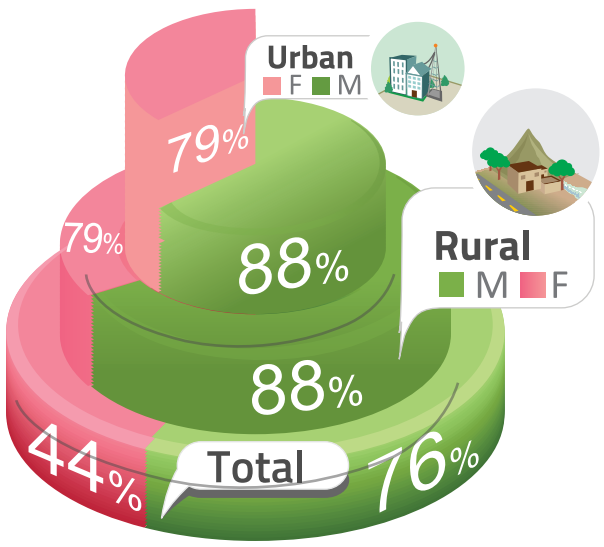
## Population on Basis of Religion (2023)

| Muslims | Christians | Qadiani Ahmadi | Hindu / Jati | Others | Scheduled Castes |
|---|---|---|---|---|---|
| 2,181,663 | 97,281 | 2,398 | 839 | 948 | 45 |

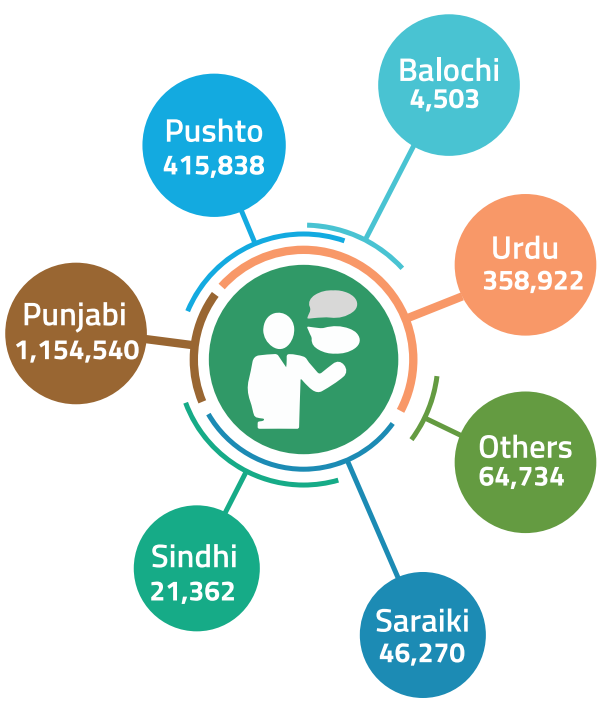
| | |
|---|---|
| 805,235 | 1998 Census |
| 2,003,368 | 2017 Census |
| 2,363,863 | 2023 Census |

## Literacy Rate (%)

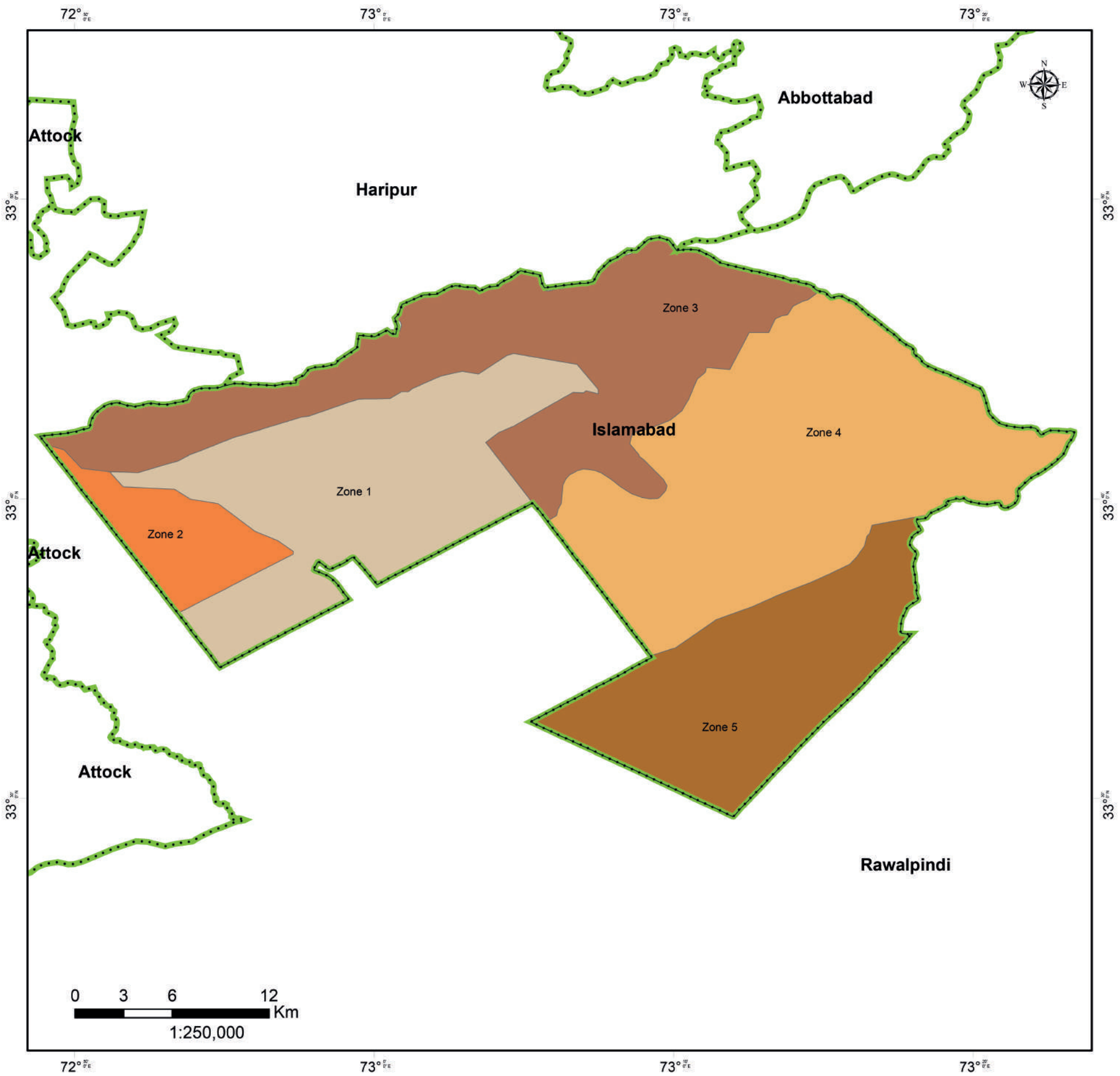
2023




## Mother Tongue



# POPULATION DISTRIBUTION MAP




## Legend

Total Population : 2,363,863
Urban Population : 1,108,872
Rural Population : 1,254,991

District Boundary

**Islamabad Zones**

- Zone 1
- Zone 2
- Zone 3
- Zone 4
- Zone 5

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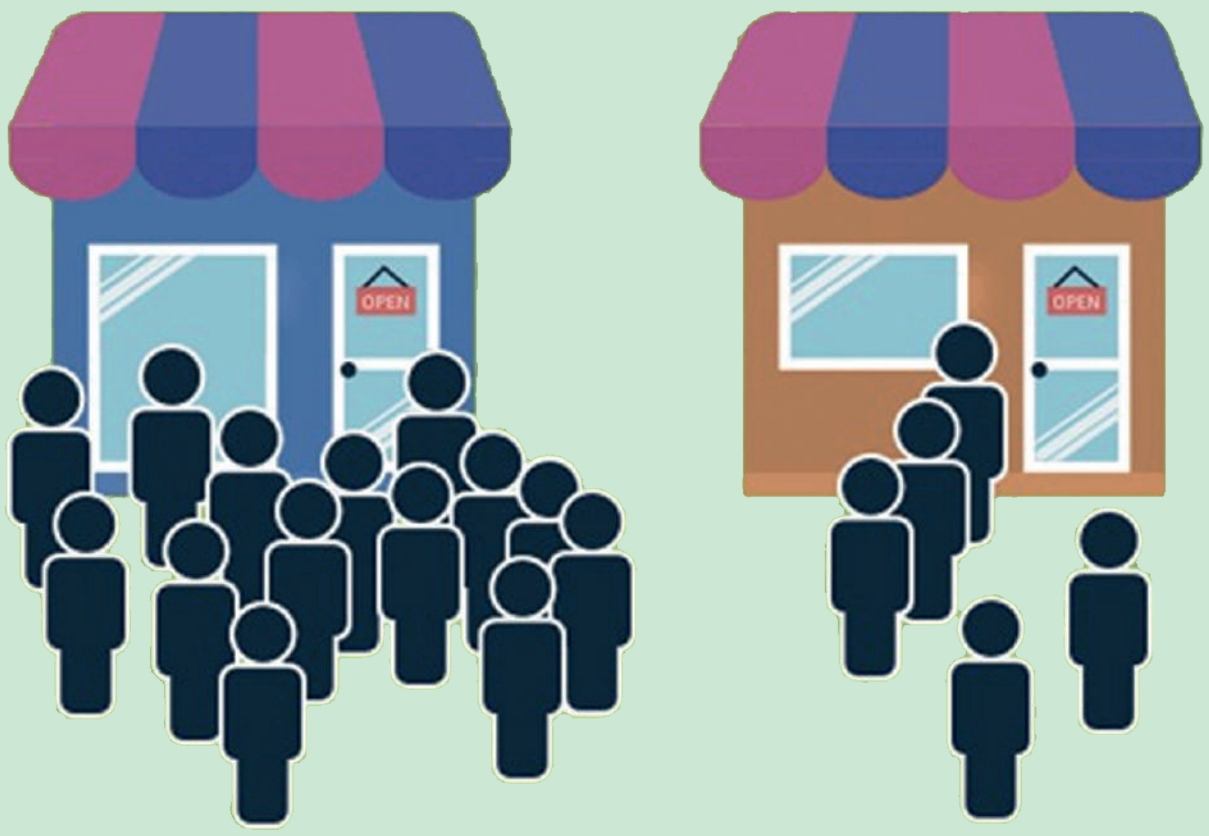
# 6 POPULATION DENSITY

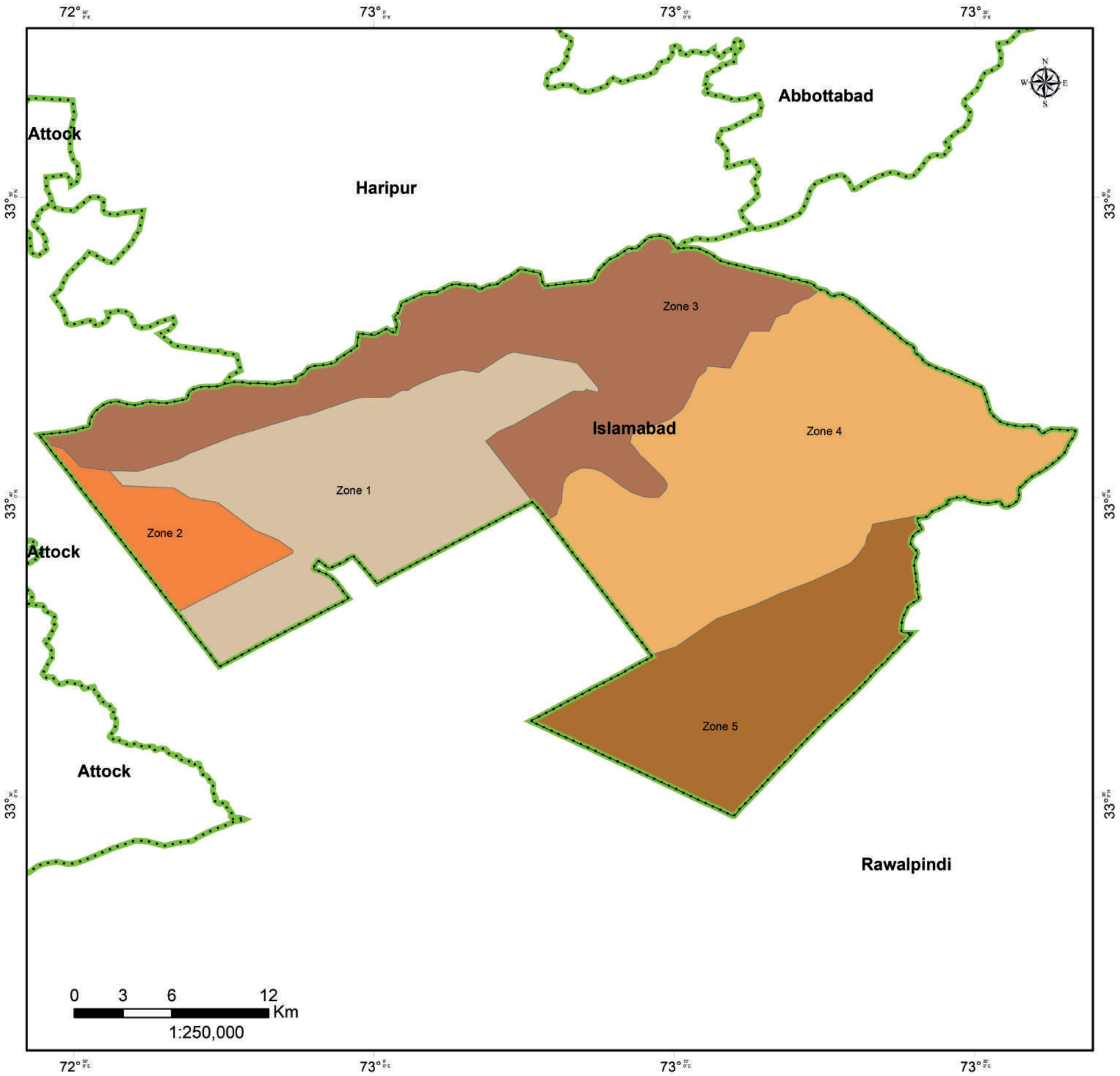
The average population density of Islamabad has significantly increased over the years. As per the 1998 census, the population density was much lower, but by 2017, it had grown to 2,211 persons per sq. km, reflecting rapid urbanization and population growth. According to the 2023 census, Islamabad's population density has further increased to 2,608 persons per sq. km, highlighting the growing pressure on the city's infrastructure and services. The urban areas of Islamabad are the most densely populated, whereas the rural outskirts remain relatively less populated, emphasizing the trend of increasing urbanization in the capital.

| Tehsil | Area(Km²) | Male Popluation | Female Popluation | Transgender Popluation | Total Popluation | Population Density (people/km2) |
|---|---|---|---|---|---|---|
| Islamabad | 906 | 1,247,963 | 1,115,900 | 270 | 2,363,863 | 2,609 |

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



# POPULATION DENSITY MAP




**Legend**

**Person/sq .km**

Population Density : 2,609

District Boundary

**Islamabad Zones**

- Zone 1
- Zone 2
- Zone 3
- Zone 4
- Zone 5

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# 7 SETTLEMENTS

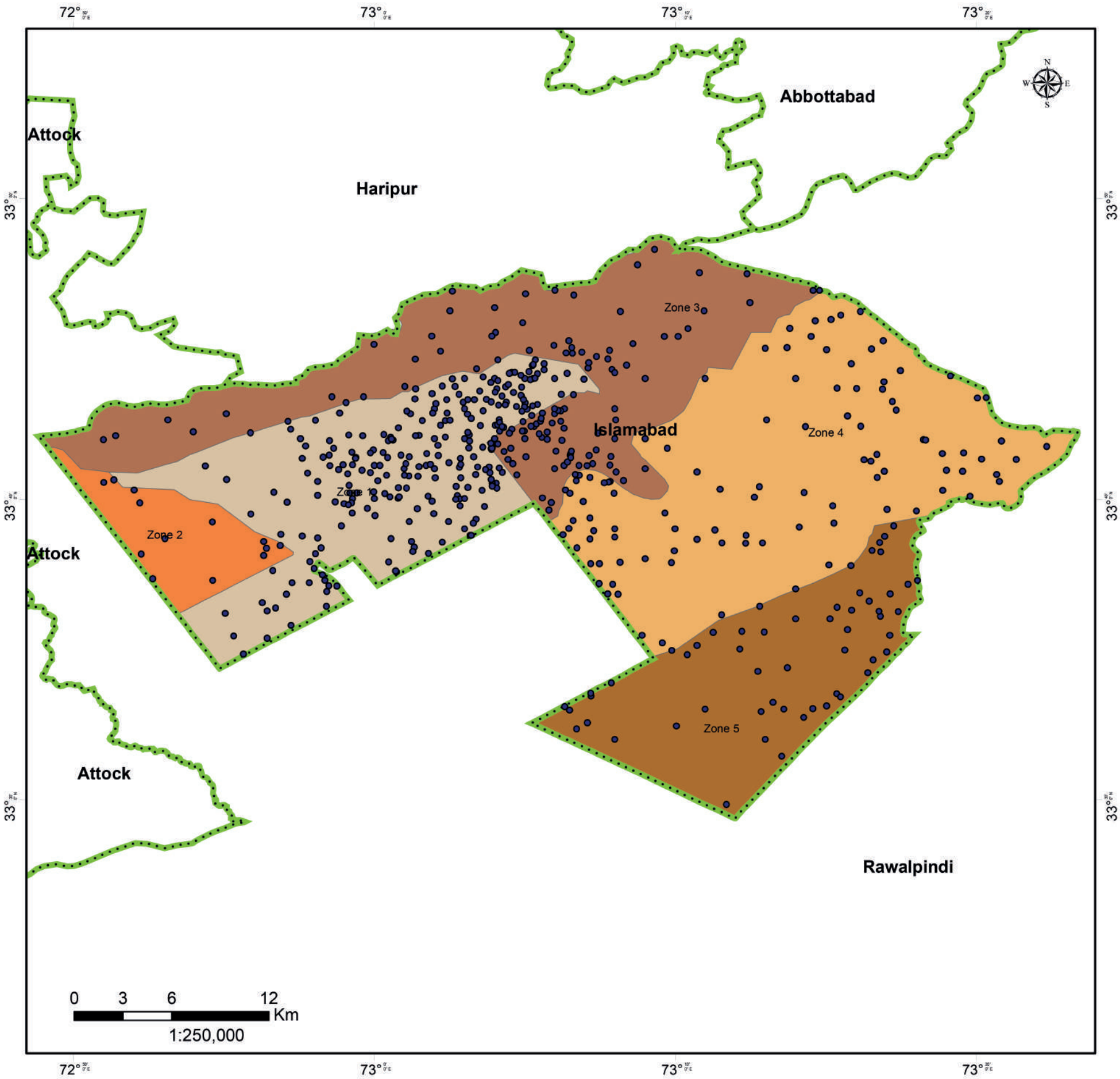
Islamabad, the capital of Pakistan, features a planned urban structure combined with rural and semi-urban settlements. The city has undergone significant expansion, with urbanization reshaping land use patterns over the years. Islamabad is divided into five zones, each with distinct characteristics in terms of urban, rural, and protected settlements.

| Zone | Description | Major Settlements |
|---|---|---|
| **Zone I (Urban Core)** | The planned urban area, consisting of G, F, H, and I sectors, government institutions, commercial hubs, and diplomatic enclaves. | G-Series (G-5 to G-13), F-Series (F-5 to F-11), H-Series, I-Series (I-8 to I-11), Diplomatic Enclave |
| **Zone II (Suburban & Housing Developments)** | Expanding residential and housing societies, primarily in the northwestern region of Islamabad. | Sector D-12, E-11, G-15, G-16, F-15, F-16, Top City, Mumtaz City, Multi Gardens, B-17 |
| **Zone III (Protected & Margalla Hills)** | Forested and conservation area of Margalla Hills National Park, with limited settlements. | Pir Sohawa, Saidpur Village, Shah Allah Ditta |
| **Zone IV (Rural & Agricultural)** | Islamabad's largest zone, featuring rural villages, agricultural lands, and new housing schemes. | Bari Imam, Phulgran, Bhara Kahu, Chak Shahzad, Rawal Town, Pind Begwal, Park View City |
| **Zone V (Industrial & Mixed Development)** | A mix of industrial zones, housing societies, and riverine areas along Soan River. | DHA Islamabad, Bahria Town, PWD, Gulberg Greens, Pakistan Town, Naval Anchorage |

**Land Use Pattern (2000 & 2023) of Islamabad District**

| Land Use Class | Area | | Change |
|---|---|---|---|
| | Year 2000 | Year 2023 | |
| Built-Up Area | 22.5% | 35.2% | 12.7% |
| Agriculture | 40.8% | 32.6% | -8.2% |
| Water Bodies | 2.3% | 2.1% | -0.2% |
| Forest Cover | 23.6% | 25.8% | 2.2% |
| Barren Land | 10.8% | 4.3% | -6.5% |

# SETTLEMENTS MAP




## Legend

- Settlements
- District Boundary

**Islamabad Zones**

- Zone 1
- Zone 2
- Zone 3
- Zone 4
- Zone 5

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# 10 TRANSPORTATION NETWORK

Islamabad, the capital of Pakistan, has a well-planned transportation network that ensures smooth connectivity within the city and links it to other parts of the country. With its modern road infrastructure, well-maintained highways, and a growing metro system, Islamabad serves as a central hub for trade, governance, and regional connectivity.

## Road Length (km)


## Number of Railway Stations in Islamabad District

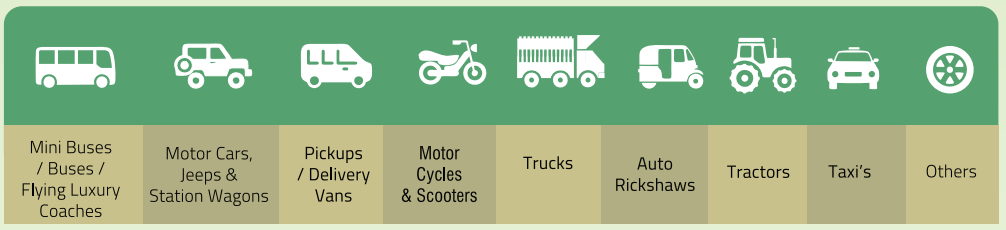
- Islamabad Railway Station (Main Station)
- Golra Sharif Railway Station
- Margalla Railway Station

## Major Roads in Islamabad District

Islamabad's road network is designed to facilitate efficient movement of traffic, with key highways and expressways connecting it to surrounding regions. Some of the major roads include:

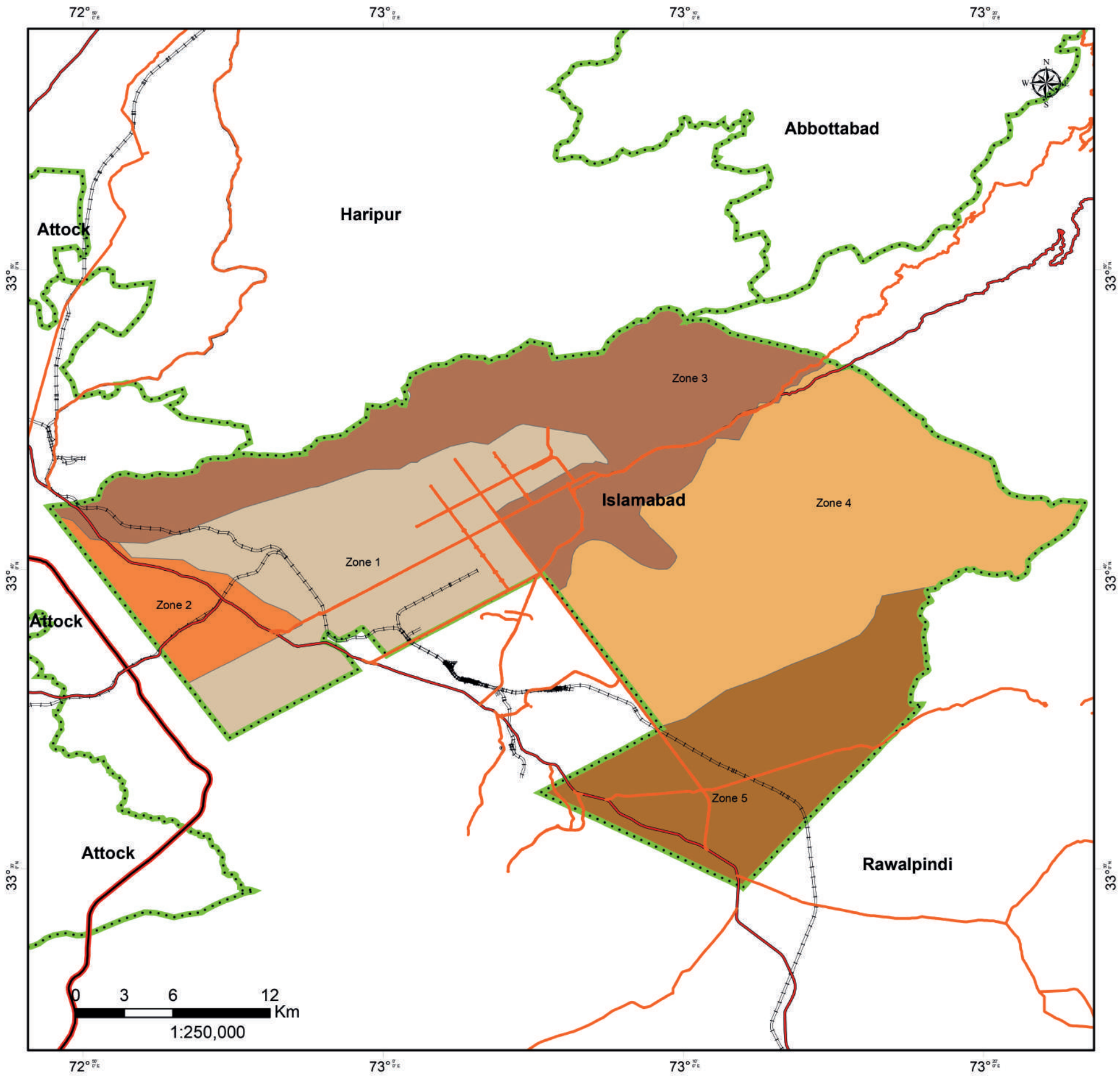
- Islamabad Expressway – A major north-south corridor connecting Islamabad to Rawalpindi and extending towards the M-2 Motorway.
- Kashmir Highway (Srinagar Highway) – A vital east-west arterial road linking Islamabad with Rawalpindi and the Islamabad International Airport.
- M-1 Motorway – Connects Islamabad to Peshawar and other parts of Khyber Pakhtunkhwa.
- M-2 Motorway – Provides a high-speed route from Islamabad to Lahore.
- Murree Expressway (N-75) – Connects Islamabad with Murree and Azad Jammu & Kashmir.
- 9th Avenue & 10th Avenue – Key urban roads improving intra-city connectivity.
- Margalla Road – Links different sectors of Islamabad and provides an alternate route to avoid congestion.

## Type of Motor Vehicles




## Nearest Major Airport from Islamabad City


# TRANSPORTATION NETWORK MAP




## Legend

- Major Roads
- National Highway
- Strategic Road
- Motorways
- Railway Tracks

**Islamabad Zones**

- Zone 1
- Zone 2
- Zone 3
- Zone 4
- Zone 5
- DistrictBoundary

**Multi Hazard Vulnerability & Risk Assessment, Islamabad, Pakistan**

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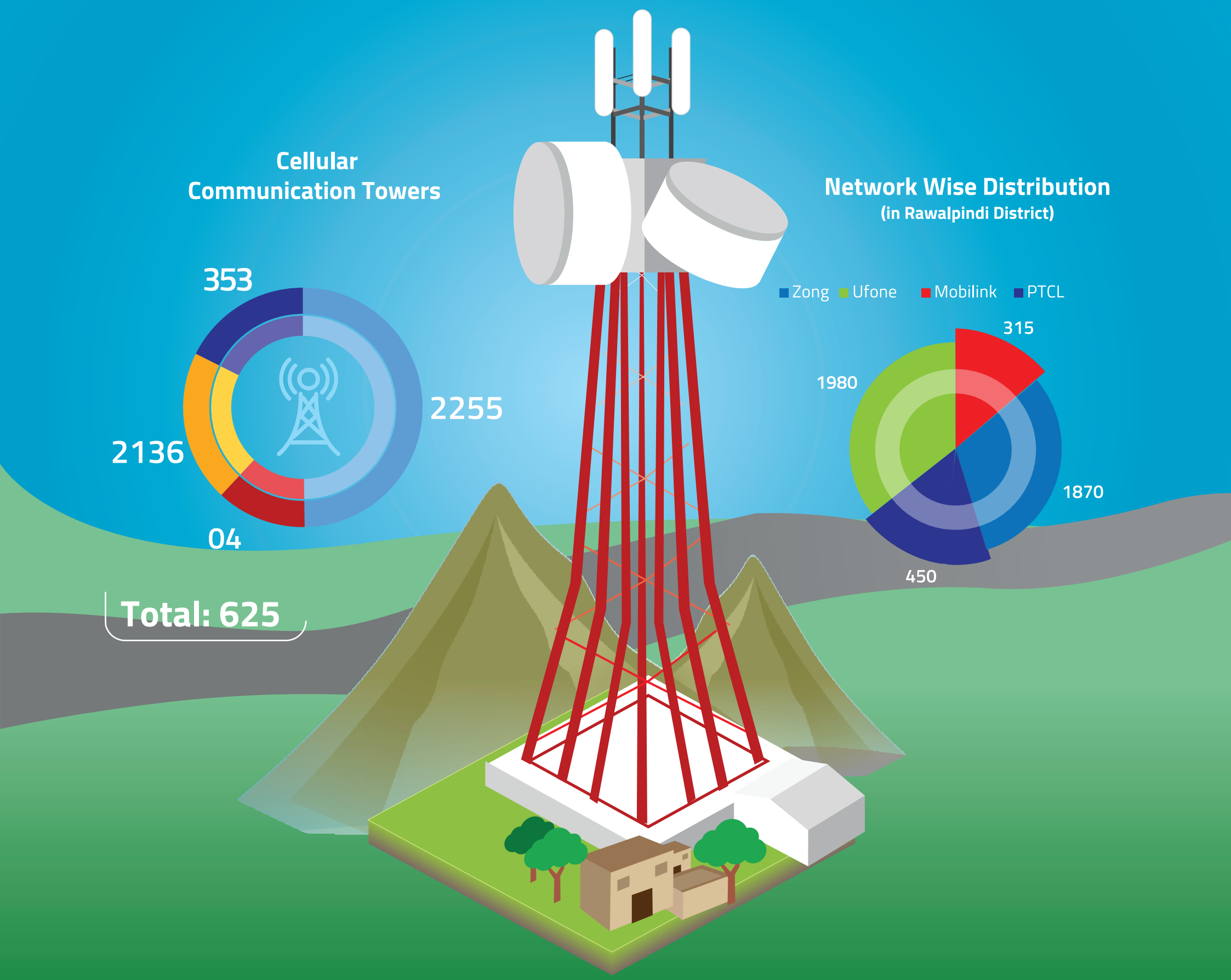
# 11 TELECOMMUNICATION

Islamabad District has experienced rapid advancements in telecommunication services over the past two decades, evolving from traditional landline-based communication to a highly developed mobile and broadband network. The widespread adoption of digital technology has significantly enhanced connectivity, enabling seamless communication, business growth, and access to online services.
The district boasts a well-established telecommunication infrastructure, with multiple telephone exchanges providing thousands of landline connections to residential, commercial, and government institutions. However, with the increasing reliance on mobile networks, landline usag
e has gradually declined, while cellular networks have expanded exponentially.

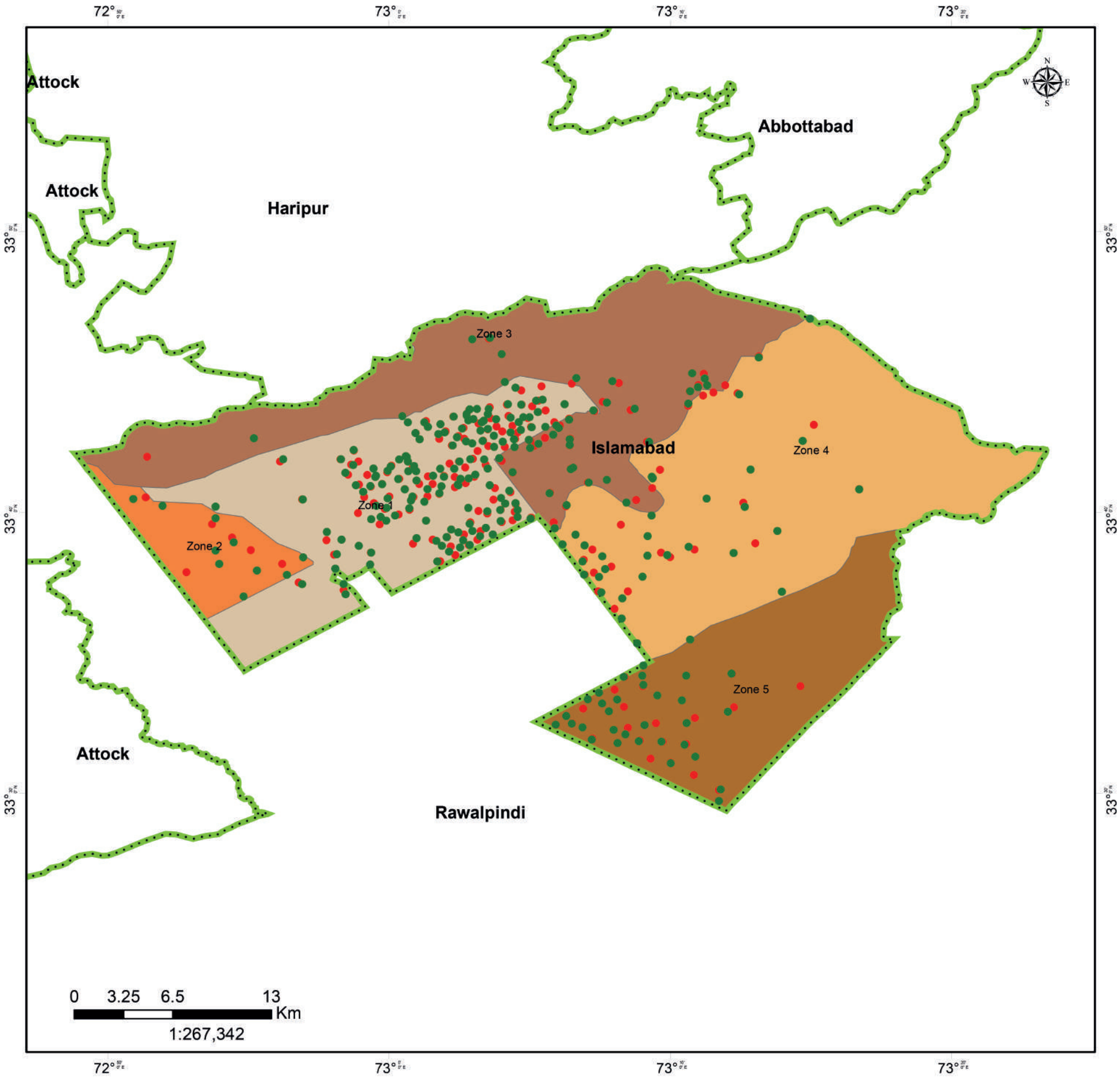
Major telecom operators have established extensive coverage across Islamabad, ensuring reliable connectivity in both urban and suburban areas. Ufone leads with 1,980 towers, followed by Zong with 1,870 towers and Mobilink (Jazz) with 315 towers. This robust infrastructure supports high-speed data services, stable voice communication, and widespread internet accessibility throughout the district.

In addition to mobile networks, Pakistan Telecommunication Company Limited (PTCL) remains a key provider of landline and broadband services, operating three PTCL exchanges across Islamabad. PTCL offers fiber-optic broadband, DSL, and other high-speed internet solutions, contributing to the city's expanding digital connectivity.

As the adoption of 4G and fiber-optic broadband continues to grow, Islamabad is poised for further advancements in digital infrastructure. Future developments such as 5G technology, enhanced broadband penetration, and smart city solutions will further strengthen the district's telecommunication landscape. The thriving telecommunication sector in Islamabad plays a vital role in economic development, fostering business expansion, and ensuring seamless digital connectivity for residents, ultimately contributing to the city's transformation into a modern, tech-driven urban hub.



# COMMUNICATION TOWER MAP




## Legend

- Ufone
- Mobilink
- Zong

**Zones**

- Zone 1
- Zone 2
- Zone 3
- Zone 4
- Zone 5
- DistrictBoundary

**Multi Hazard Vulnerability & Risk Assessment, Islamabad, Pakistan**

PAKISTAN National Disaster Management Authority NDMA

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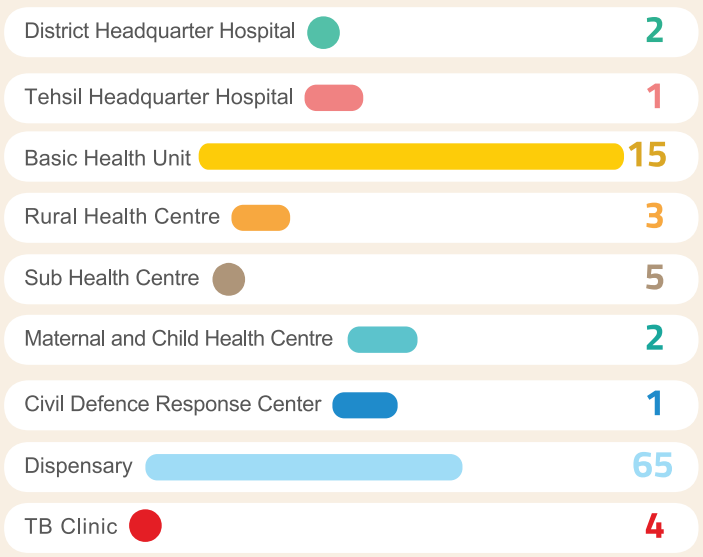
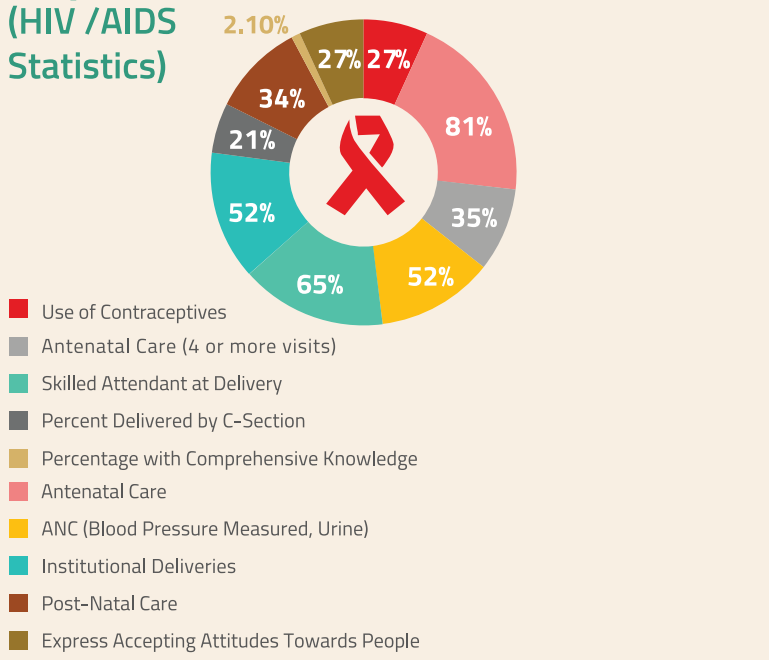
# 12 PUBLIC HEALTHCARE FACILITIES

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.

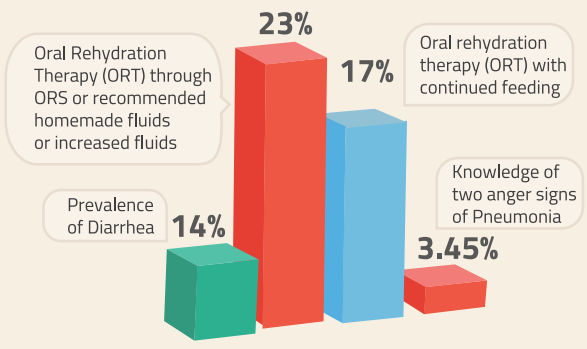
## Health Facilities by Type



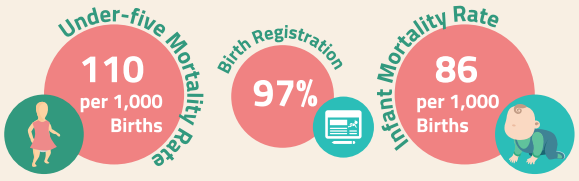

## Reproductive Health (HIV /AIDS Statistics)



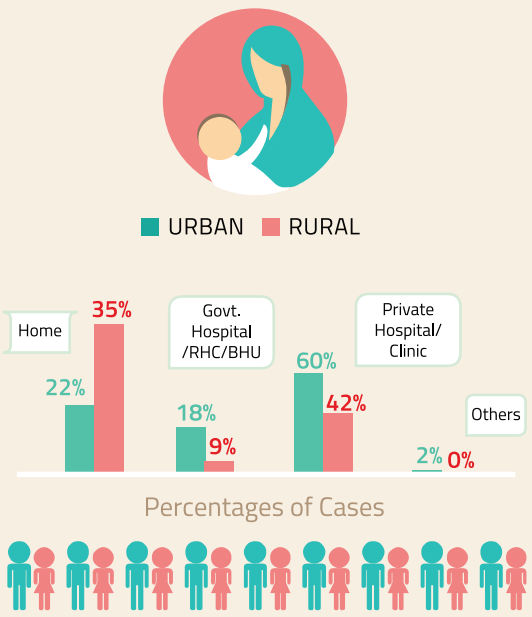

## Statistics of Disease in Children




## Child Mortality Statistics

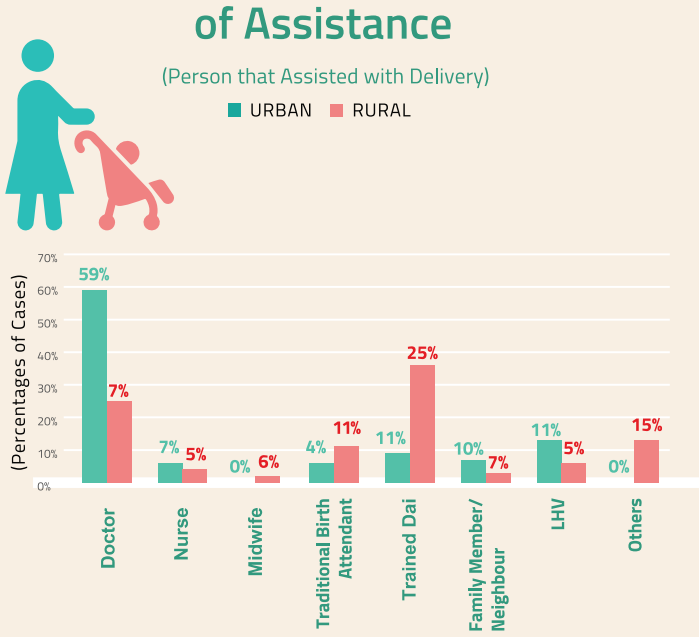



## Child Delivery by Location



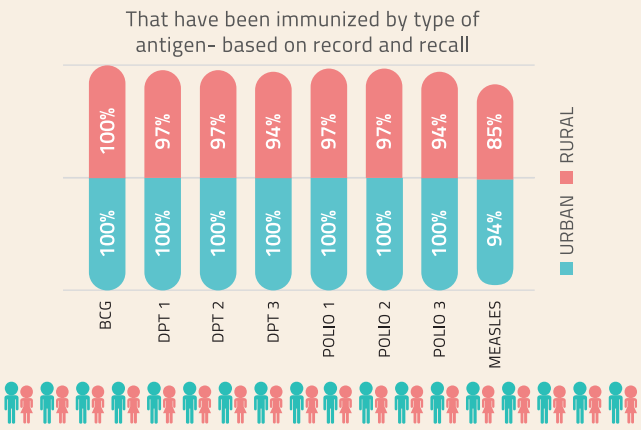

## Child Delivery by Type of Assistance

(Person that Assisted with Delivery)

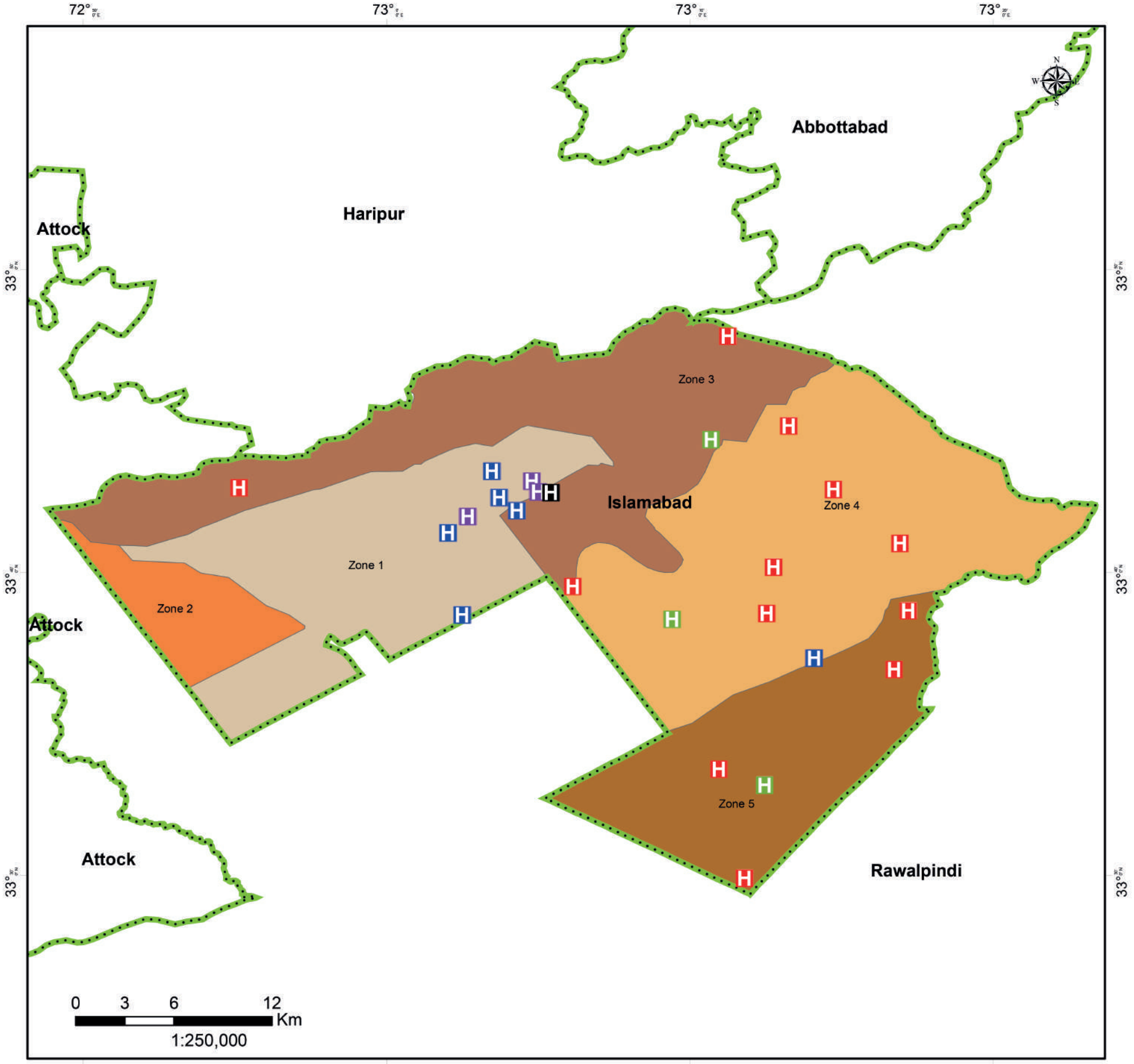



## Children12-23 Months

That have been immunized by type of antigen- based on record and recall



# HEALTH FACILITIES




## Legend

- BASIC HEALTH UNIT
- DISPENSARY
- HEALTH CENTRE
- HOSPITAL
- RURAL HEALTH CENTRE

**Islamabad Zones**

- Zone 1
- Zone 2
- Zone 3
- Zone 4
- Zone 5
- DistrictBoundary

**Multi Hazard Vulnerability & Risk Assessment, Islamabad, Pakistan**

UN-HABITAT

# 13 PUBLIC EDUCATION FACILITIES

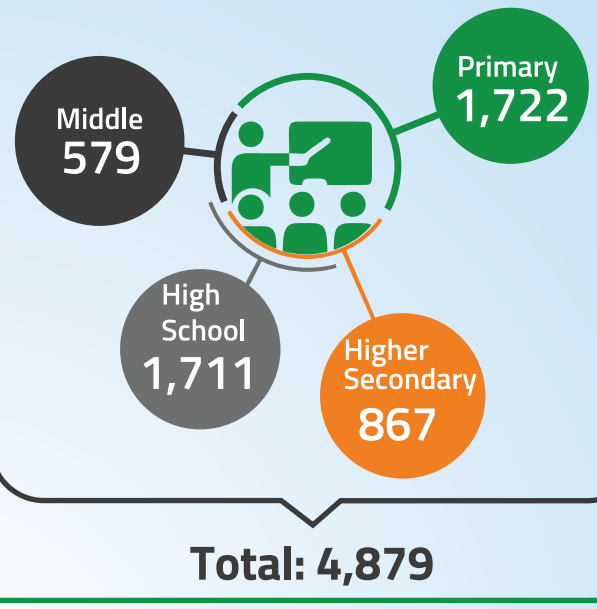
## Education Facilities

| Govt. Schools | Private Schools | Colleges | Universities |
|---|---|---|---|
| 425 | 1,292 | 70 | 26 |

## Total Enrollment by Type

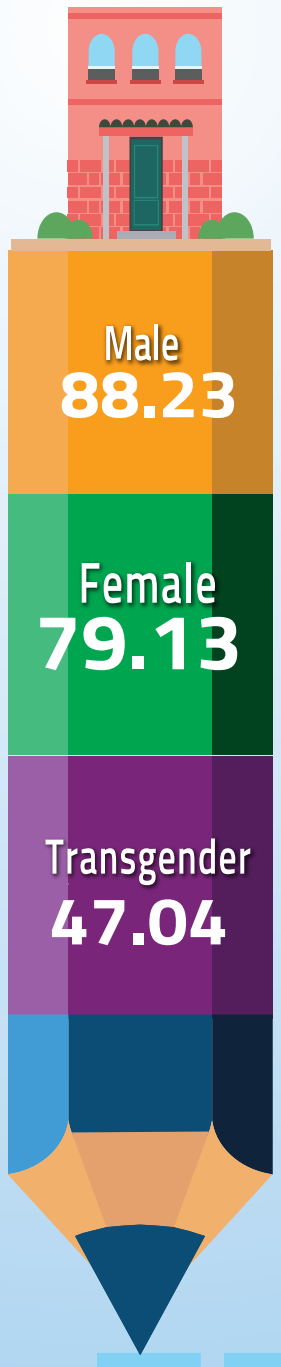
| | |
|---|---|
| Govt. Schools | 225,118 |
| Private Schools | 331,701 |
| Uinversities | 104,4622 |

## Number of Teachers

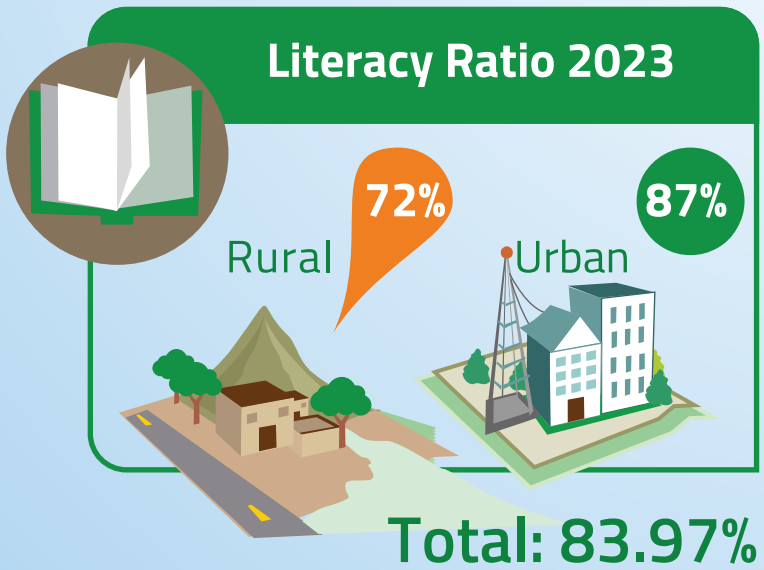



Total: 4,879

## Gender Wise Literacy Rate

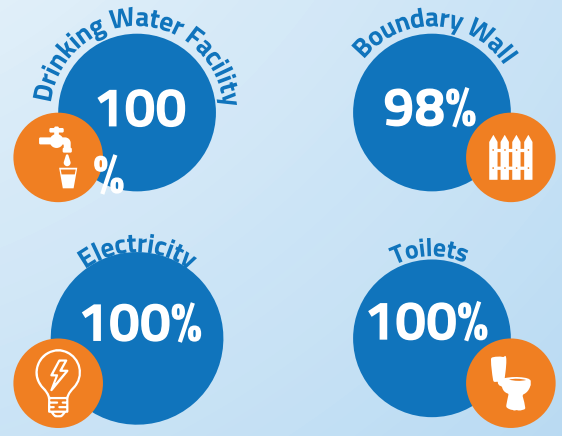



## Literacy Ratio 2023



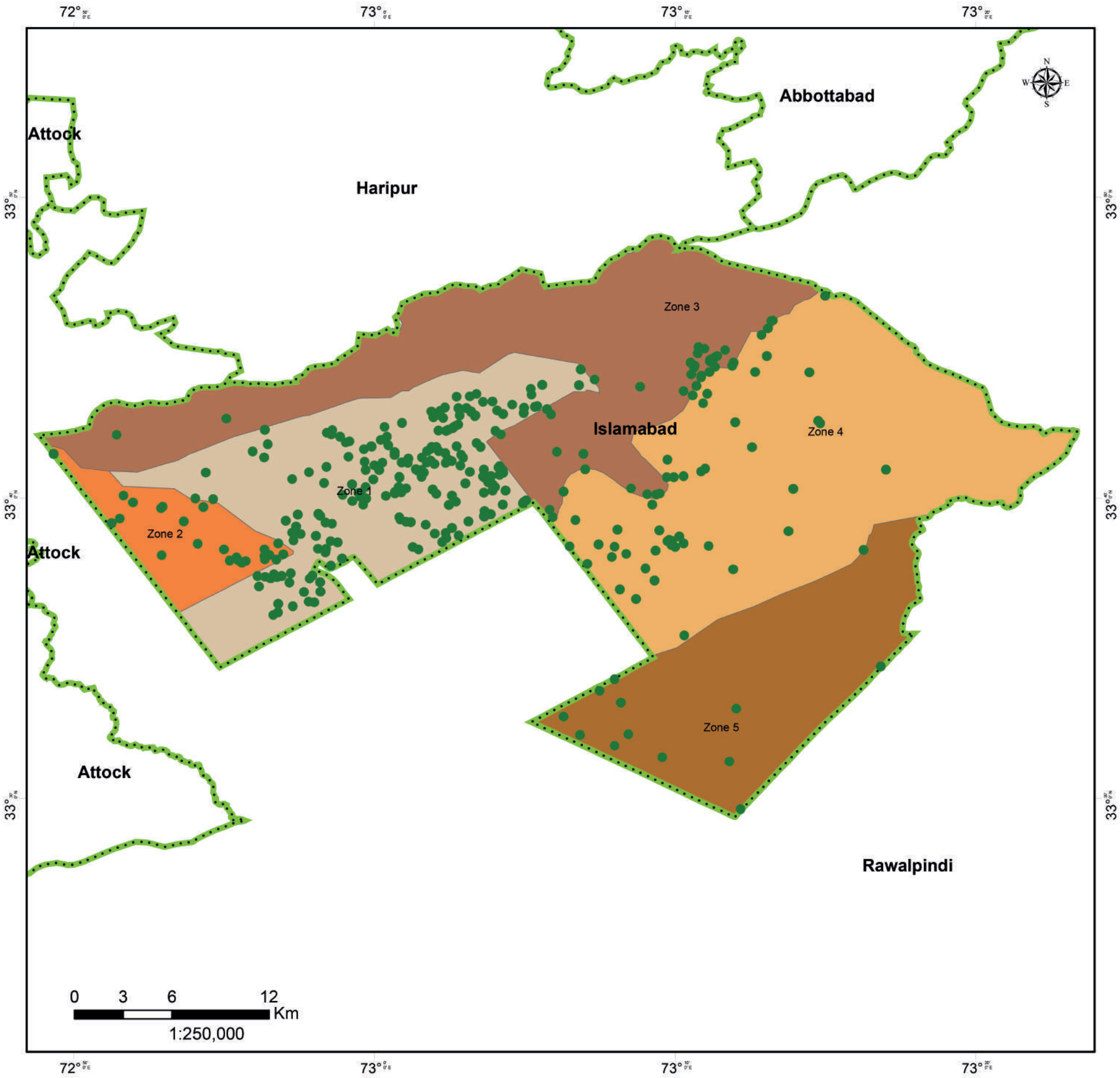

Total: 83.97%

## Tehsil Wise Facilities in Schools




■ Facility Available

# EDUCATION FACILITIES MAP




## Legend

- Education Facilities
- DistrictBoundary

**Islamabad Zones**

- Zone 1
- Zone 2
- Zone 3
- Zone 4
- Zone 5

**Multi Hazard Vulnerability & Risk Assessment, Islamabad, Pakistan**

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# 14 IRRIGATION INFRASTRUCTURE

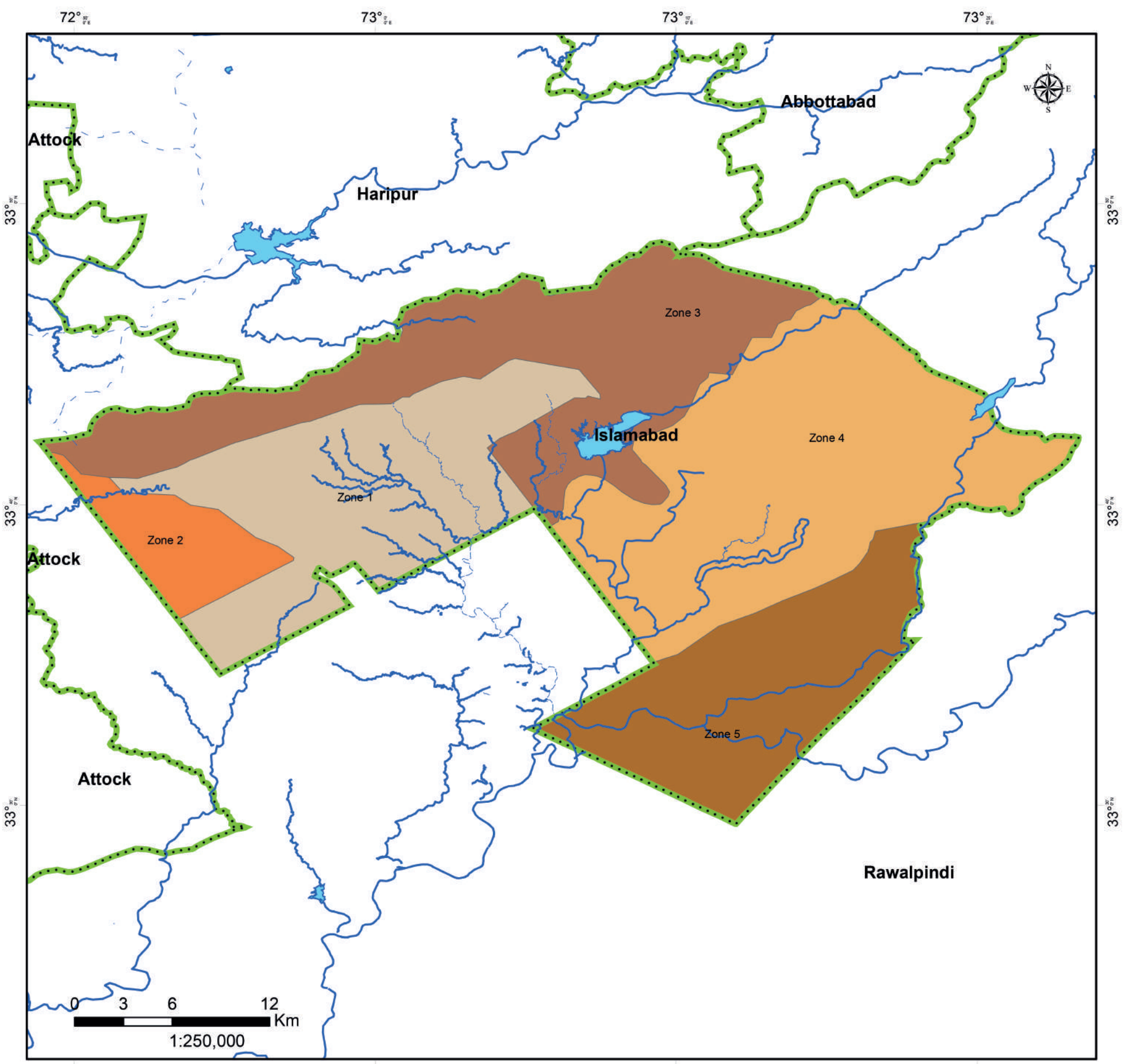
Islamabad District has a relatively limited but essential water distribution system supporting both agricultural and urban water supply needs. Unlike Rawalpindi, Islamabad does not have an extensive canal-based irrigation system; instead, it relies on surface water from nearby reservoirs, seasonal streams, and small distributaries for irrigation and water supply.

The main water sources for Islamabad include the Rawal Dam, Simly Dam, and Khanpur Dam, which provide drinking water as well as limited irrigation support. Seasonal streams such as the Korang River and Soan River contribute to groundwater recharge and small-scale irrigation. Additionally, local distributary networks help supply water to peri-urban agricultural lands. However, water availability is highly dependent on seasonal rainfall, making sustainable management crucial.

## Key Water Sources and Irrigation Systems in Islamabad District

| Water Source | Origin | Length (km) | Main Branches & Distributaries | Areas Served | Key Features & Remarks |
|---|---|---|---|---|---|
| Rawal Dam Feeder Canal | Rawal Dam | 25 km | Small distributaries | Islamabad City, Rawalpindi | Primarily supplies drinking water; some irrigation benefits. |
| Simly Dam Canal System | Simly Dam | 20km | Connected to local streams | Islamabad, Murree | Supports limited irrigation and drinking water supply. |
| Khanpur Canal | Khanpur Dam | 45 km | Minor irrigation channels | Islamabad, Taxila, Wah | Provides water for domestic use and barani farming. |
| Korang River System | Murree Hills | 30 km | Tributaries and distributaries | Islamabad, Rawalpindi | Seasonal stream, contributes to groundwater recharge. |
| Soan River Irrigation System | Soan River | 50 km | Connected to local streams | Murree, Rawalpindi | Supports limited irrigation in surrounding areas. |
| Ling River Irrigation System | Ling River | 15 km | Local distributaries | Islamabad, Rawalpindi, Chakwal | Provides limited irrigation, mostly seasonal. |
| Small Distributary System | Various Sources | 35 km | Multiple small distributaries | Peri-urban Islamabad | Supplies irrigation to scattered agricultural areas. |

# IRRIGATION MAP




## Legend

- Dams & Water Bodies
- river
- Ditch
- Drain
- Canal
- stream
- DistrictBoundary

**Islamabad Zones**

- Zone 1
- Zone 2
- Zone 3
- Zone 4
- Zone 5

**Multi Hazard Vulnerability & Risk Assessment, Islamabad, Pakistan**

PAKISTAN National Disaster Management Authority NDMA

UN-HABITAT

# 15 MAJOR INDUSTRIES

Islamabad's economy is supported by a variety of industries, with significant contributions from sectors like food products and beverages, chemicals, pharmaceuticals, and non-metallic mineral products. According to the Census of Manufacturing Industries (2015-16) city has a robust food processing industry, including the production of grain mill products and animal feed, which cater to local and regional markets. The chemicals and chemical products sector are vital, with numerous companies engaged in the production of fertilizers, plastics, and industrial chemicals. Pharmaceuticals play a key role in Islamabad's industrial landscape, with several major pharmaceutical companies headquartered in the city, producing both generic and branded medicines. Additionally, the non-metallic mineral products sector thrives, particularly in the manufacturing of structural clay and ceramic products, as well as the cutting, shaping, and finishing of stone, which are essential for the construction and real estate industries. These industries, alongside the growing tech, education, and government sectors, contribute to Islamabad's diverse and dynamic economy.

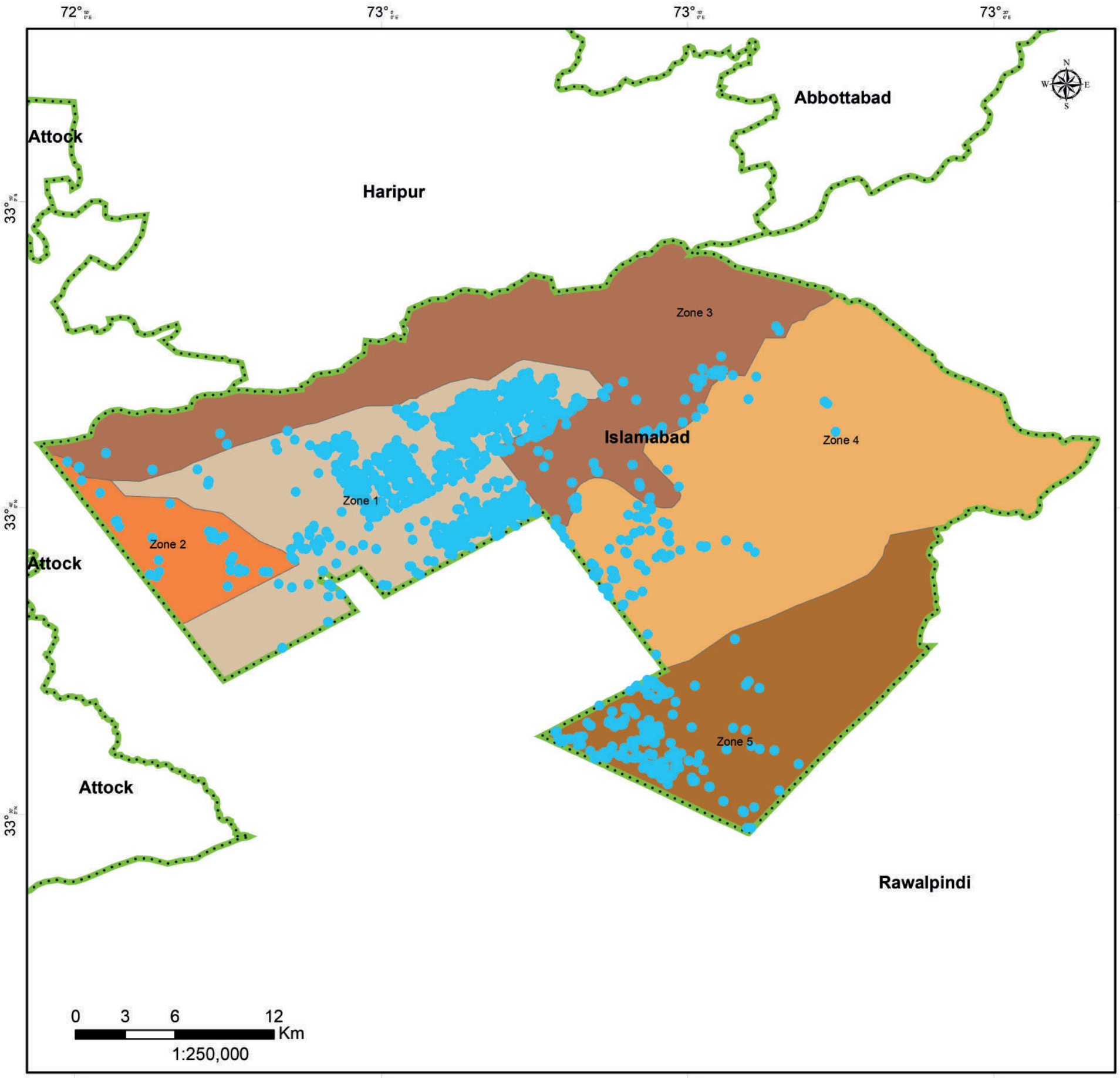
## Number of Registered Factories & Employment Level

42,628 Estimated Employment

120 Number of Factories

| Industry | No. of units | Installed Capacity |
|---|---|---|
| Food Product & Beverages | 2 | |
| Grain Mill Products, Starches etc. | 2 | |
| Grain Mill Products | 2 | |
| Grain Milling | 2 | |
| Medicinal Active Substances | 2 | |
| Pharmaceuticals | 2 | |
| Non-Metallic Mineral Products | 2 | |
| Cutting, Shaping & Finishing of Stone | 2 | |
| Basic Metals | 2 | |
| Electrical Equipment | 2 | |
| Plastic Products | 2 | |

# INDUSTRIES MAP




## Legend

- Industries
- DistrictBoundary

**Islamabad Zones**

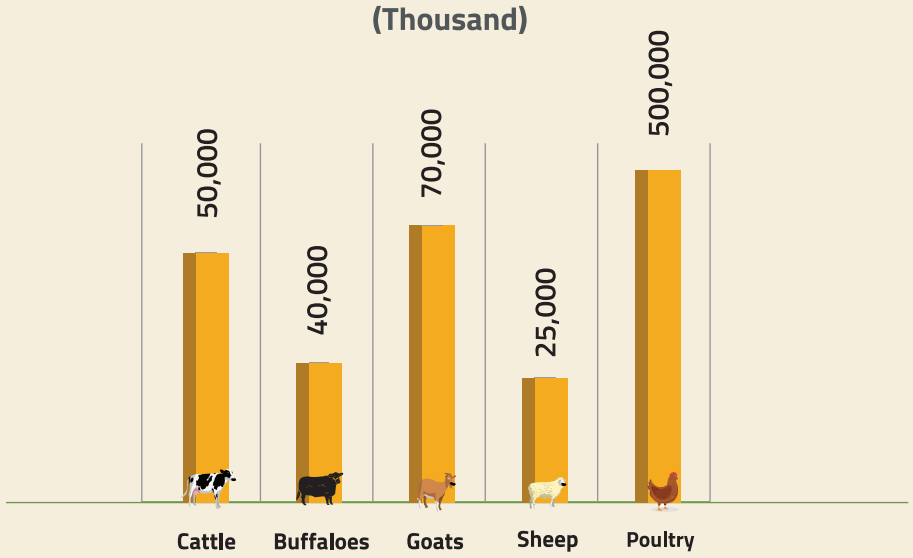
- Zone 1
- Zone 2
- Zone 3
- Zone 4
- Zone 5

**Multi Hazard Vulnerability & Risk Assessment, Islamabad, Pakistan**

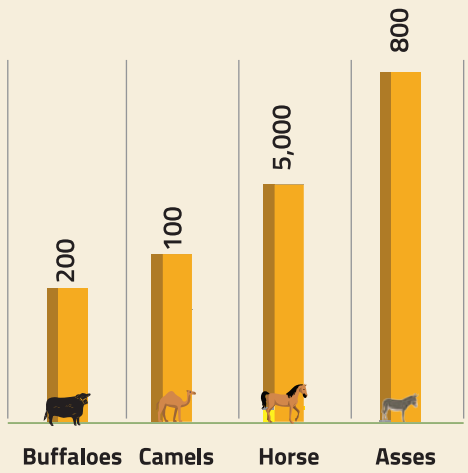
UN-HABITAT

# 16 LIVESTOCK

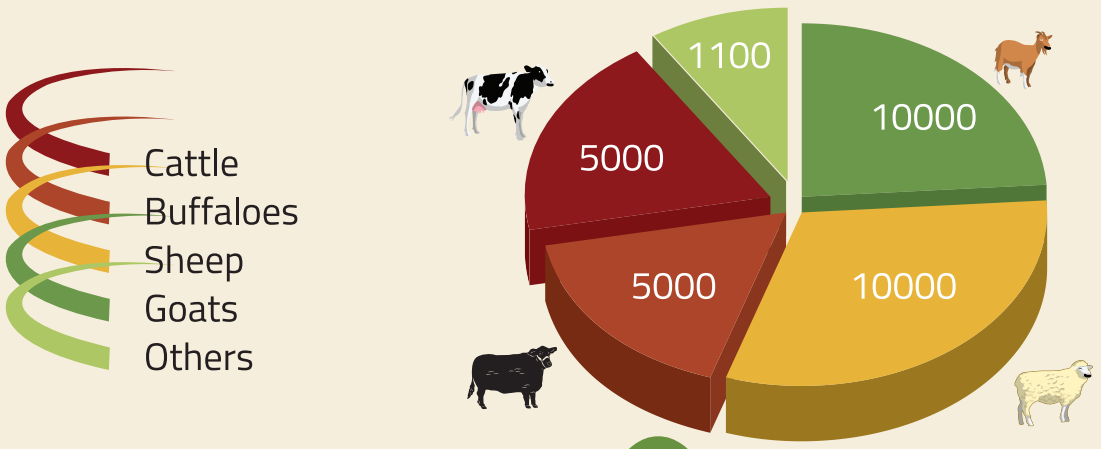
## Number of Domestic Livestock
(Thousand)



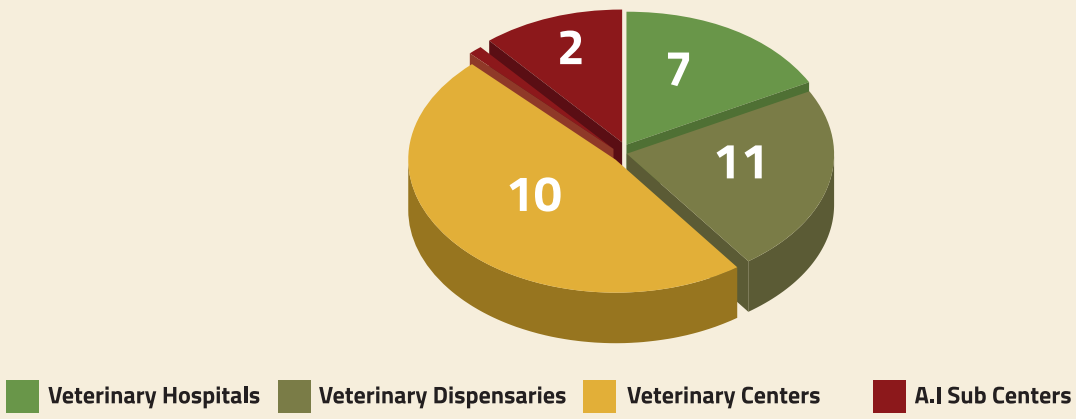

## Number of Work Animals by Type (2023)
(Number)




## Animals Slaughtered in Recognized & Unrecognized Slaughterhouses:
(In Hundred)




## Veterinary Healthcare Facilities (2013-14)




## Established Private Poultry Farms (2013-14)

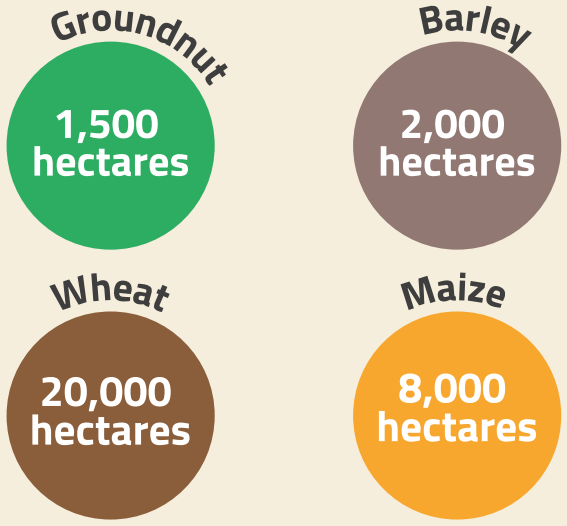
| | Broiler Farms | Layer Farms | Breeding Farms |
|---|---|---|---|
| Number | 50 | 20 | 5 |
| Capacity to Rear Birds per Annum (Thousand) | 500,000 | 200,000 | 50,000 |

# 17 AGRICULTURE

Islamabad District, the capital territory of Pakistan, has a limited but significant agricultural landscape that plays a role in supporting local food production and economic activities. While urbanization has reduced agricultural land, the district still benefits from fertile plains, natural water sources, and a moderate climate, allowing for the cultivation of various crops, fruits, and livestock farming. The district primarily relies on the Simly Dam, Rawal Dam, and groundwater sources, including tube wells and traditional wells, for irrigation.

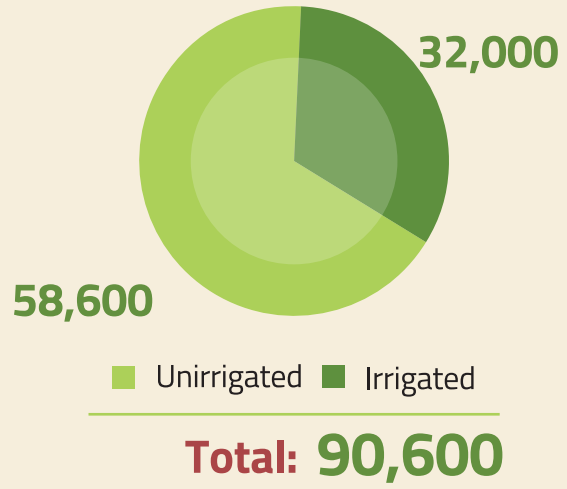
Islamabad follows a two-season cropping pattern, with major crops grown during the Rabi (winter) and Kharif (summer) seasons. During the Rabi season, wheat, barley, mustard, and various vegetables are cultivated, while the Kharif season supports maize, millet, sugarcane, and pulses. The district also has an emerging horticulture sector, producing fruits such as citrus (oranges, kinnow), guava, pomegranate, and apricot. Additionally, vegetables like tomatoes, onions, spinach, and potatoes are cultivated, contributing to local markets and food supply chains.

## Major Crop Production

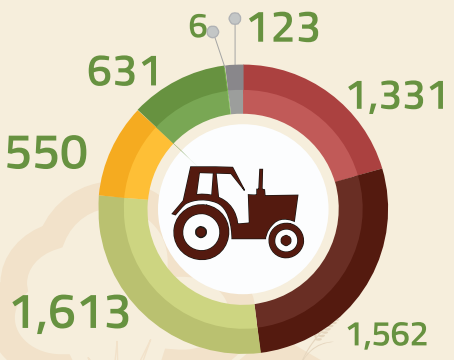



## Total Area Sown

(Thousand Hectares)



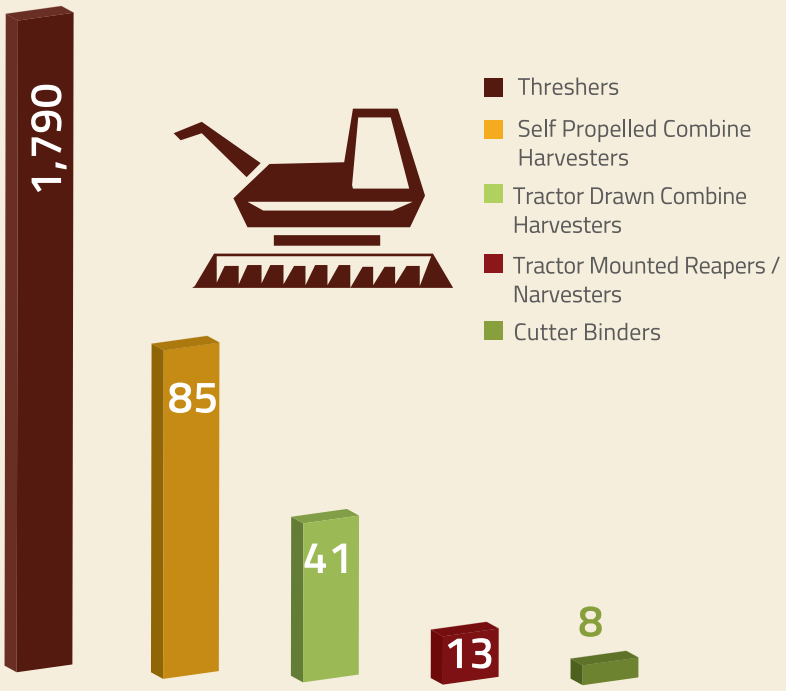

## Tractors by Make




- Fiat (640)
- Belarus
- Others
- Fiat (480)
- Belarus Ford (4000/4600)
- Massey Ferguson
- Belarus Ford (3000/3600)

Total: 5,816


## Threshers & Harvesters




- Threshers
- Self Propelled Combine Harvesters
- Tractor Drawn Combine Harvesters
- Tractor Mounted Reapers / Narvesters
- Cutter Binders

Total: 1,937

# 18 RESCUE 1122

In Islamabad, the Metropolitan Corporation Islamabad (MCI) operates the CARES 1122 emergency service, which functions similarly to Rescue 1122 in other provinces. CARES 1122 provides rapid response to medical emergencies, fire incidents, and disaster situations, ensuring timely assistance to residents. The service is equipped with ambulances, fire trucks, and trained personnel to handle emergencies efficiently. Citizens can access CARES 1122 by dialing 1122, allowing them to receive immediate medical aid, fire rescue, and disaster response support across the capital.

**FUNCTIONS/ RESPONSIBILITIES**

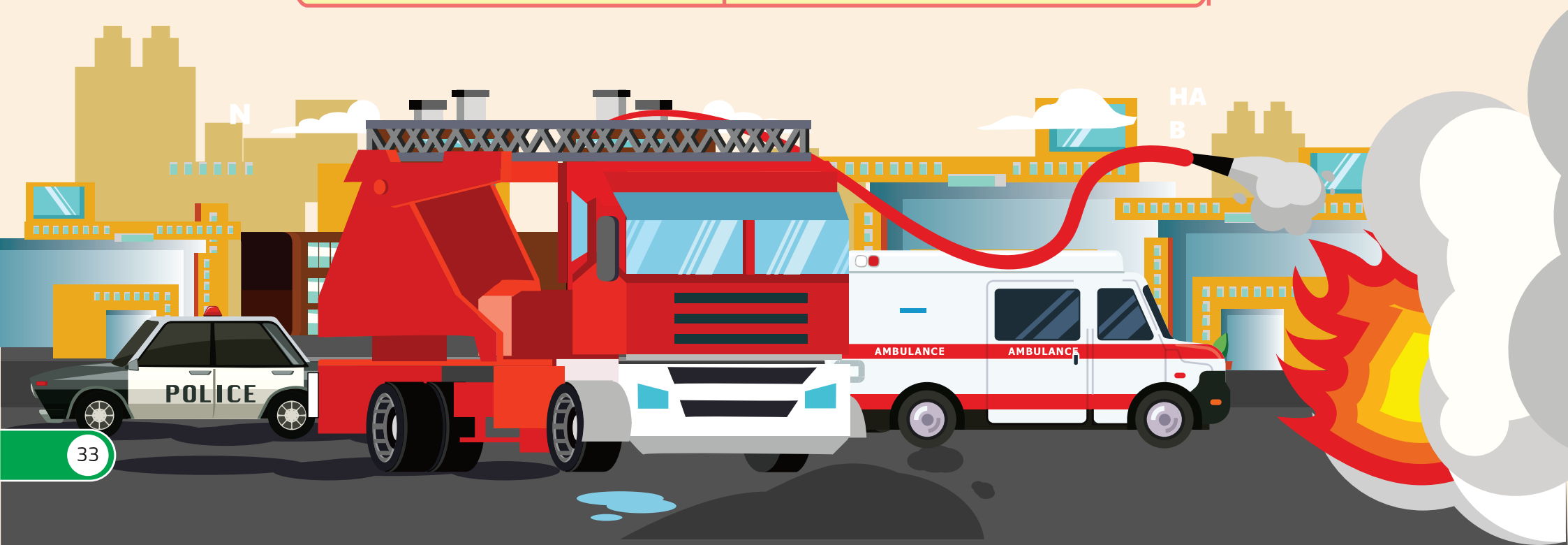
- To provide emergency care to the citizens of Islamabad round the clock
- To provide the First Aid emergency Services to the Patient's and to shift/transport to the nearest hospital
- To cater/response any type of natural and man made disaster like road traffic accident, gunshot and bomb blast, burns, stroke, acute cardiac /respiratory problem, loss of consciousness, other drugs intoxication, any other problem putting life of the patient at risk Earthquake, road accident and flood etc
- To deploy the ambulances on special occasions like Government level VIP functions, religious procession, Political rallies, foreign dignitaries visits etc
- To coordinate with other departments/organizations/institutions relating to medical emergency
- To take necessary steps for betterment/improvement of this service on the basis of experiences

**Existing LOCATIONS of MCI CARES CENTER**

- E-7, near Faisal Mosque
- F-6, near Super Market
- G-6/2, Capital Hospital
- G-10, Markaz
- I-8, near CDA Enquiry
- I-10/2, west service road
- Sihala, Rural Health Center
- Tramri Chowk, Rural Health Center
- Bharakahu, Rural Health Center
- Golra, Road side Porta Cabin placed
- Sohan, Road side Porta Cabin placed
- F-10/E-11, Directorate of Health Services

## Rescue Equipment

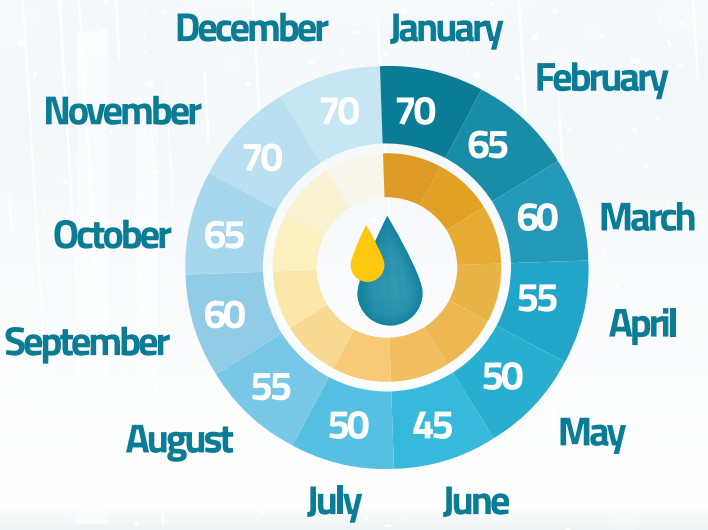
| | | | |
|---|---|---|---|
| Life Jackets | 260 | Fire Vehicles | 18 |
| Water R.Van | 1 | Emergency Responders | 345 |
| Boats | 3 | Volunteers | 4,700 |



# 19 CLIMATOLOGY

Islamabad experiences a subtropical climate with four distinct seasons, characterized by hot summers, a monsoon season, mild autumns, and cool winters. Summer temperatures can reach up to 36-38°C in June, while winters see lows of around 3-5°C in January. The city receives substantial rainfall, particularly during the monsoon months of July and August, which often results in localized flooding. Humidity levels fluctuate throughout the year, peaking during monsoon and winter months. Wind speeds vary seasonally, with stronger winds observed from March to June. Overall, Islamabad's climate remains moderate compared to other regions in Pakistan, making it a favorable environment for residential and commercial activities.

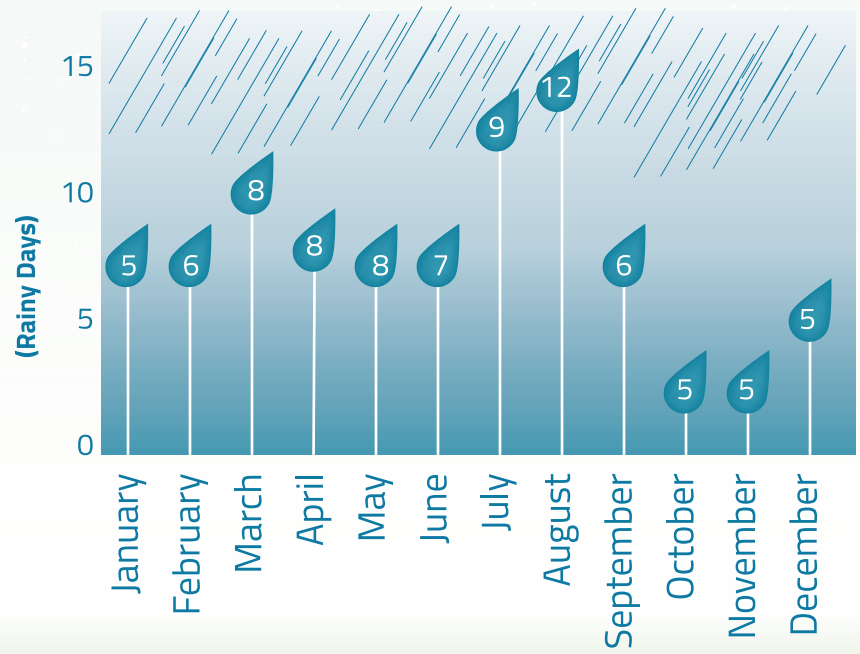
## Relative Humidity (%)



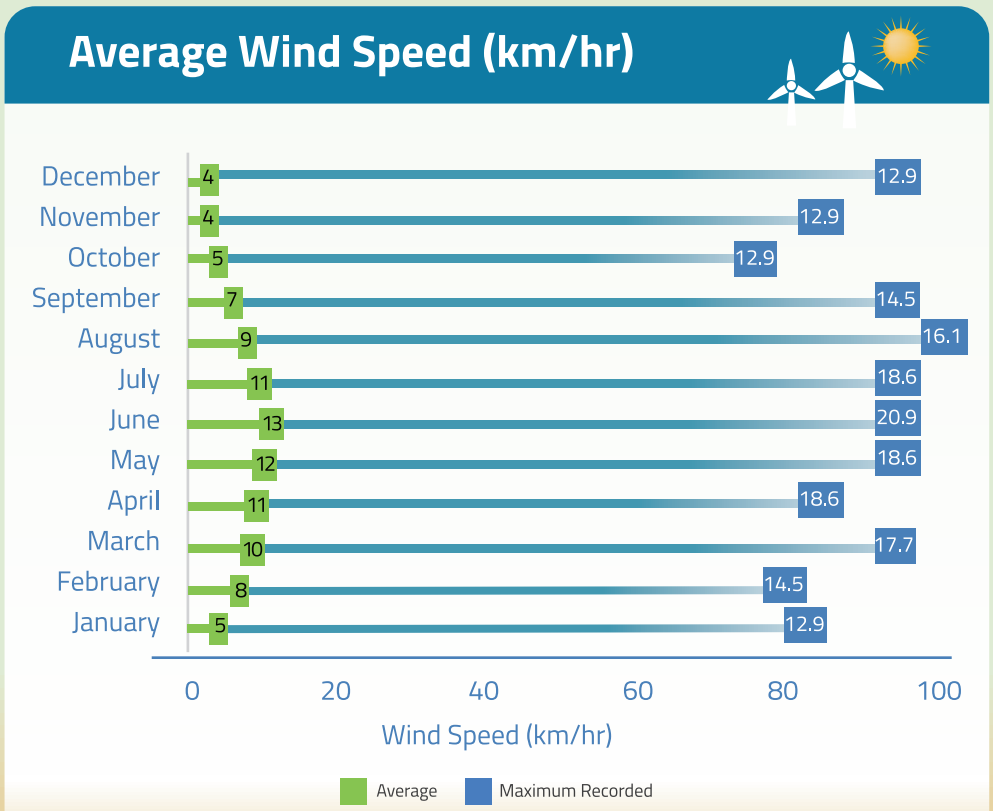

## Average Precipitation (mm)

| | | | | | |
|---|---|---|---|---|---|
| January | 67.1 | February | 84.1 | March | 92.4 |
| April | 63.2 | May | 34.1 | June | 75.3 |
| July | 305.3 | August | 340.3 | September | 110.7 |
| October | 31.7 | November | 14.4 | December | 36.2 |

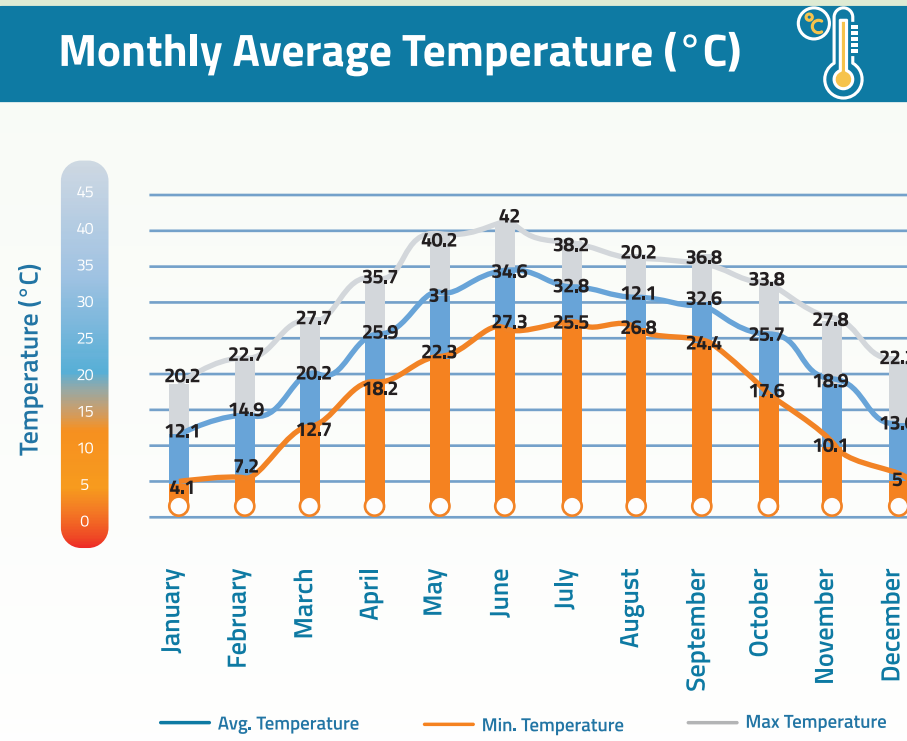
## Average Rain Day (per month)




## Average Wind Speed (km/hr)




## Monthly Average Temperature (°C)



# B | HAZARD ASSESSMENT

- DROUGHT
- EARTHQUAKE
- FLOOD

# 2 DROUGHT HAZARD ASSESSMENT

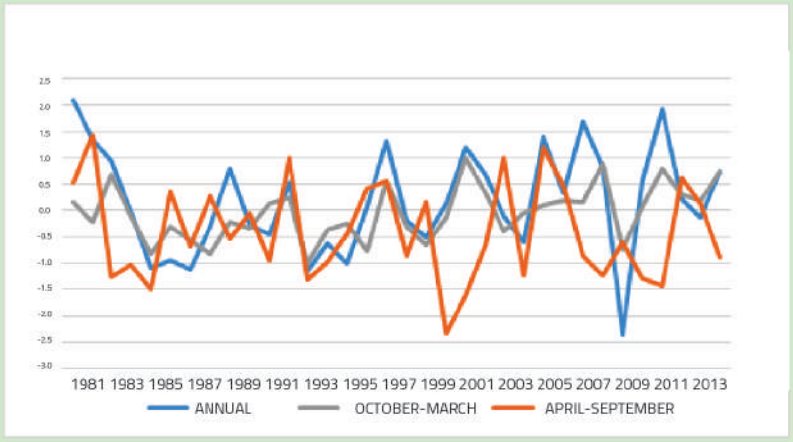
A large part of Pakistan faces severe effects of drought for most part of the year. Long-drawn-out precence of drought is signiciant challenge to agriculture, human lives, livestock, forests, water resource management, urban planing and food security. Due to changing climatic patterns, the drought phenomenon 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

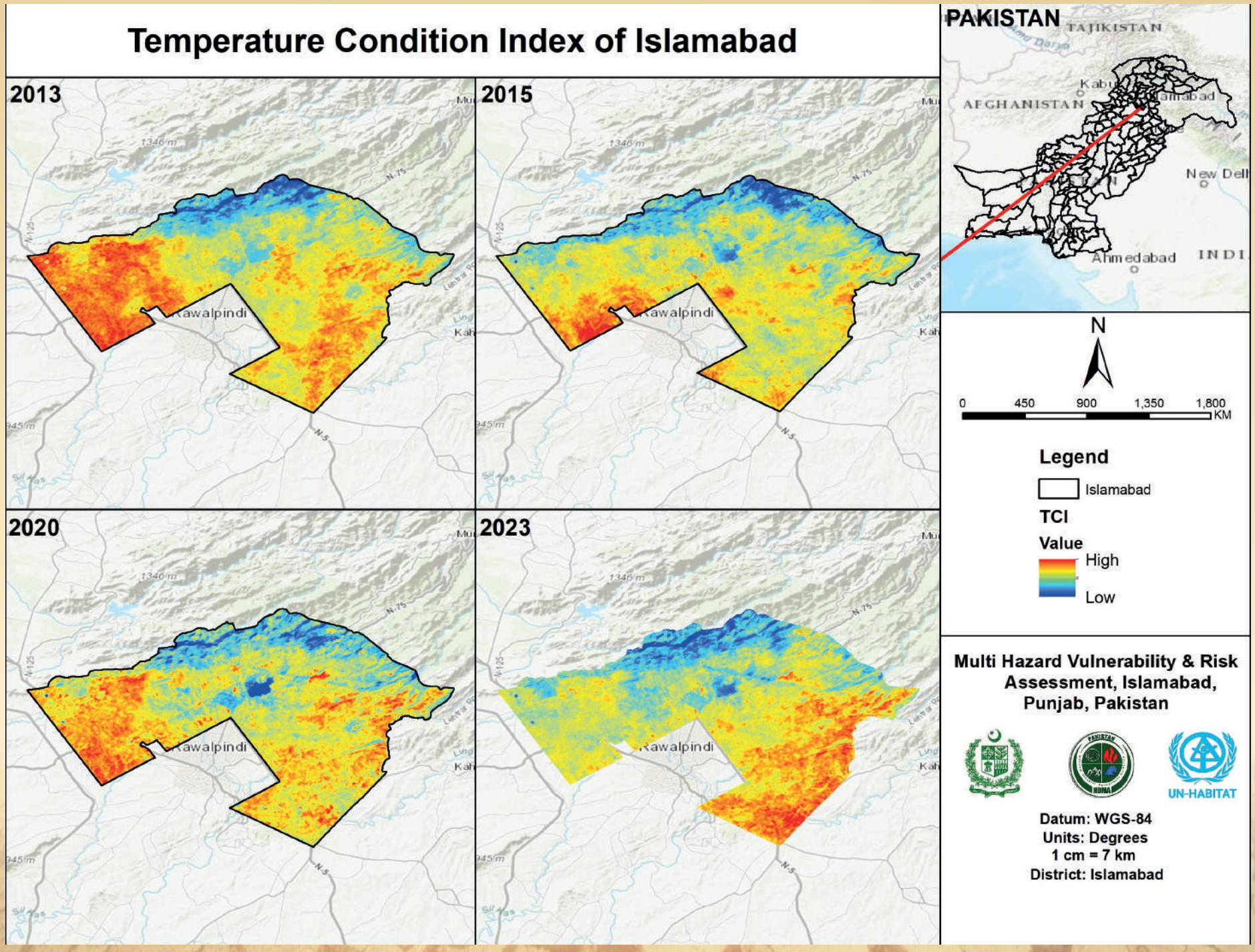
A return period is the recurrence interval of a drought. Its is a statistical measurement, particulary based on previous data. Strategic planning and management of water resources under climate change and drought conditions ofetn require the assessment of return periods of drought events catergorized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

### Standard Precipitation Index (SPI) 1981-2024

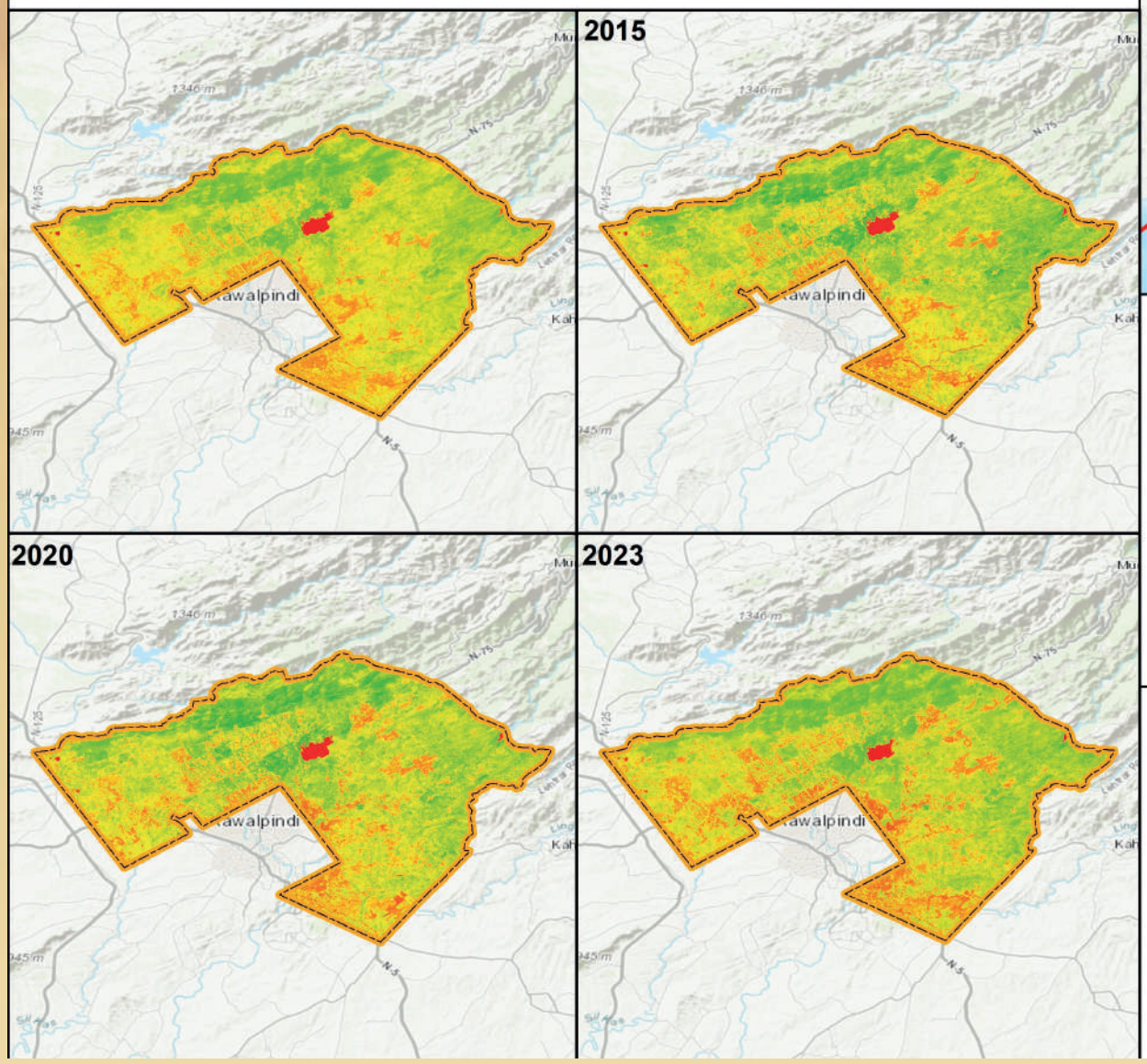



| SPI Value | Conditions |
|---|---|
| 2.0+ | Extremely Wet |
| 1.5 to 1.99 | Very Wet |
| 1.0 to 1.49 | Moderately Wet |
| -0.99 to 0.99 | Near Normal |
| -1.0 to -1.49 | Moderately Dry |
| -1.5 to -1.99 | Severely Dry |
| -2.0 and less | Extremely Dry |

**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 Islamabad





N

0 450 900 1,350 1,800 KM

**Legend**

Islamabad

**NDVI**

**Value**

High

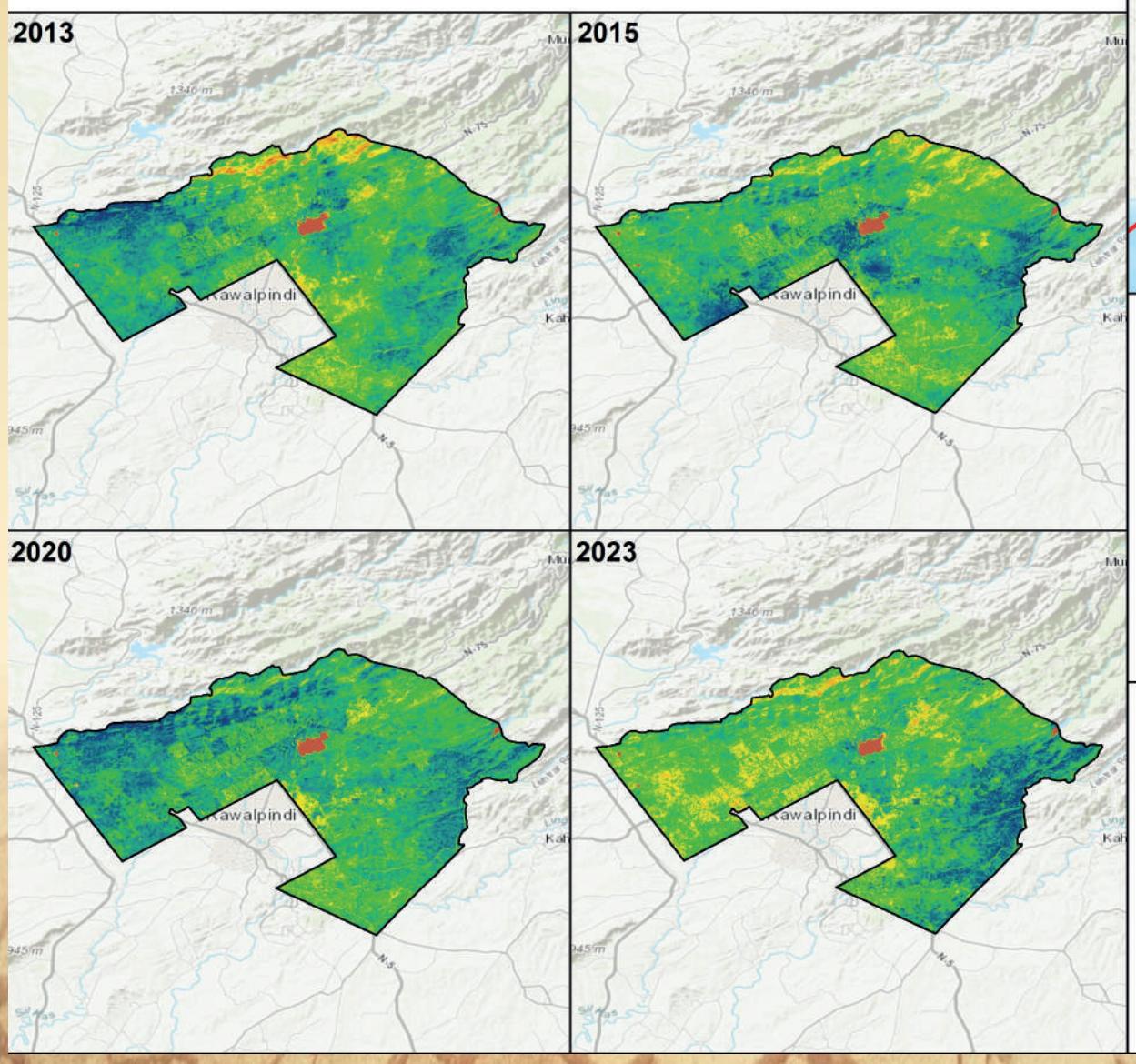
Low

**Multi Hazard Vulnerability & Risk Assessment, Islamabad, Punjab, Pakistan**

UN-HABITAT

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

## Vegetation Health Index of Islamabad





N

0 450 900 1,350 1,800 KM

**Legend**

Islamabad

**VHI**

**Value**

High

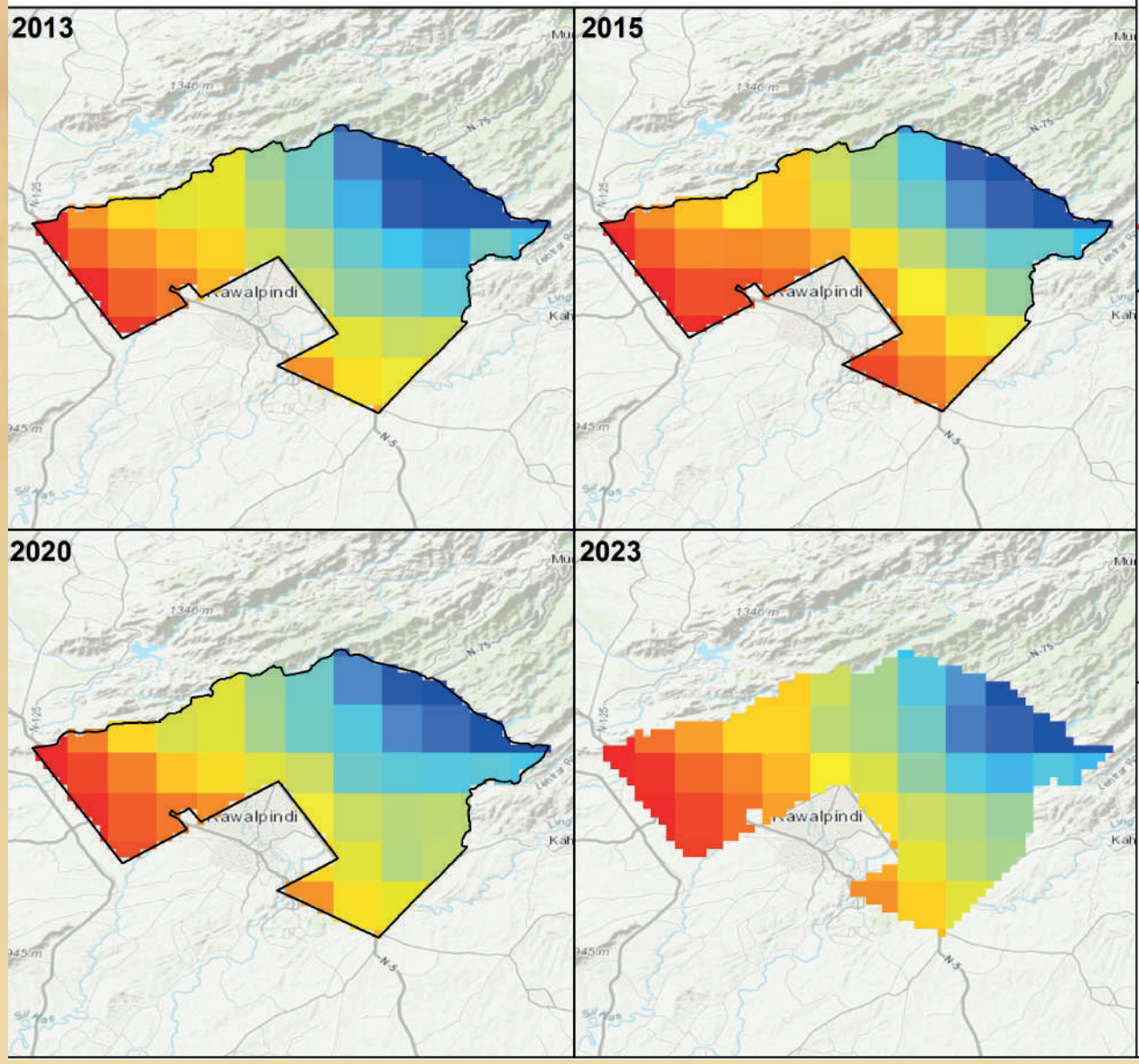
Low

**Multi Hazard Vulnerability & Risk Assessment, Islamabad, Punjab, Pakistan**

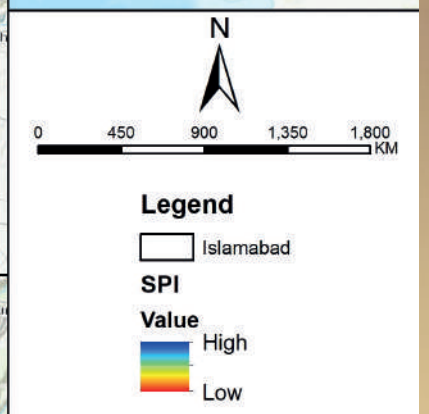
UN-HABITAT

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

## Standardized Precipitation Index of Islamabad





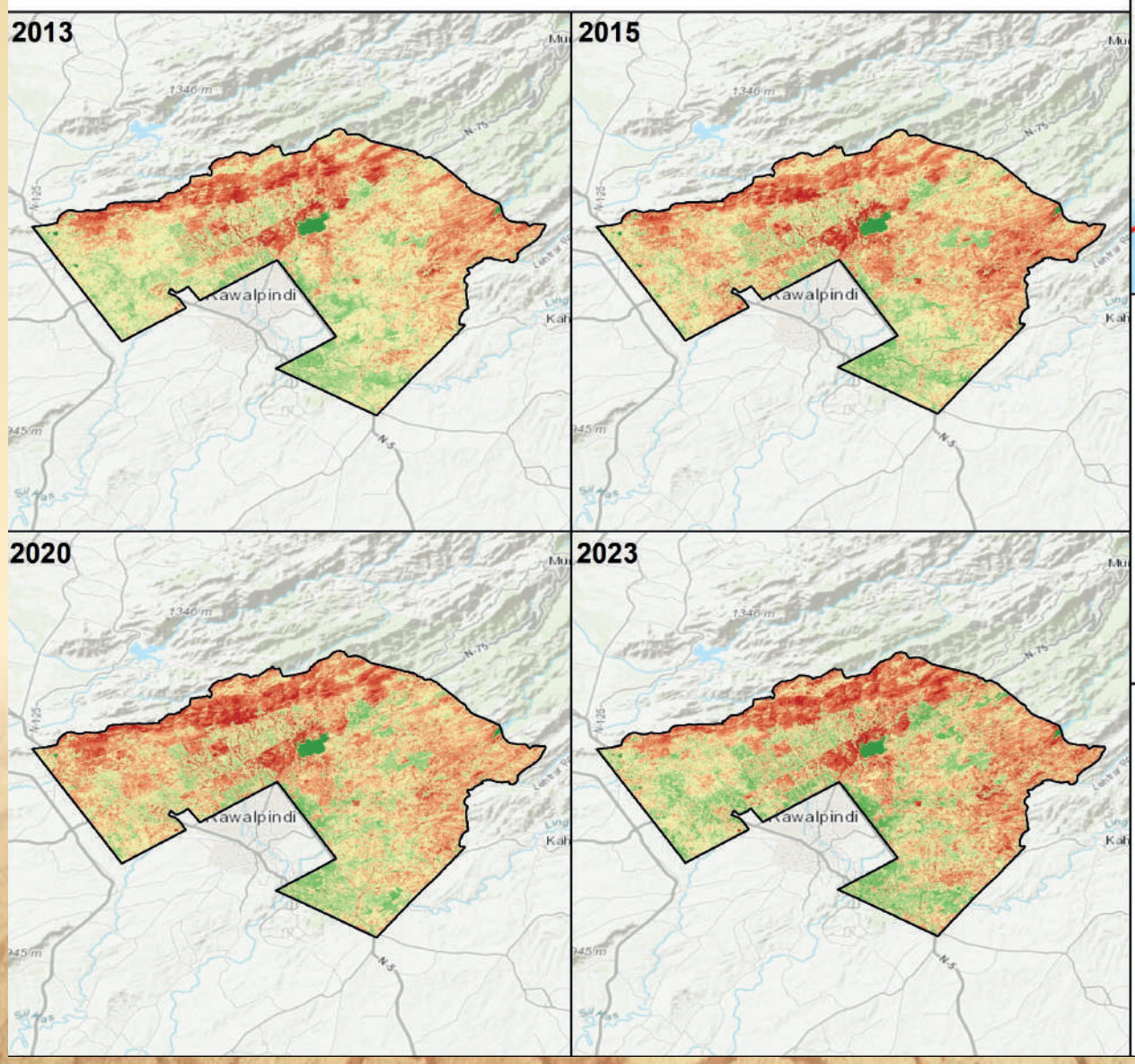



**Multi Hazard Vulnerability & Risk Assessment, Islamabad, Punjab, Pakistan**

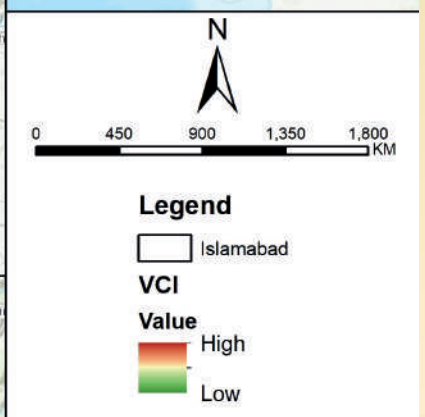
UN-HABITAT

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

## Vegetation Condition Index of Islamabad





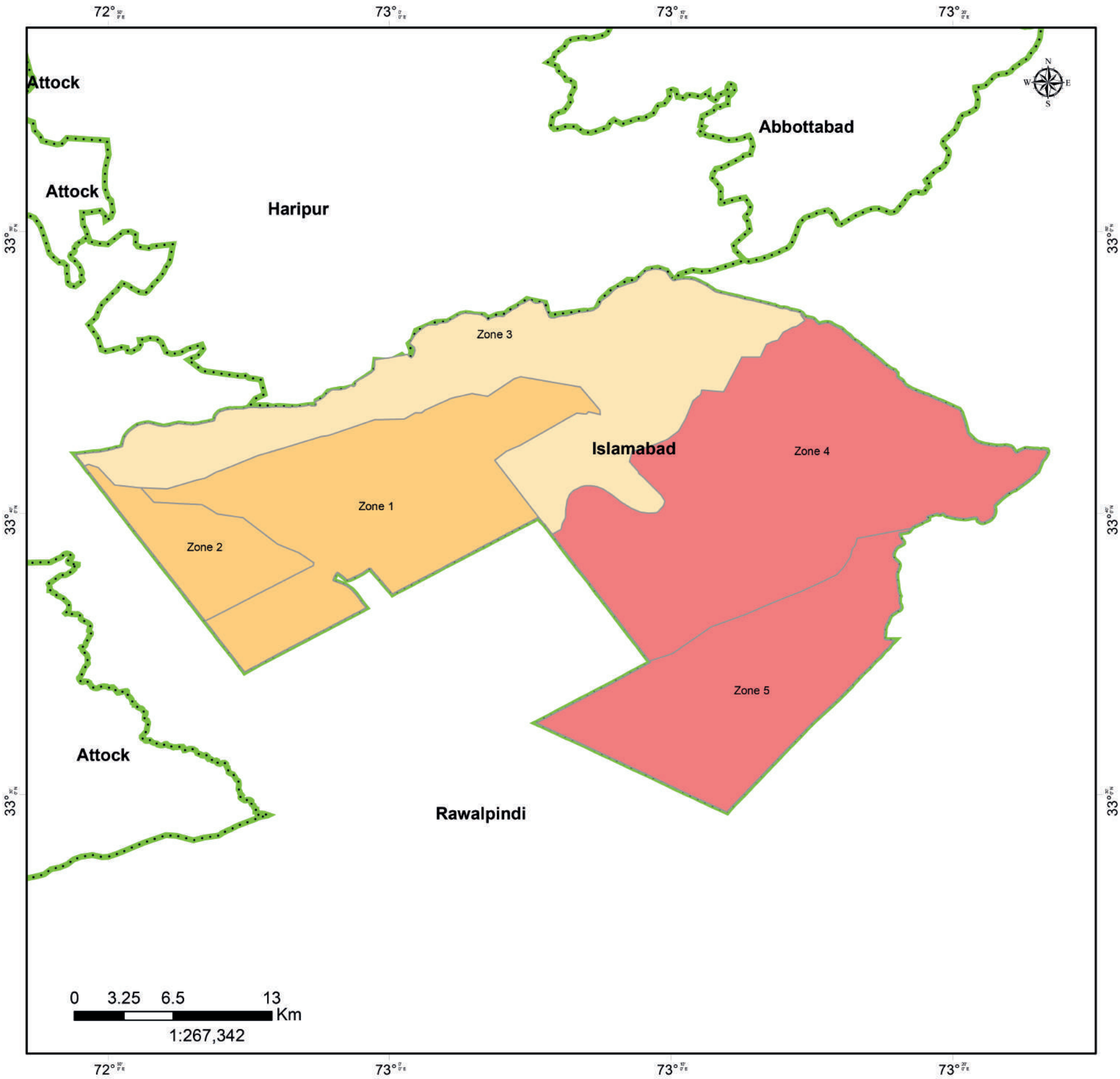



**Multi Hazard Vulnerability & Risk Assessment, Islamabad, Punjab, Pakistan**

UN-HABITAT

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

# DROUGHT PRONE UNION COUNCILS




## Legend

**Drought Hazard**

- Mild Drought
- Moderate Drought
- No Drought
- District Boundary

**Multi Hazard Vulnerability & Risk Assessment, Islamabad, Pakistan**

PAKISTAN National Disaster Management Authority NDMA

UN-HABITAT

# 21 EARTHQUAKE HAZARD ASSESSMENT

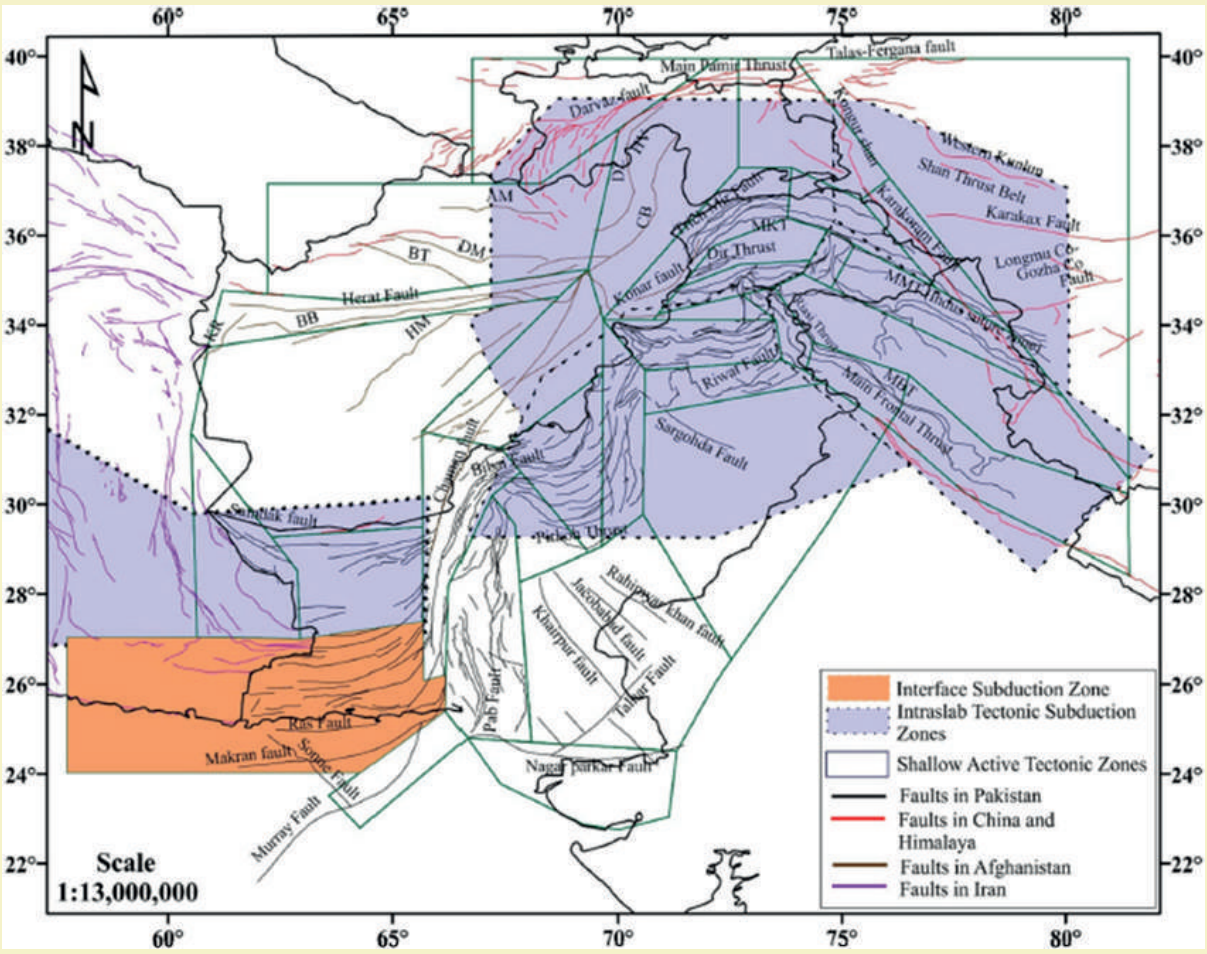
Islamabad is situated in a seismically active zone due to its proximity to the Himalayan tectonic belt, making it vulnerable to earthquakes of varying magnitudes. The region is influenced by active fault systems, including the Main Boundary Thrust and the Hazara-Kashmir Syntaxis. Historical seismic records indicate moderate to high seismicity, with past earthquake magnitudes ranging between 4.5 and 7.5 on the Richter scale. Probabilistic Seismic Hazard Analysis (PSHA) for Islamabad reveals spatial variations in ground motion intensity, with higher hazards near fault lines. The seismic hazard zoning follows Pakistan's Building Code classifications, categorizing Islamabad into different risk levels based on Peak Ground Acceleration (PGA). Seismic hazard assessments, incorporating return periods of 50, 100, and 475 years, are conducted using advanced computational models, ensuring informed risk mitigation strategies. Given its seismic risk, Islamabad requires strict enforcement of earthquake-resistant construction, soil stability analysis, and early warning mechanisms to enhance resilience against potential seismic events.

The main findings of the probabilistic seismic hazard assessment reveal that ground motion in District Rawalpindi 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.

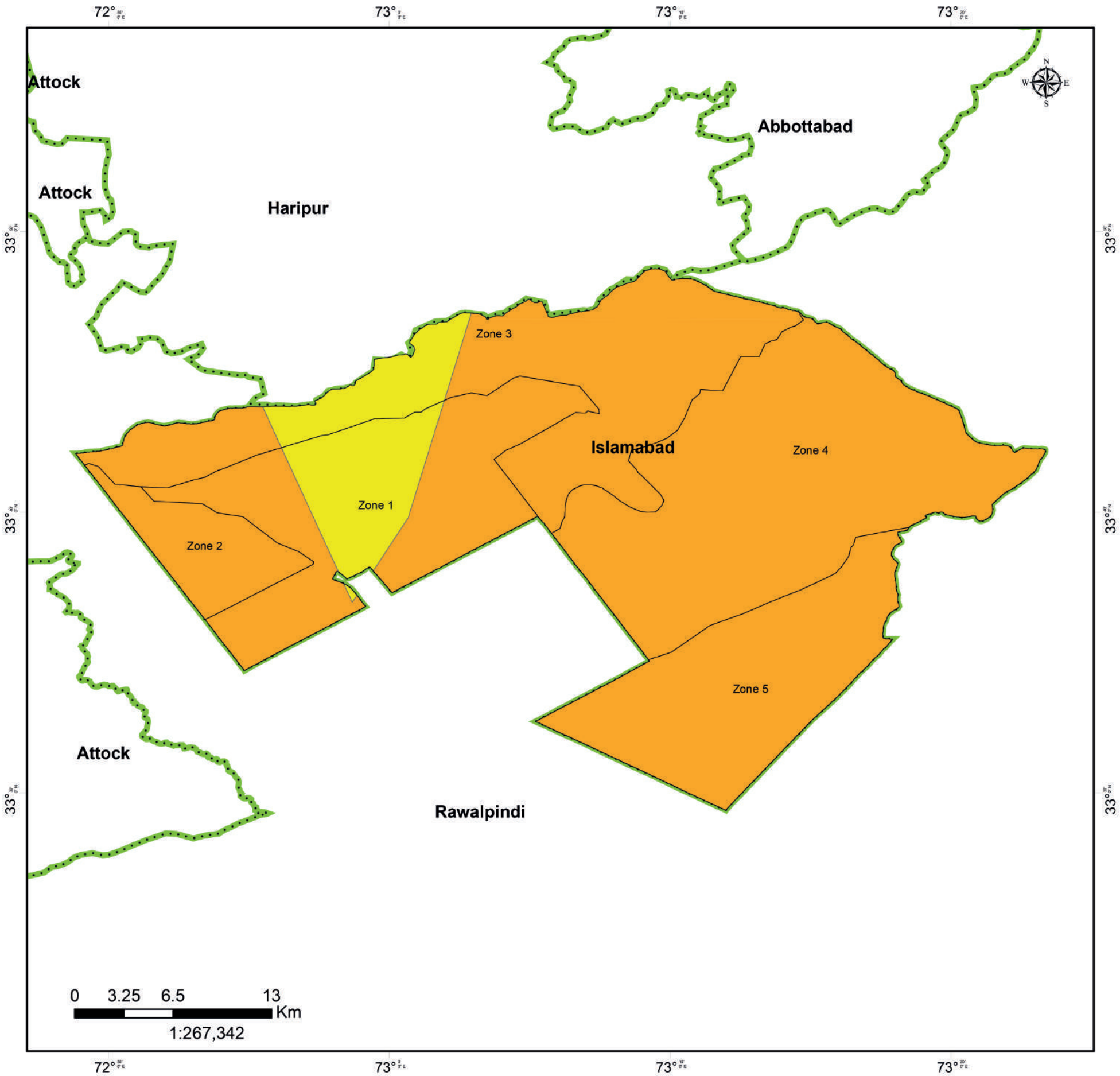
Hazard Zones Classification The seismic hazard zones are classified into five categories based on Peak Ground Acceleration (PGA):

- 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

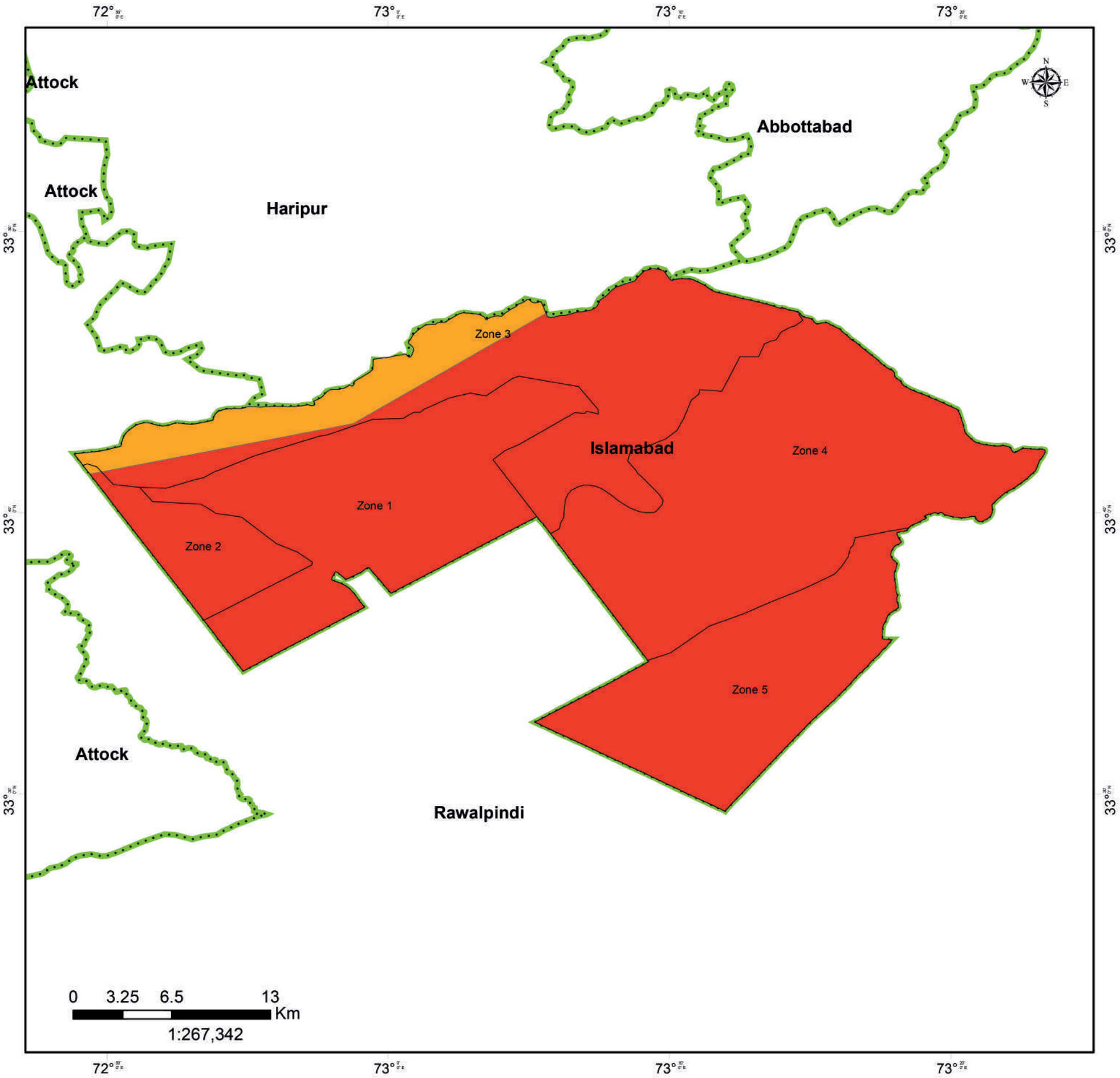
**Earthquake Hazard 50 Year Return Period**

- Medium
- High
- Islamabad Zones
- District Boundary

## Multi Hazard Vulnerability & Risk Assessment, Islamabad, Pakistan

UN-HABITAT

# EARTHQUAKE HAZARD100 YEARS RETURN PERIOD




## Legend

**Earthquake Hazard 100 Year Return Period**

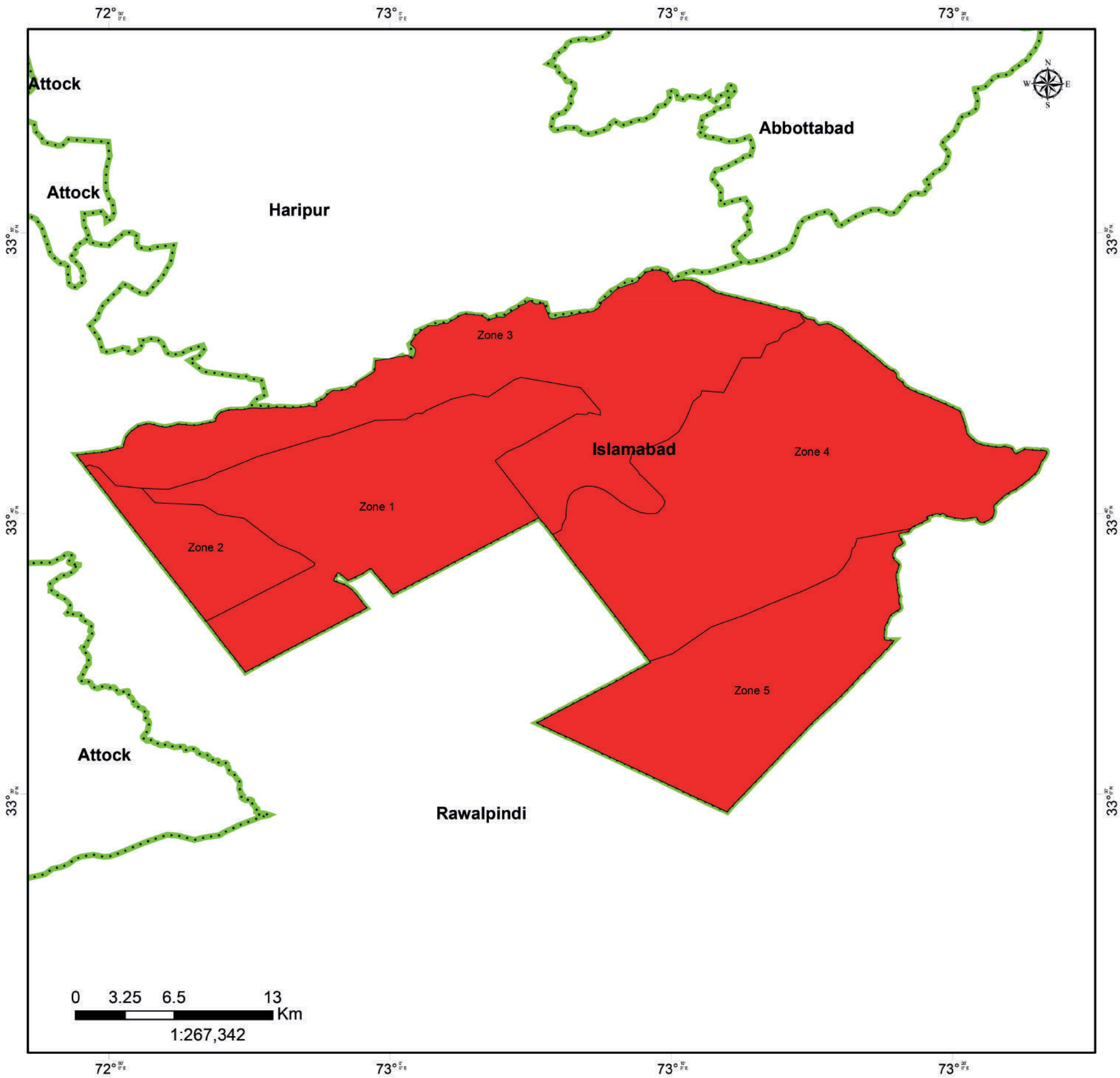
- High
- Very High
- Islamabad Zones
- District Boundary

## Multi Hazard Vulnerability & Risk Assessment, Islamabad, Pakistan

PAKISTAN National Disaster Management Authority NDMA

UN-HABITAT

# EARTHQUAKE HAZARD 475 YEARS RETURN PERIOD




## Legend

**Earthquake Hazard 475 Year Return Period**

- Very High
- Islamabad Zones
- District Boundary

## Multi Hazard Vulnerability & Risk Assessment, Islamabad, Pakistan

# 22 FLOOD HAZARD ASSESSMENT

Islamabad, the capital city of Pakistan, is susceptible to flood hazards due to its terrain, seasonal monsoon rains, and the presence of multiple water channels, including the Korang River and Soan River. The city has experienced severe flooding in the past, with major flood events recorded in 2001, 2010, and 2014, causing damage to infrastructure, residential areas, and public services. The increasing urban expansion and encroachments along water bodies exacerbate flood risks, necessitating the development of robust flood protection and mitigation strategies.

**Flood Protection Structures**

**Drains:**

- Korang River Drain
- Soan River Drain
- Simly Dam Spillway
- Rawal Lake Spillway
- Sectoral Drainage Channels

**Embankments & Flood Protection Bunds:**

- Korang River Embankment
- Soan River Flood Protection Bund
- Rawal Lake Protection Embankments
- Simly Dam Flood Containment Structures

**Assessment Methodology**

The flood hazard assessment for Islamabad employs hydrodynamic modeling using HEC-RAS and GIS-based flood mapping techniques. The methodology includes:

- Digital Elevation Model (DEM) analysis for flood-prone terrain mapping.
- Hydrological data assessment, including peak discharge levels from rainfall and river flow monitoring stations.
- GIS-based flood extent mapping to identify vulnerable areas.
- Drainage infrastructure and embankment evaluation to determine flood protection effectiveness.

**Major Flood Events & Historic Peaks**

Islamabad has recorded significant flood events over the years, with major flood peaks exceeding safety thresholds. The 2010 flood, triggered by heavy monsoon rains, resulted in major inundation across urban sectors, affecting low-lying areas such as G-6, G-7, and I-9.

## Damages & Losses (2010 Floods)

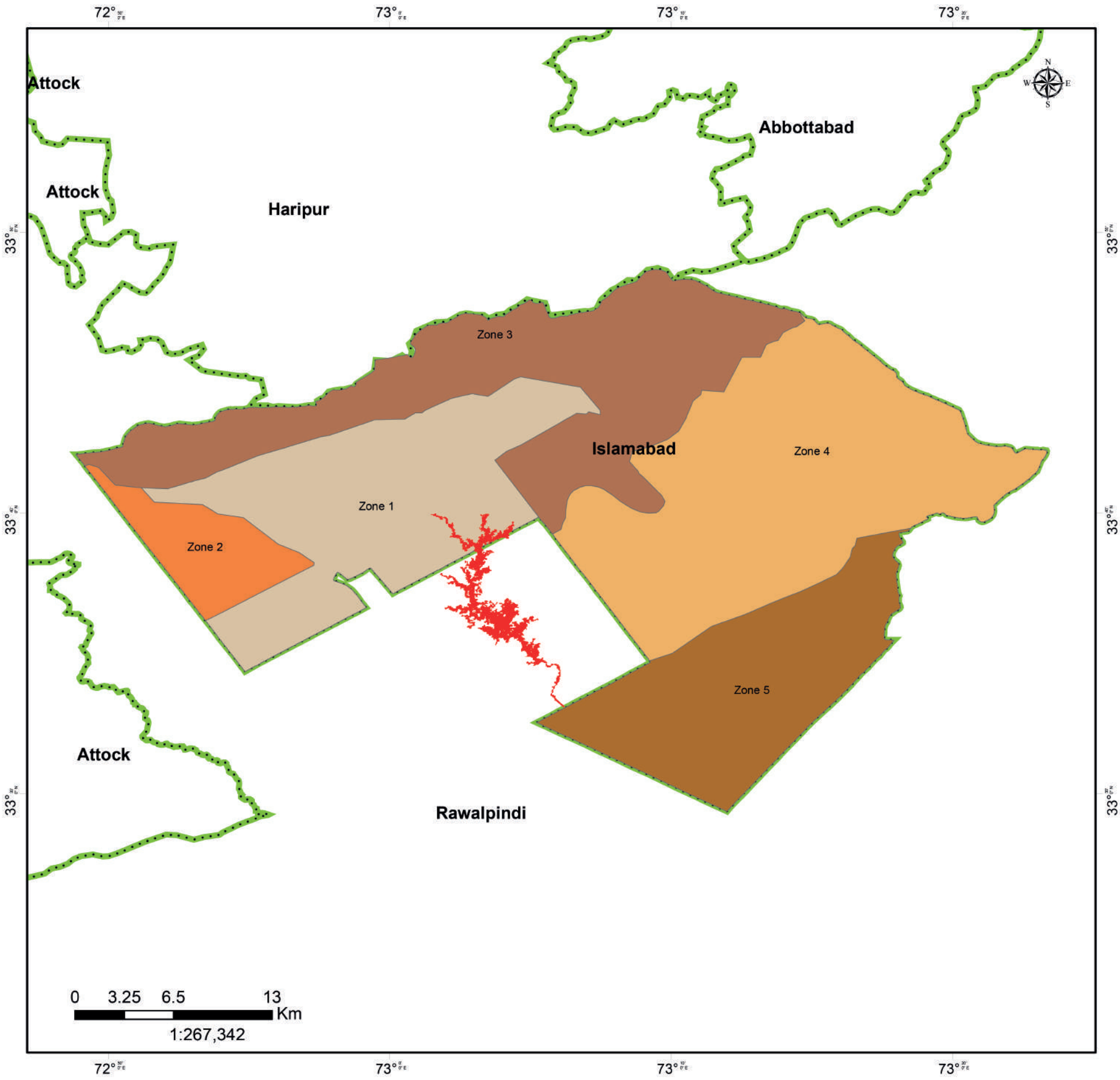
### Housing Impact by Building Type and Damage Extent

| Sectors/Areas | Kacha | Pacca | Partially Damaged | Completely Damaged | Urban | Rural | Total |
|---|---|---|---|---|---|---|---|
| G-6 | 100 | 250 | 200 | 150 | 280 | 320 | 600 |
| I-9 | 80 | 200 | 170 | 140 | 220 | 250 | 470 |
| G-7 | 90 | 230 | 190 | 160 | 240 | 270 | 510 |

### Agricultural Losses

| Union Councils | Crop Damage (Acres |
|---|---|
| Tarlai | 3,000 |
| Sihala | 4,200 |
| Kurri | 2,800 |
| **Total** | **10,500** |

# FLOOD HAZARD 10 YEARS RETURN PERIOD




## Legend

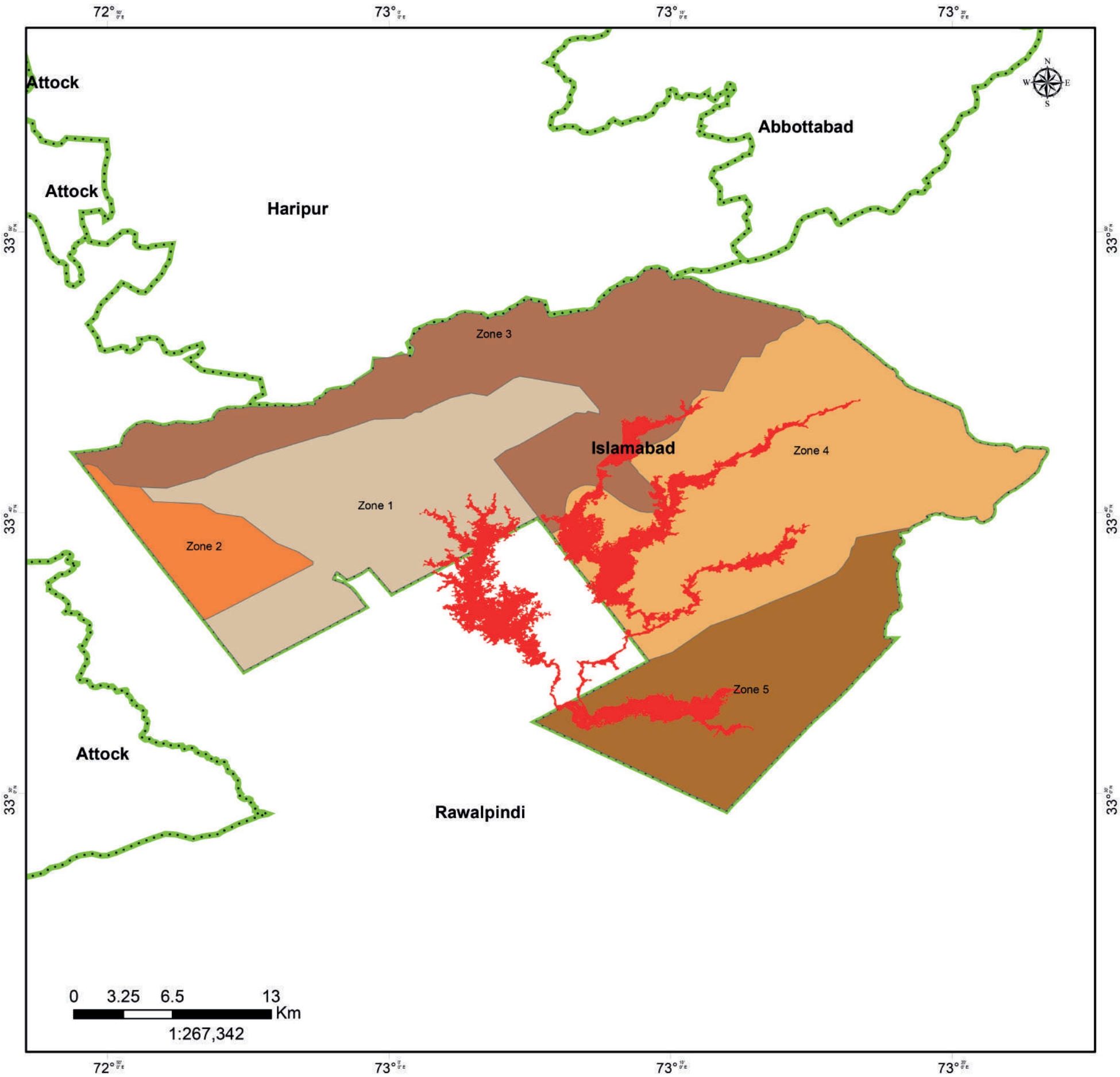
Flood Hazard 10 Year Return Period

**Zones**

- Zone 1
- Zone 2
- Zone 3
- Zone 4
- Zone 5
- District Boundary

## Multi Hazard Vulnerability & Risk Assessment, Islamabad, Pakistan

# FLOOD HAZARD 50 YEARS RETURN PERIOD




## Legend

- Flood Hazard 50 Year Return Period

**Zones**

- Zone 1
- Zone 2
- Zone 3
- Zone 4
- Zone 5
- District Boundary

**Multi Hazard Vulnerability & Risk Assessment, Islamabad, Pakistan**

PAKISTAN National Disaster Management Authority NDMA

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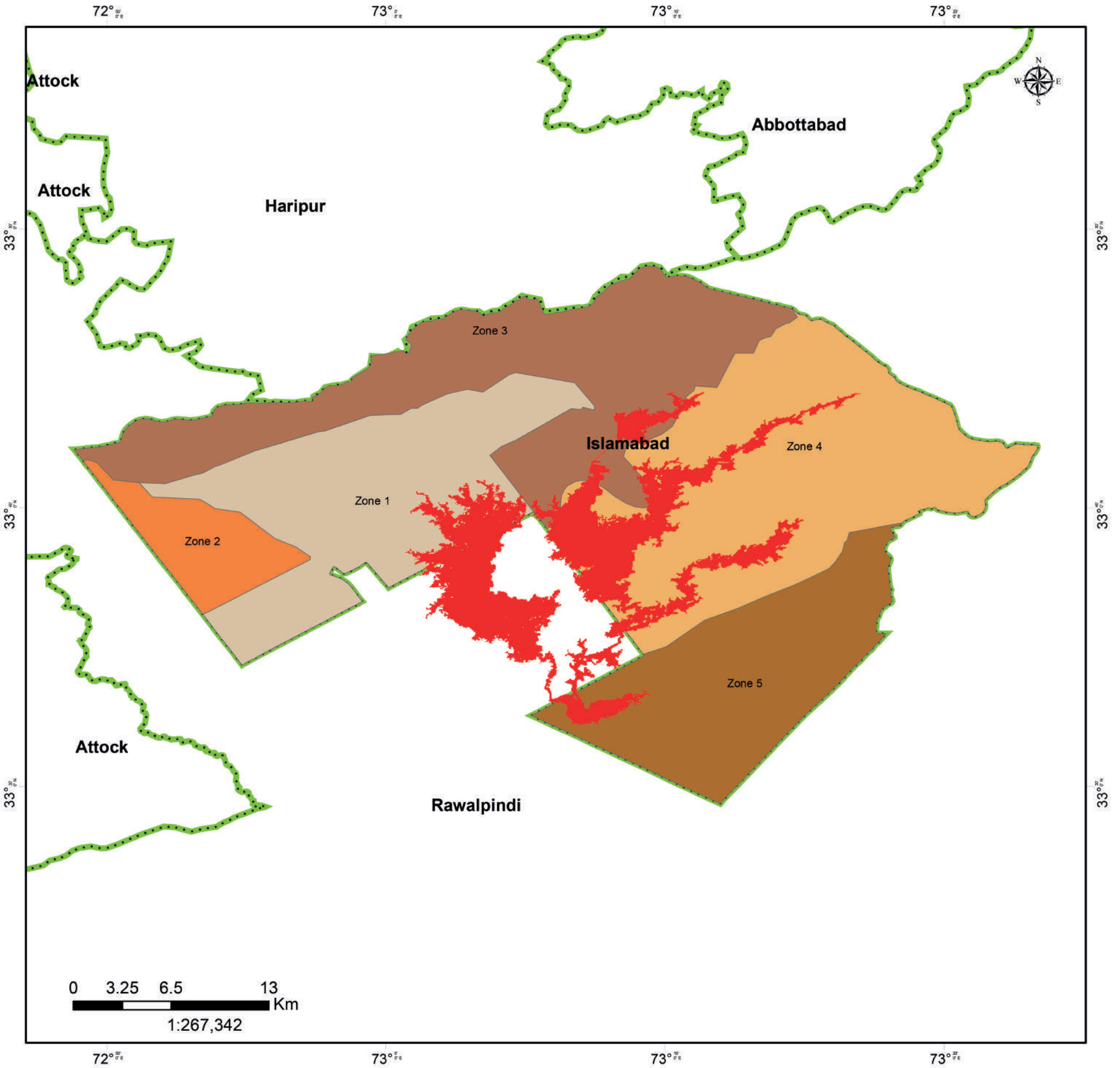
# FLOOD HAZARD 100 YEARS RETURN PERIOD




## Legend

- Flood Hazard 100 Year Return Period

**Zones**

- Zone 1
- Zone 2
- Zone 3
- Zone 4
- Zone 5
- District Boundary

## Multi Hazard Vulnerability & Risk Assessment, Islamabad, Pakistan

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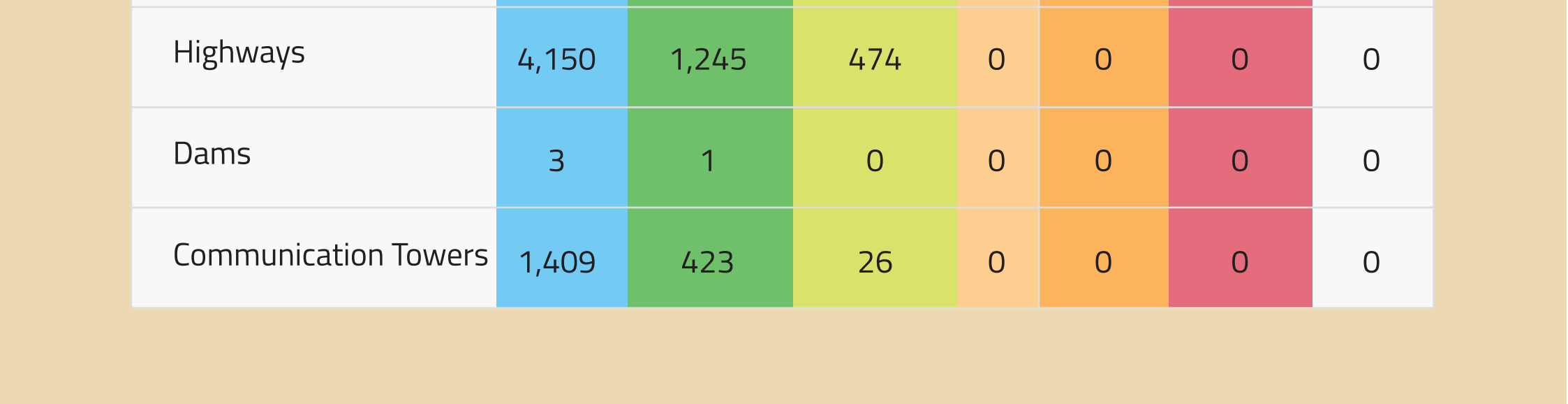
# C | EXPOSURE ASSESSMENT

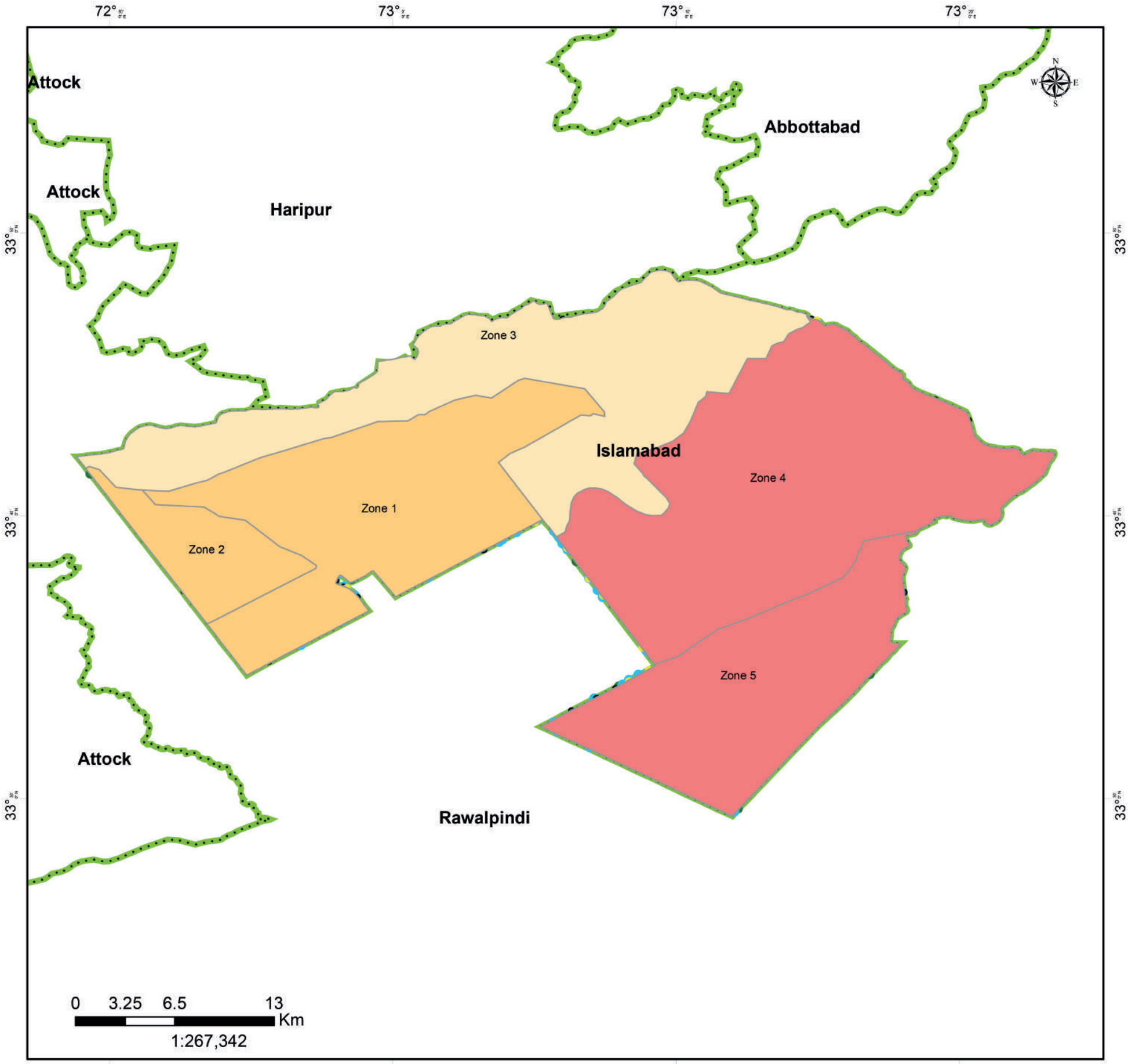
- DROUGHT
- EARTHQUAKE
- FLOOD

# 23 ELEMENTS EXPOSED TO DROUGHT HAZARD

| Elements | Exposed | Resilient (Safe) | Vulnerable | | | | |
|---|---|---|---|---|---|---|---|
| | | | Very Low | Low | Medium | High | Very High |
| Population | 2mln | 1mln | 57,920 | 0 | 0 | 0 | 0 |
| Settlements | 525 | 15 | 7 | 0 | 0 | 0 | 0 |
| Railways | 7 | 2 | 1 | 0 | 0 | 0 | 0 |
| Airports | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Schools | 332 | 100 | 2 | 0 | 0 | 0 | 0 |
| Highways | 4,150 | 1,245 | 474 | 0 | 0 | 0 | 0 |
| Dams | 3 | 1 | 0 | 0 | 0 | 0 | 0 |
| Communication Towers | 1,409 | 423 | 26 | 0 | 0 | 0 | 0 |



# COMMUNICATION TOWERS,INDUSTRIES,EDUCATION FACILITIES & SETTLEMENTS EXPOSED TO DROUGHT




**Legend**

**Drought Hazard**

- Mild Drought
- Moderate Drought
- No Drought
- Communication Towers
- Settlements
- Industries
- Education Facilities
- District Boundary

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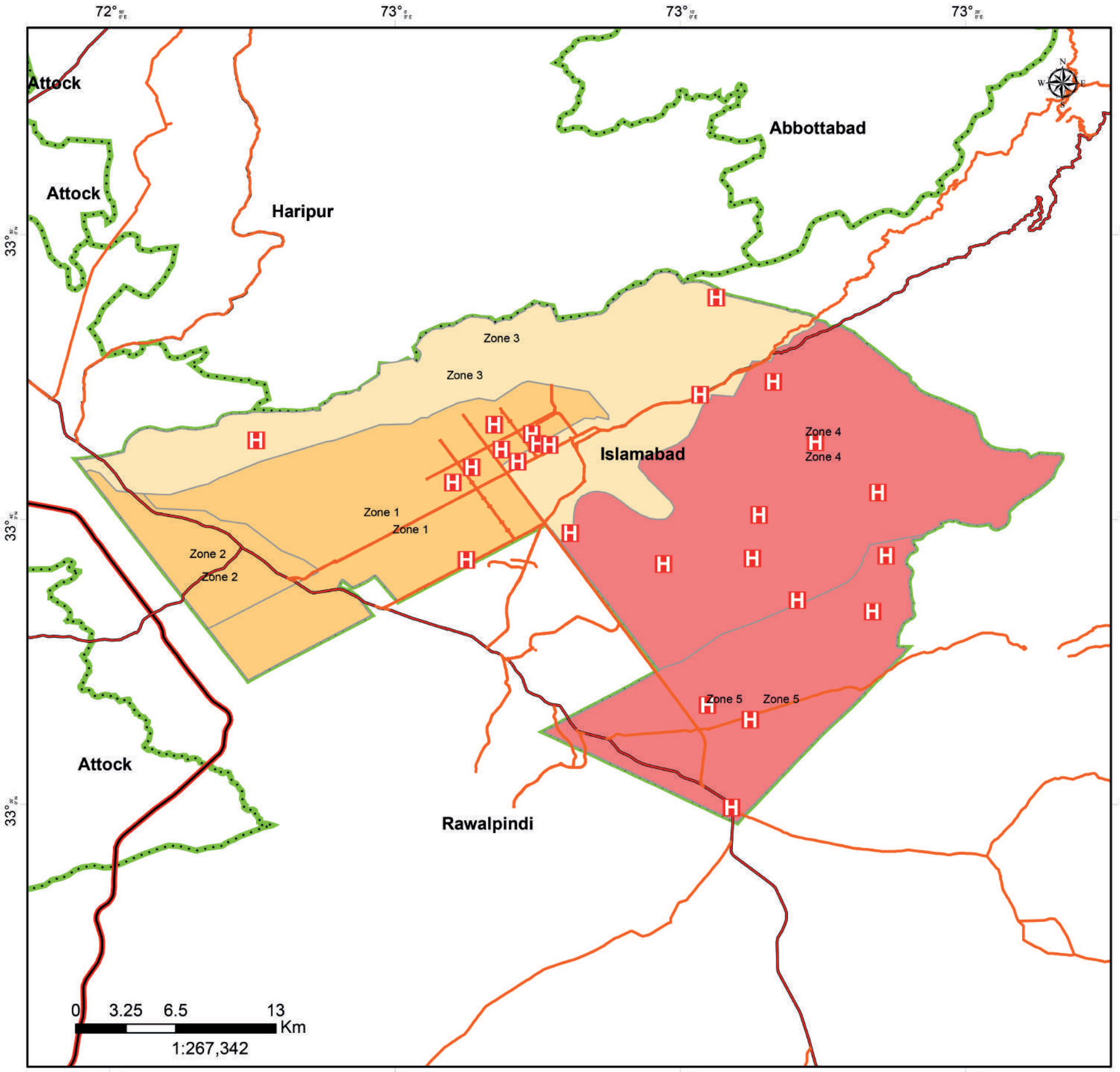
# HEALTH FACILITIES & TRANSPORTATION NETWORK EXPOSED TO DROUGHT




**Legend**

**Drought Hazard**

- Mild Drought
- Moderate Drought
- No Drought
- Health Facilities
- Major Roads
- National Highway
- Strategic Road
- Motorways
- Islamabad Zones
- District Boundary

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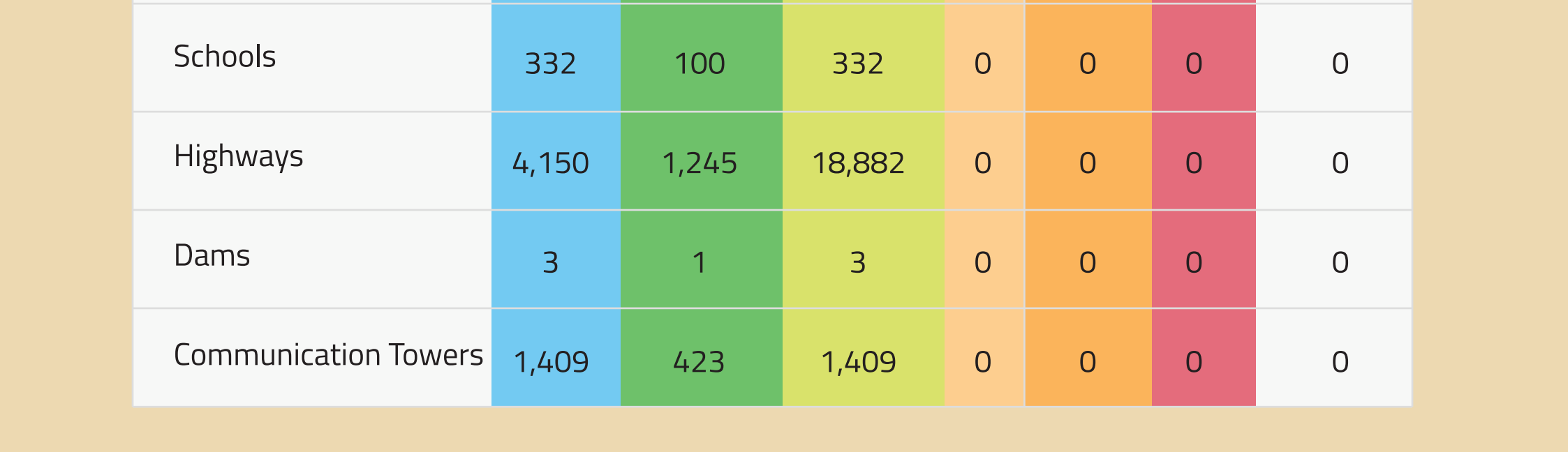
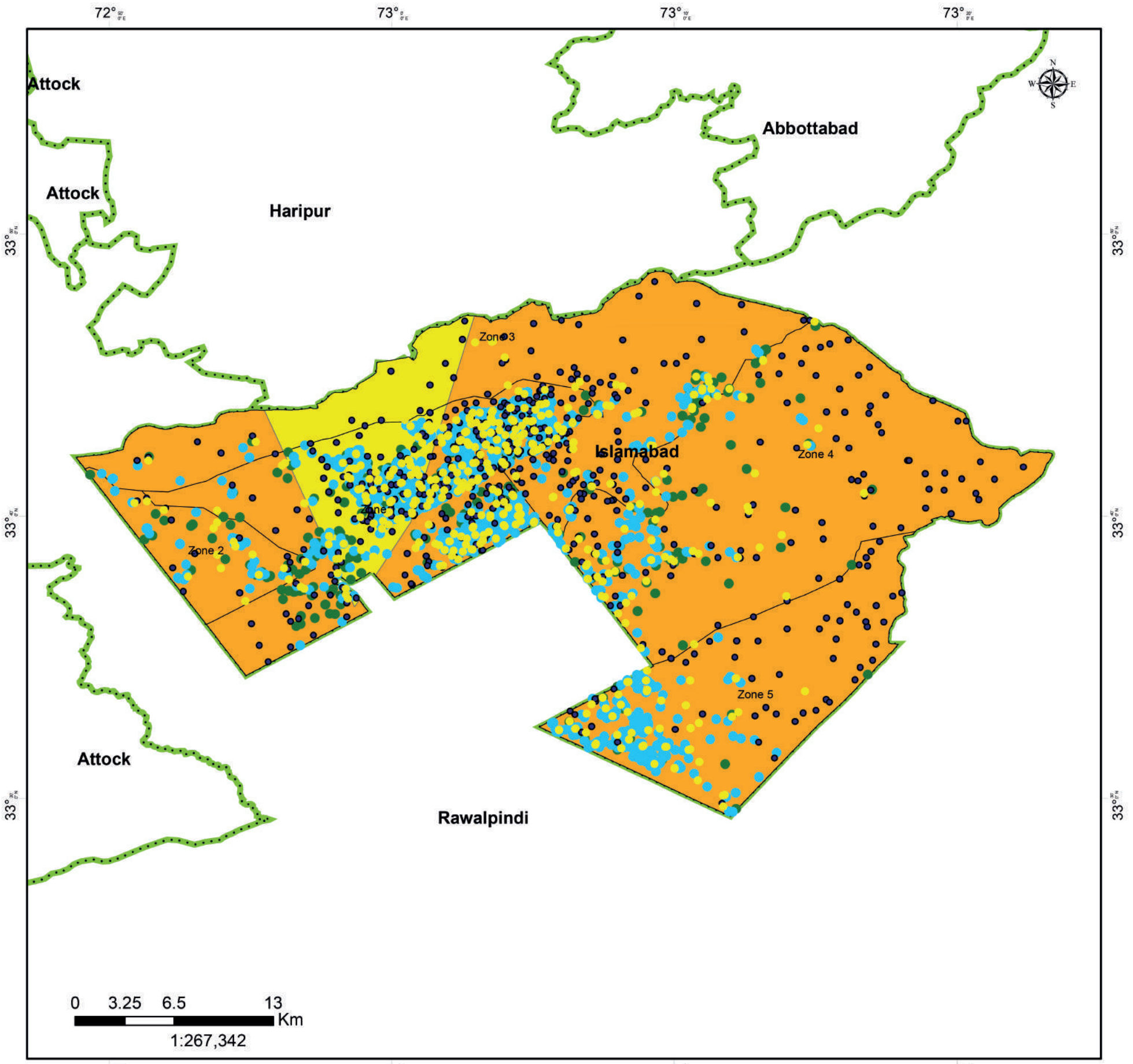
# 24 ELEMENTS EXPOSED TO EARTHQUAKE HAZARD

| Elements | Exposed | Resilient (Safe) | Vulnerable | | | | |
|---|---|---|---|---|---|---|---|
| | | | Very Low | Low | Medium | High | Very High |
| Population | 2mln | 1mln | 2,046,487 | 0 | 0 | 0 | 0 |
| Settlements | 525 | 158 | 525 | 0 | 0 | 0 | 0 |
| Railways | 7 | 2 | 7 | 0 | 0 | 0 | 0 |
| Airports | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Schools | 332 | 100 | 332 | 0 | 0 | 0 | 0 |
| Highways | 4,150 | 1,245 | 18,882 | 0 | 0 | 0 | 0 |
| Dams | 3 | 1 | 3 | 0 | 0 | 0 | 0 |
| Communication Towers | 1,409 | 423 | 1,409 | 0 | 0 | 0 | 0 |



# COMMUNICATION TOWERS,INDUSTRIES,EDUCATION FACILITIES & SETTLEMENTS EXPOSED TO EARTHQUAKE 50 YEARS RETURN PERIOD




## Legend

**Earthquake Hazard 50 Year Return Period**

- Medium
- High
- Communication Towers
- Industries
- Education Facilities
- Settlements
- Islamabad Zones
- District Boundary

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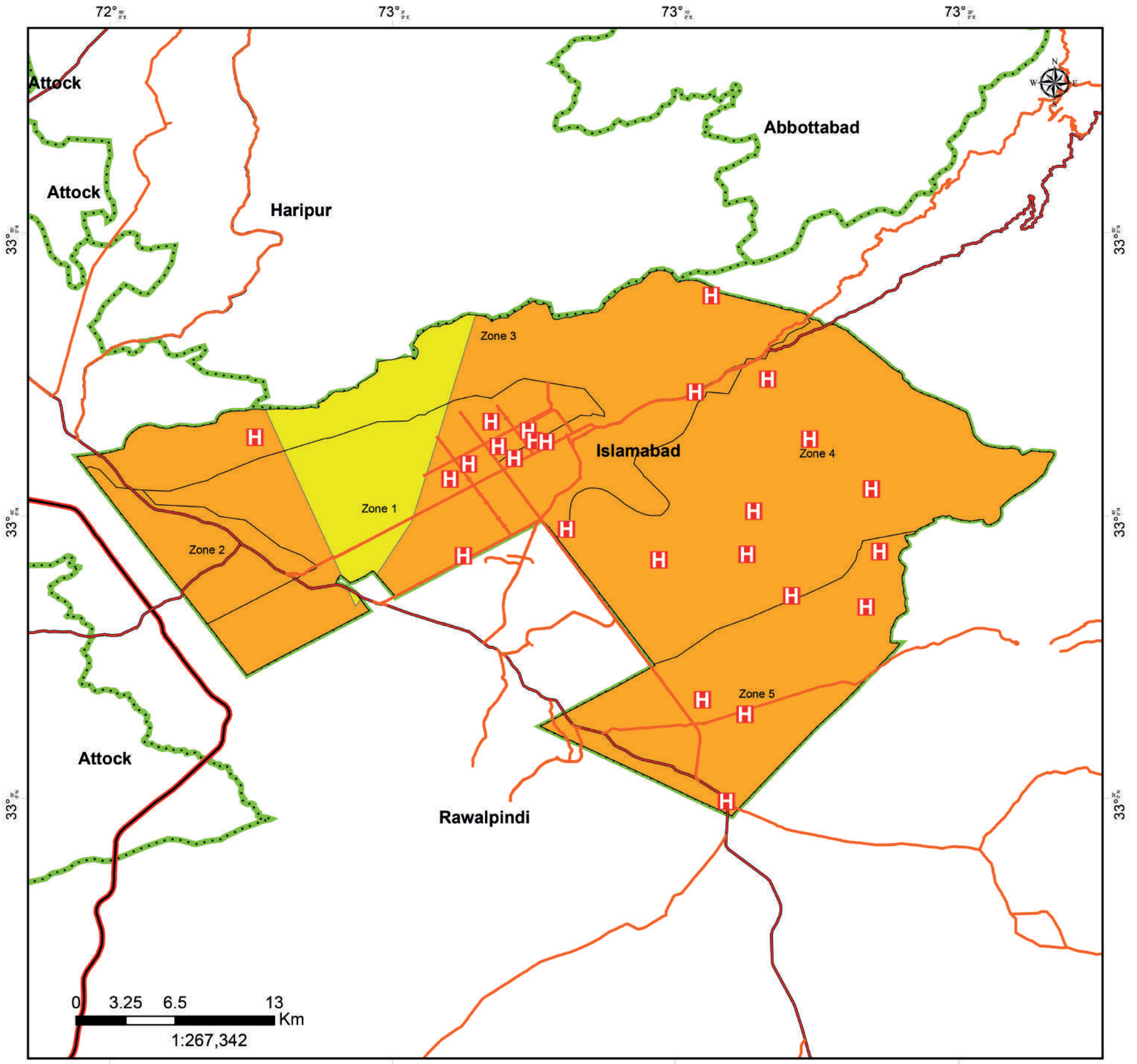
# HEALTH FACILITIES & TRANSPORTATION NETWORK EXPOSED TO EARTHQUAKE 50 YEARS RETURN PERIOD



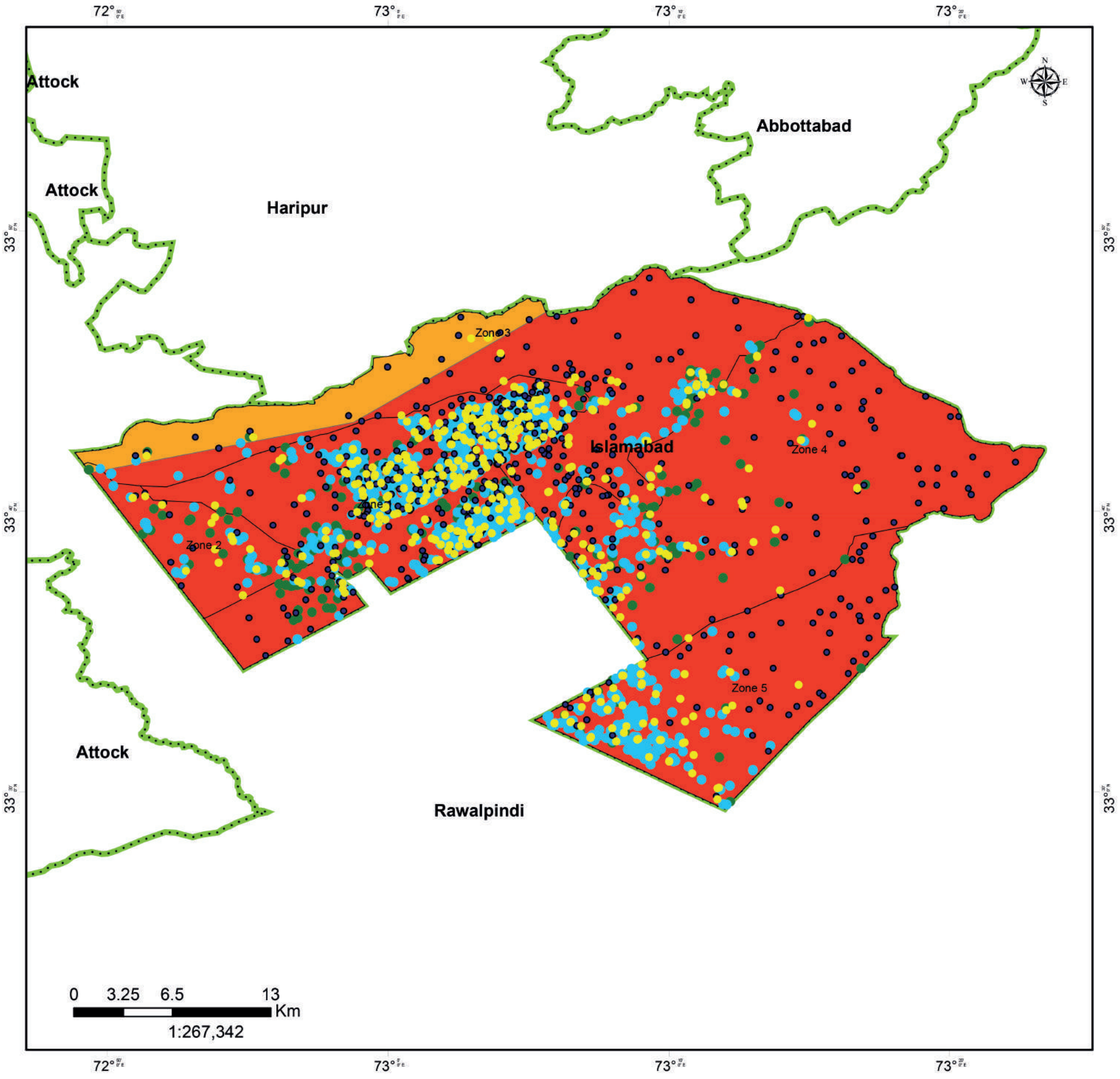

**Legend**

**Earthquake Hazard 50 Year Return Period**

- Medium
- High
- Health Facilities
- Major Roads
- National Highway
- Strategic Road
- Motorways
- Islamabad Zones
- District Boundary

**Multi Hazard Vulnerability & Risk Assessment, Islamabad, Pakistan**

# COMMUNICATION TOWERS,INDUSTRIES,EDUCATION FACILITIES & SETTLEMENTS EXPOSED TO EARTHQUAKE 100 YEARS RETURN PERIOD




## Legend

**Earthquake Hazard 100 Year Return Period**

- High
- Very High
- Communication Towers
- Industries
- Education Facilities
- Settlements
- Islamabad Zones
- District Boundary

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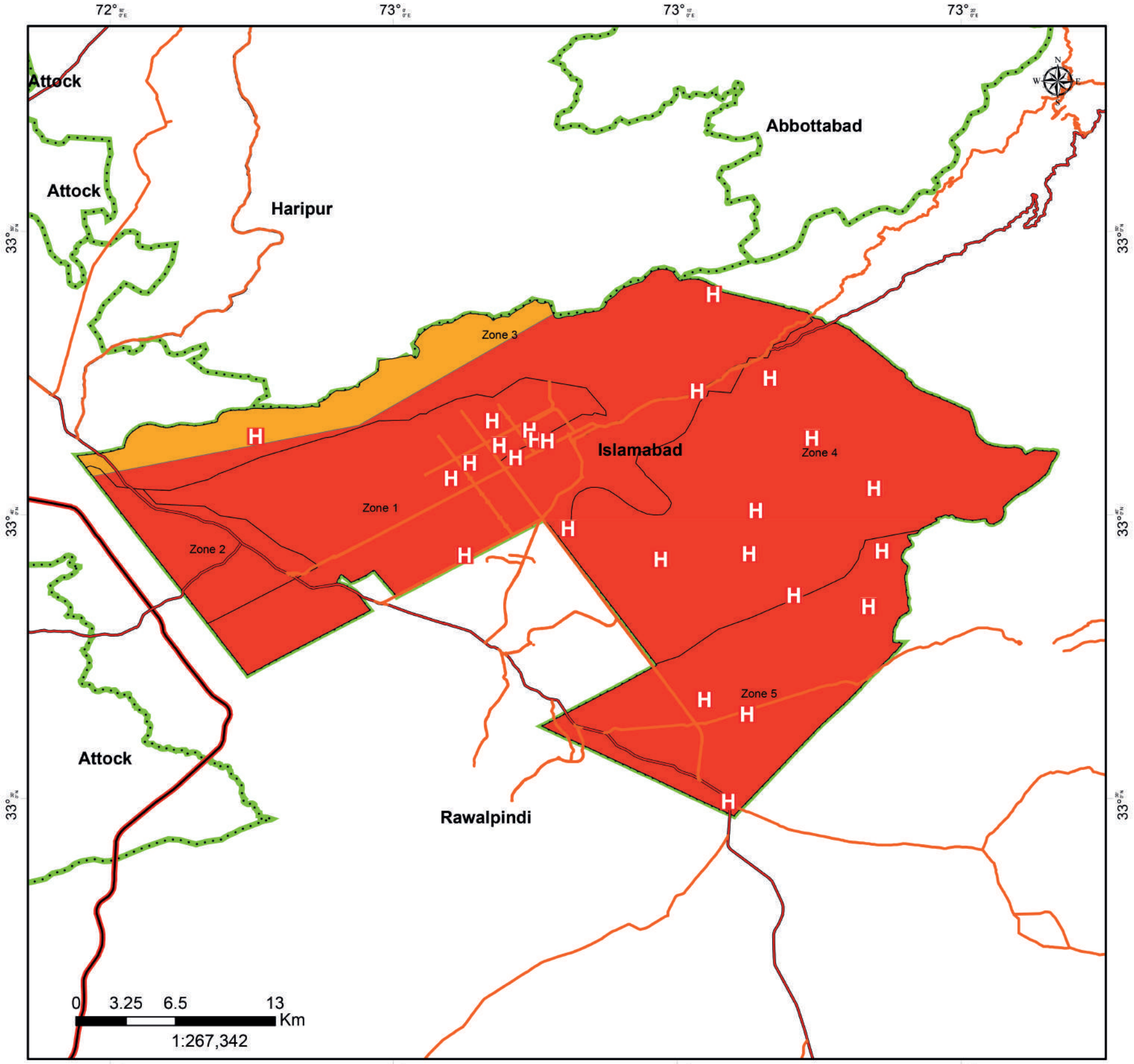
# HEALTH FACILITIES & TRANSPORTATION NETWORK EXPOSED TO EARTHQUAKE 100 YEARS RETURN PERIOD




## Legend

**Earthquake Hazard 100 Year Return Period**

- High
- Very High
- Health Facilities
- Major Roads
- National Highway
- Strategic Road
- Motorways
- Islamabad Zones
- District Boundary

## Multi Hazard Vulnerability & Risk Assessment, Islamabad, Pakistan

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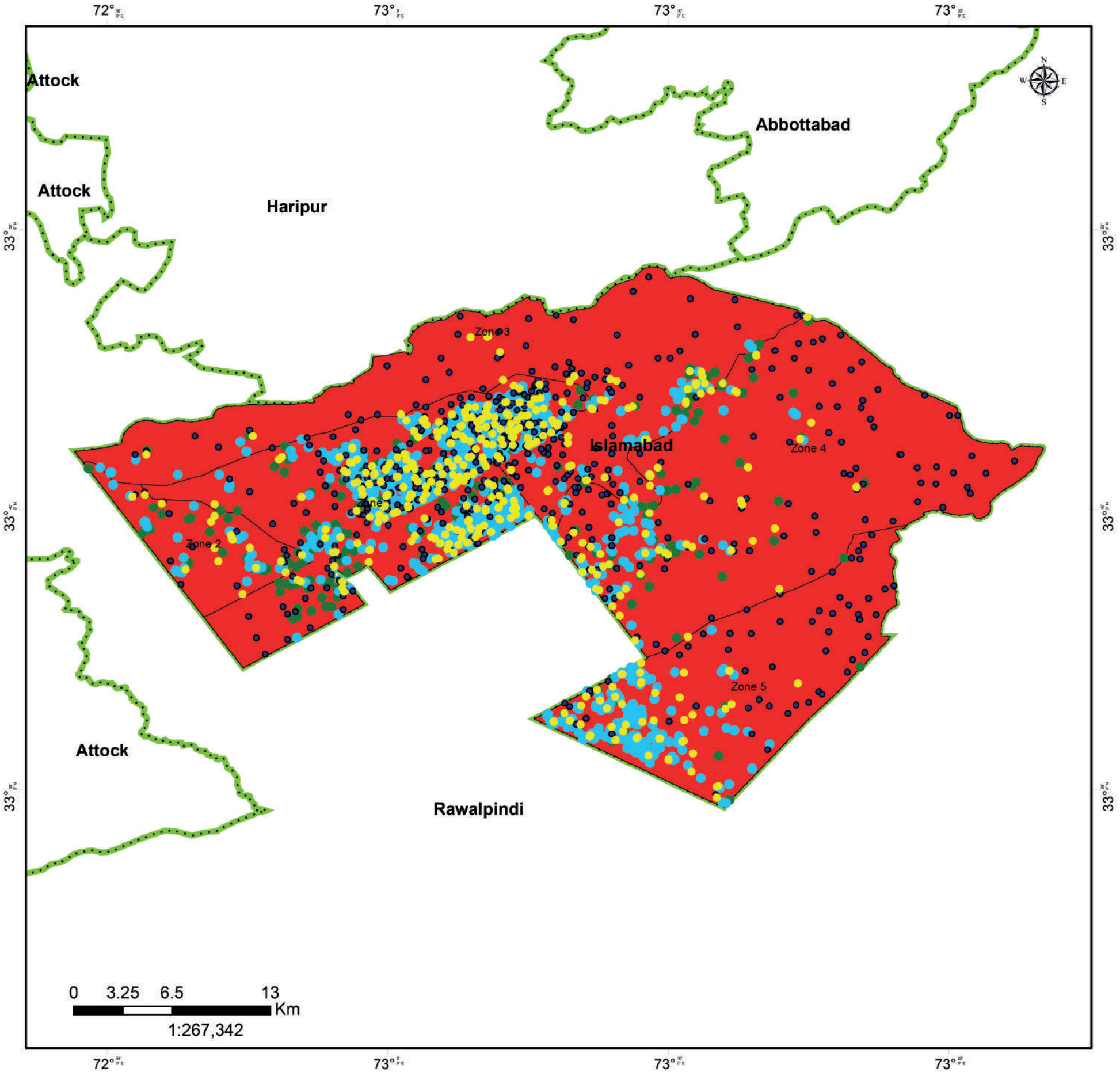
# COMMUNICATION TOWERS,INDUSTRIES,EDUCATION FACILITIES & SETTLEMENTS EXPOSED TO EARTHQUAKE 475 YEARS RETURN PERIOD




## Legend

**Earthquake Hazard 475 Year Return Period**

- Very High
- Communication Towers
- Industries
- Education Facilities
- Settlements
- Islamabad Zones
- District Boundary

**Multi Hazard Vulnerability & Risk Assessment, Islamabad, Pakistan**

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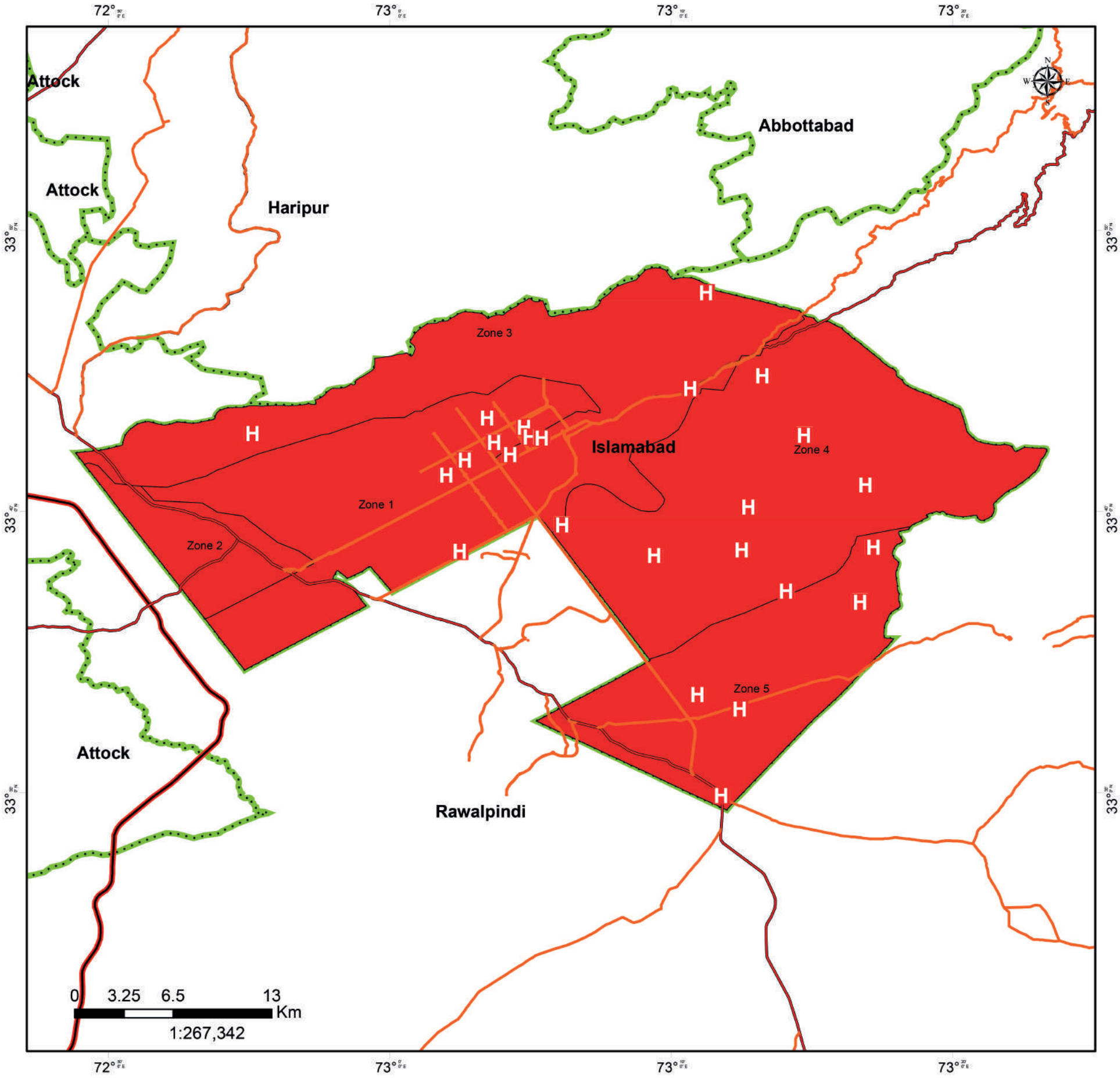
# HEALTH FACILITIES & TRANSPORTATION NETWORK EXPOSED TO EARTHQUAKE 475 YEARS RETURN PERIOD




## Legend

**Earthquake Hazard 475 Year Return Period**

- Very High
- Health Facilities
- Major Roads
- National Highway
- Strategic Road
- Motorways
- Islamabad Zones
- District Boundary

## Multi Hazard Vulnerability & Risk Assessment, Islamabad, Pakistan

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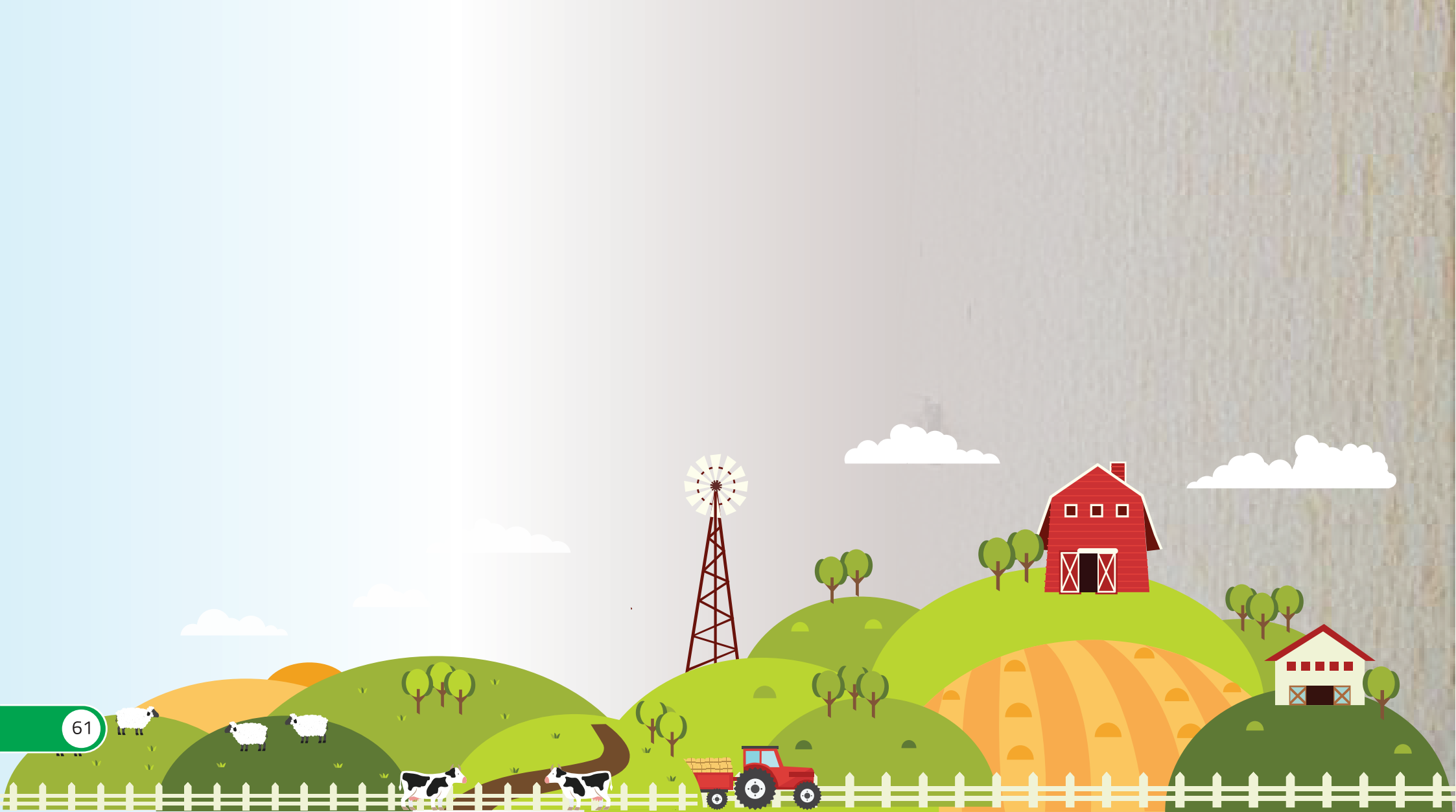
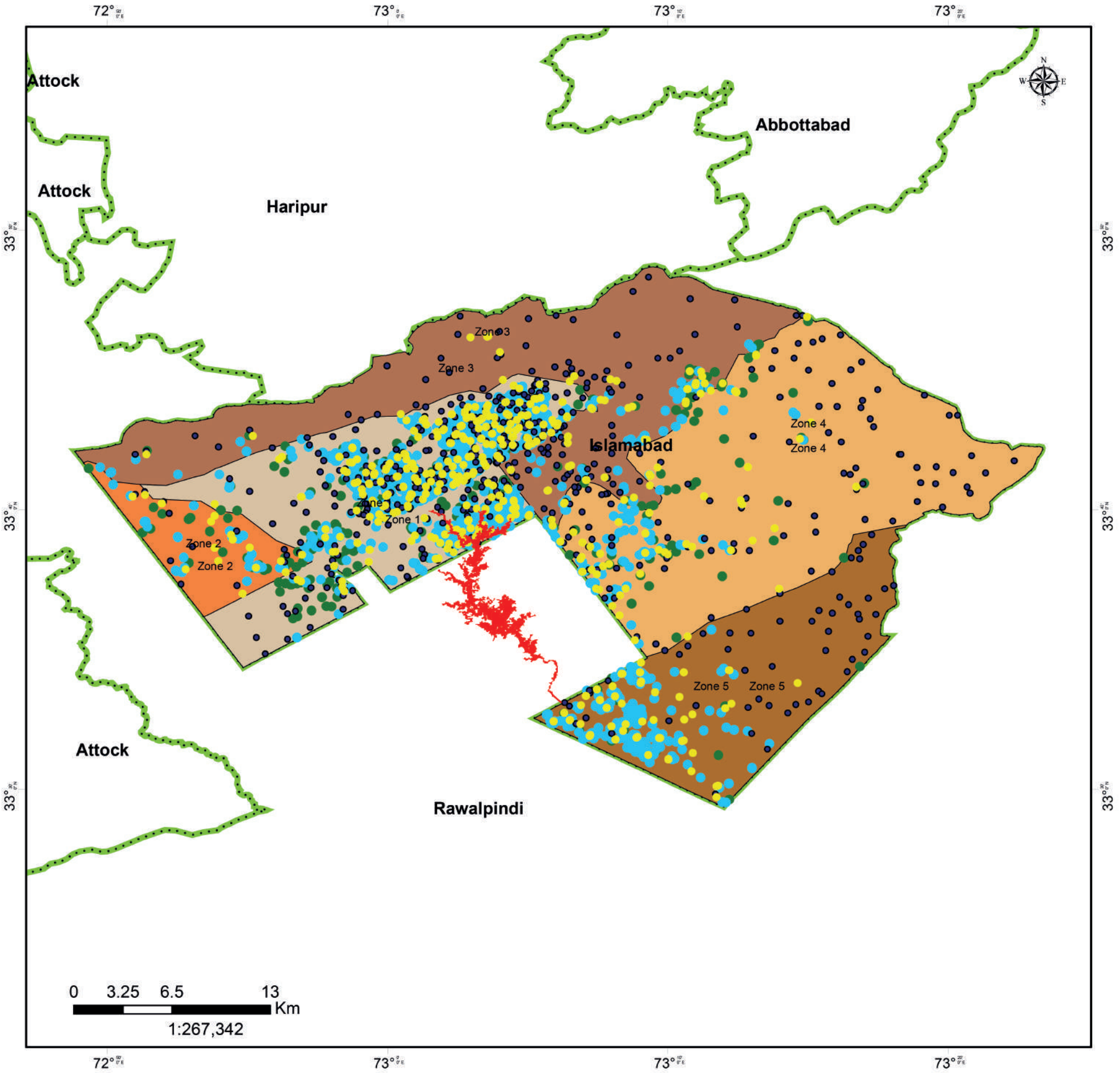
# 25 ELEMENTS EXPOSED TO FLOOD HAZARD

| Elements | Exposed | Resilient (Safe) | Vulnerable | | | | Risk |
|---|---|---|---|---|---|---|---|
| | | | Very Low | Low | Medium | High | |
| Population | 2mln | 1mln | 2,043,309 | 3,179 | 0 | 0 | 0 |
| Settlements | 525 | 158 | 523 | 2 | 0 | 0 | 0 |
| Railways | 7 | 2 | 7 | 0 | 0 | 0 | 0 |
| Airports | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Schools | 332 | 100 | 332 | 0 | 0 | 0 | 0 |
| Highways | 4,150 | 1,245 | 18,880 | 2 | 0 | 0 | 0 |
| Dams | 3 | 1 | 3 | 0 | 0 | 0 | 0 |
| Communication Towers | 1,409 | 423 | 1,408 | 1 | 0 | 0 | 0 |



# COMMUNICATION TOWERS,INDUSTRIES,EDUCATION FACILITIES & SETTLEMENTS EXPOSED TO FLOOD 10 YEARS RETURN PERIOD




**Legend**

- Flood Hazard 10 Year Return Period
- Communication Towers
- Settlements
- Industries
- Education Facilities

**Zones**

- Zone 1
- Zone 2
- Zone 3
- Zone 4
- Zone 5
- District Boundary

**Multi Hazard Vulnerability & Risk Assessment, Islamabad, Pakistan**

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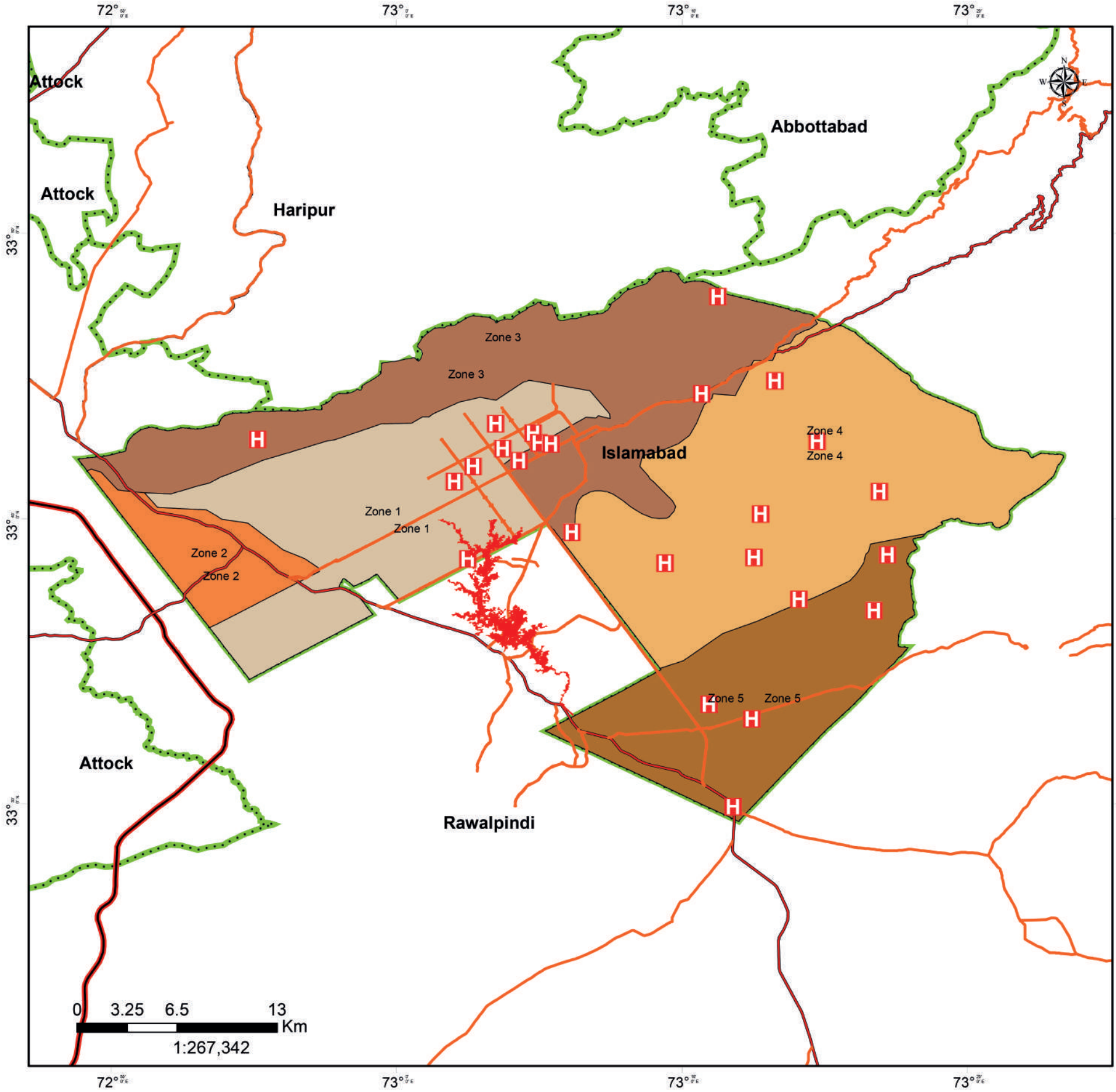
# HEALTH FACILITIES & TRANSPORTATION NETWORK EXPOSED TO FLOOD 10 YEARS RETURN PERIOD




## Legend

- Flood Hazard 10 Year Return Period
- Health Facilities
- Major Roads
- National Highway
- Strategic Road
- Motorways
- Islamabad Zones

**Zones**

- Zone 1
- Zone 2
- Zone 3
- Zone 4
- Zone 5
- District Boundary

**Multi Hazard Vulnerability & Risk Assessment, Islamabad, Pakistan**

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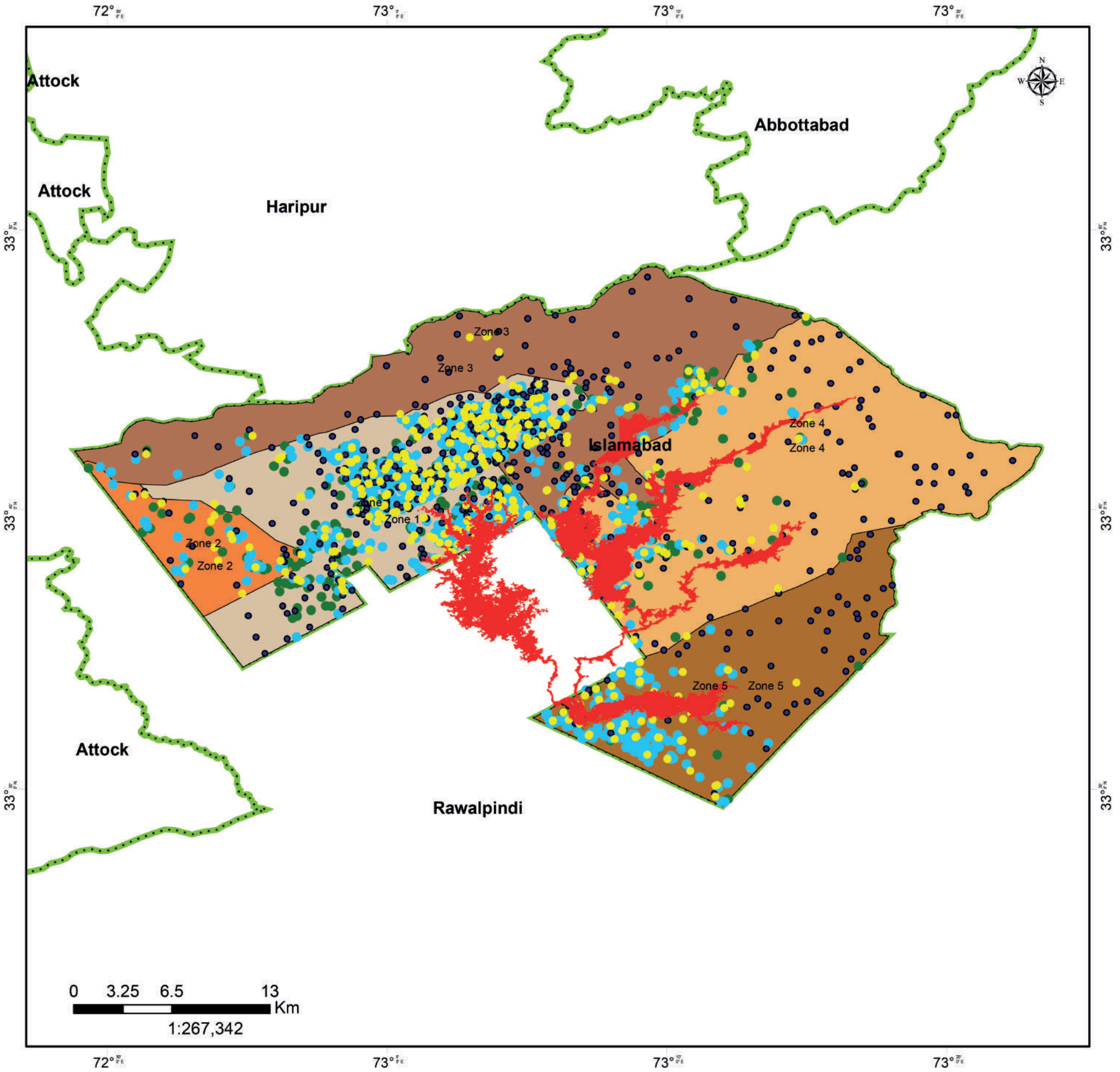
# COMMUNICATION TOWERS,INDUSTRIES,EDUCATION FACILITIES & SETTLEMENTS EXPOSED TO FLOOD 50 YEARS RETURN PERIOD




**Legend**

- Flood Hazard 50 Year Return Period
- Communication Towers
- Settlements
- Industries
- Education Facilities

**Zones**

- Zone 1
- Zone 2
- Zone 3
- Zone 4
- Zone 5
- District Boundary

**Multi Hazard Vulnerability & Risk Assessment, Islamabad, Pakistan**

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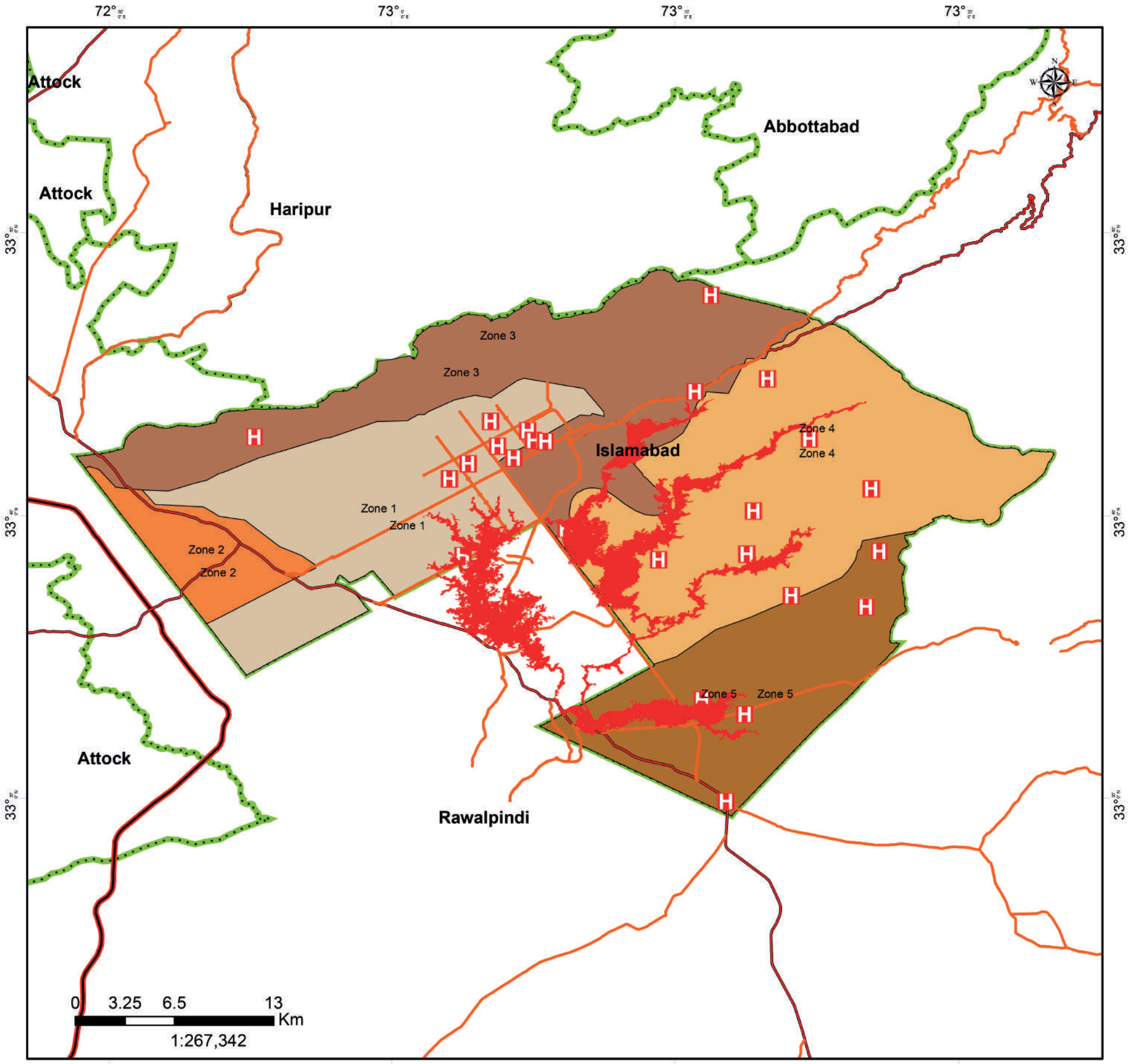
# HEALTH FACILITIES & TRANSPORTATION NETWORK EXPOSED TO FLOOD 50 YEARS RETURN PERIOD




## Legend

- Flood Hazard 50 Year Return Period
- Health Facilities
- Major Roads
- National Highway
- Strategic Road
- Motorways
- Islamabad Zones

**Zones**

- Zone 1
- Zone 2
- Zone 3
- Zone 4
- Zone 5
- District Boundary

## Multi Hazard Vulnerability & Risk Assessment, Islamabad, Pakistan

PAKISTAN National Disaster Management Authority NDMA

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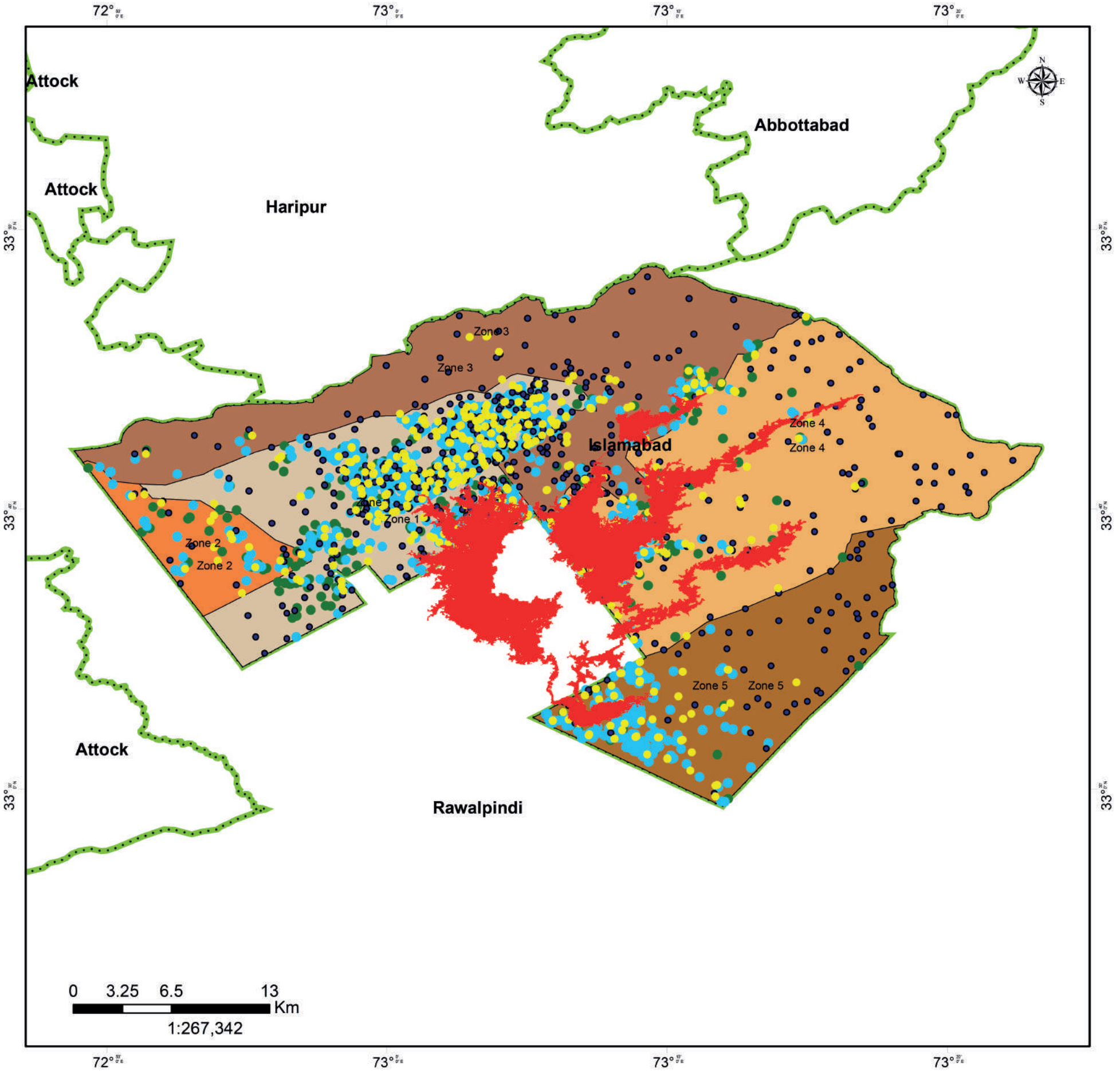
# COMMUNICATION TOWERS,INDUSTRIES,EDUCATION FACILITIES & SETTLEMENTS EXPOSED TO FLOOD 100 YEARS RETURN PERIOD




**Legend**

- Flood Hazard 100 Year Return Period
- Communication Towers
- Settlements
- Industries
- Education Facilities

**Zones**

- Zone 1
- Zone 2
- Zone 3
- Zone 4
- Zone 5
- District Boundary

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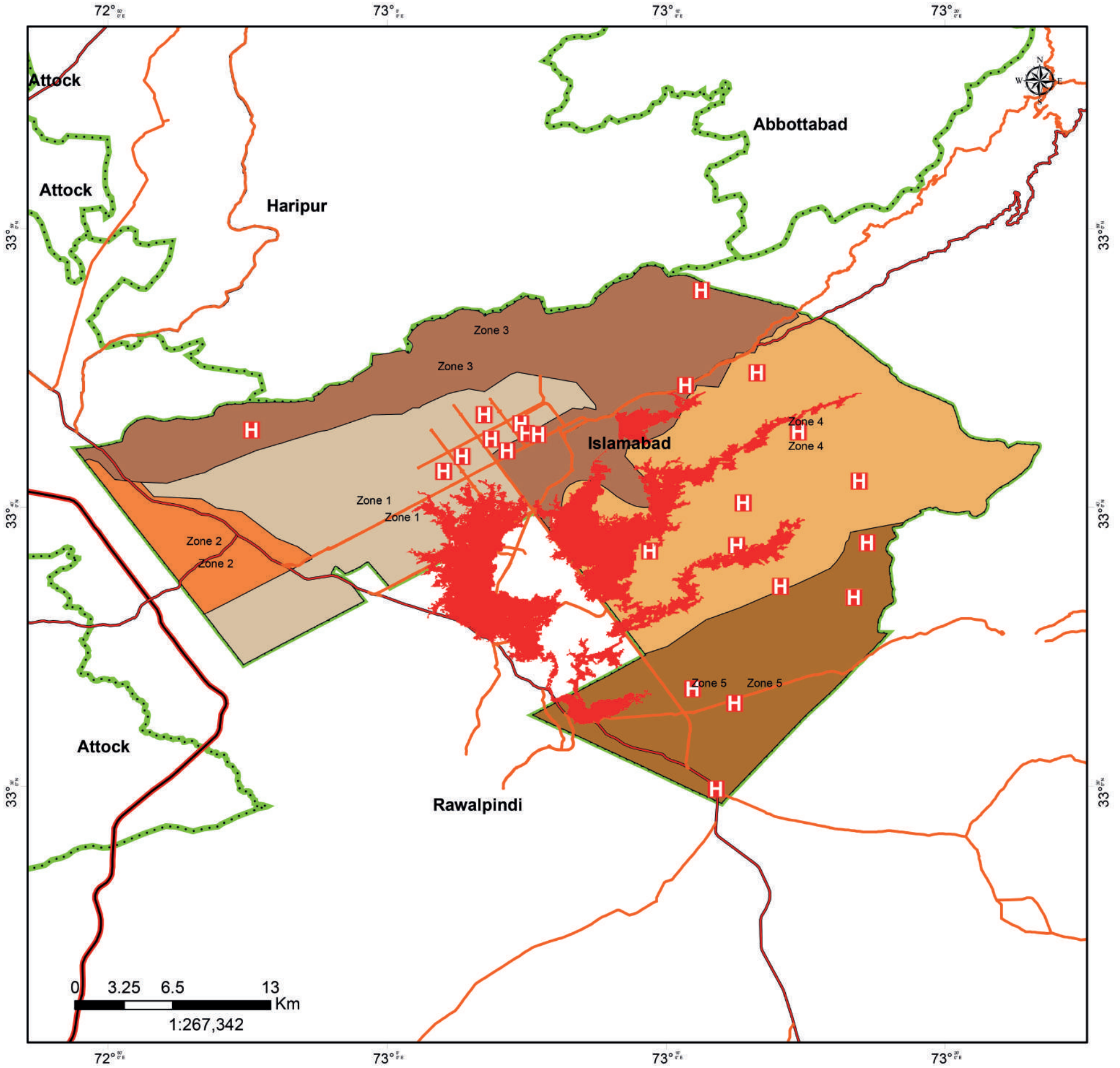
# HEALTH FACILITIES & TRANSPORTATION NETWORK EXPOSED TO FLOOD 100 YEARS RETURN PERIOD




**Legend**

- Flood Hazard 100 Year Return Period
- Health Facilities
- Major Roads
- National Highway
- Strategic Road
- Motorways
- Islamabad Zones

**Zones**

- Zone 1
- Zone 2
- Zone 3
- Zone 4
- Zone 5
- District Boundary

**Multi Hazard Vulnerability & Risk Assessment, Islamabad, Pakistan**

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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 | 1.5 | 5.10 |
| Stone Masonry | M1 | 3.4 | 6.52 |
| Mud/Adobe Masonry | M2 | 6.23 | 8.16 |
| Brick Masonry | M5 | 2.56 | 4.65 |
| Wood/Bamboo Traditional | M7 | 3.75 | 1.50 |
| Block Masonry | M8 | 1.55 | 3.00 |
| Others Undefined | 00 | 6 | 5.52 |

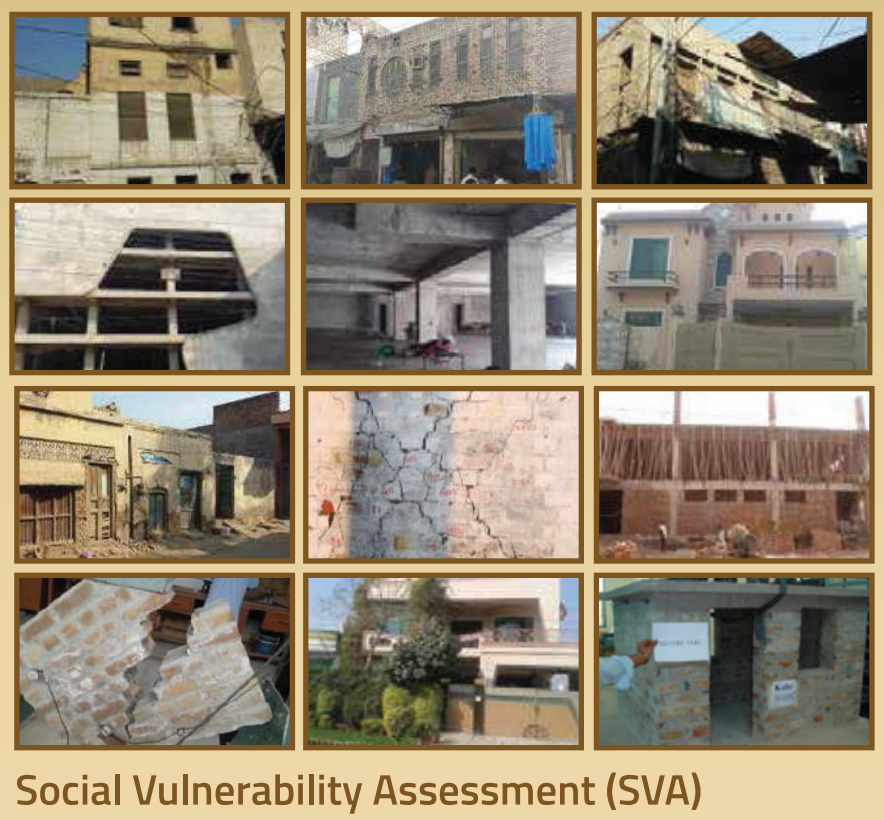
**Building Vulnerability Scoring as per PBS Classification**

| Building Types | Floods | Earthquakes |
|---|---|---|
| Kaccha | 3.5 | 10 |
| Semi-Pacca | 2.0 | 5 |
| Pacca | 1.5 | 6 |

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 | 0 - 5% |
| Moderate | 5 - 20% |
| Heavy | 20 - 50% |
| Severe | 50 - 100% |

**Buildings Surveyed for Physical Vulnerability Assessment**



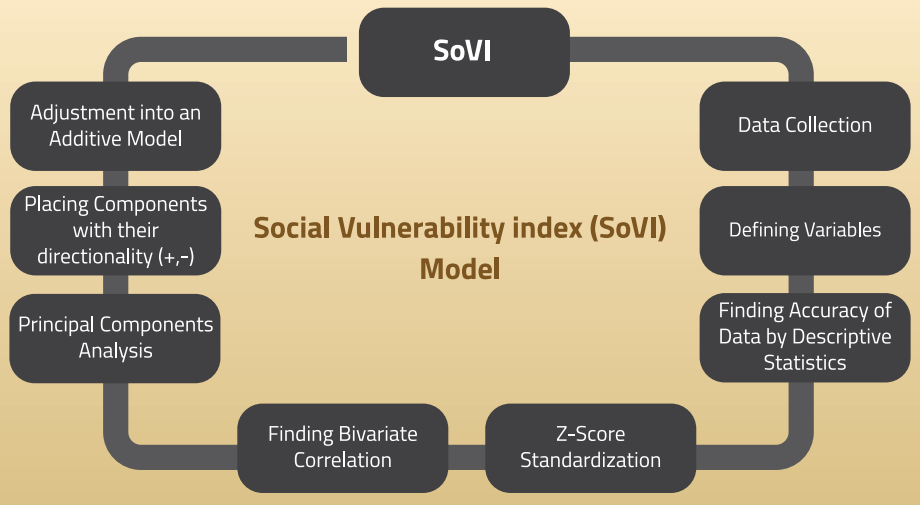
## Social Vulnerability Assessment (SVA)

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 | 30.76% |
| 2 | Rural Farm Populations | Positive | 11.5% |
| 3 | Information Access | Negative | 7.9% |
| 4 | Children with Disabilities | Positive | 1.99% |
| 5 | Social Benefits | Negative | 2.36% |
| 6 | Infant safety | Negative | 4.54% |
| 7 | Low income laborers | Positive | 5.32% |
| 8 | Poverty/Need for External Income Source | Positive | 4.65% |
| 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 | Zone | Food Security Ranking |
|---|---|---|
| Islamabad | Zone 1 | 2 |
| Islamabad | Zone 2 | 2 |
| Islamabad | Zone 3 | 2 |
| Islamabad | Zone 4 | 2 |
| Islamabad | Zone 5 | 2 |

# 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** | | |

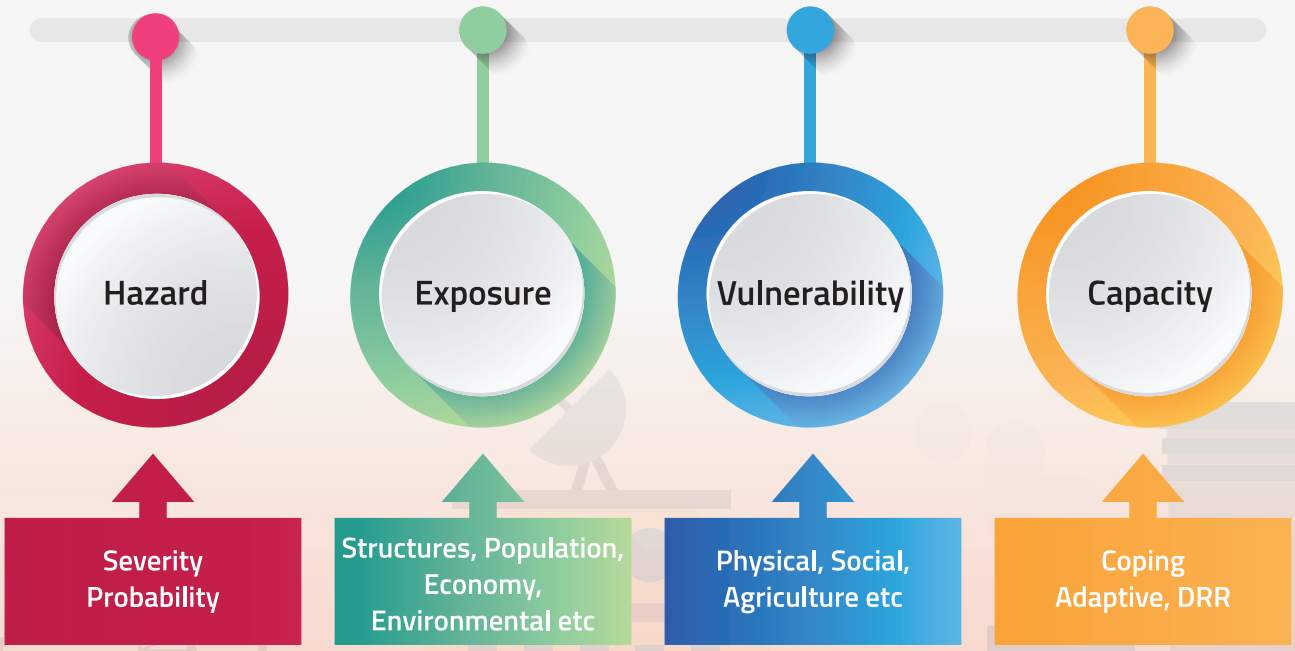
| Drought Hazard Severity Score | | |
|---|---|---|
| No Drought | 1 | Very Low |
| Mild | 2 | Low |
| Moderate | 3 | Medium |
| Severe | 4 | High |
| Extreme | 5 | Very High |
| 0 represents **No Hazard** | | |

| 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 |

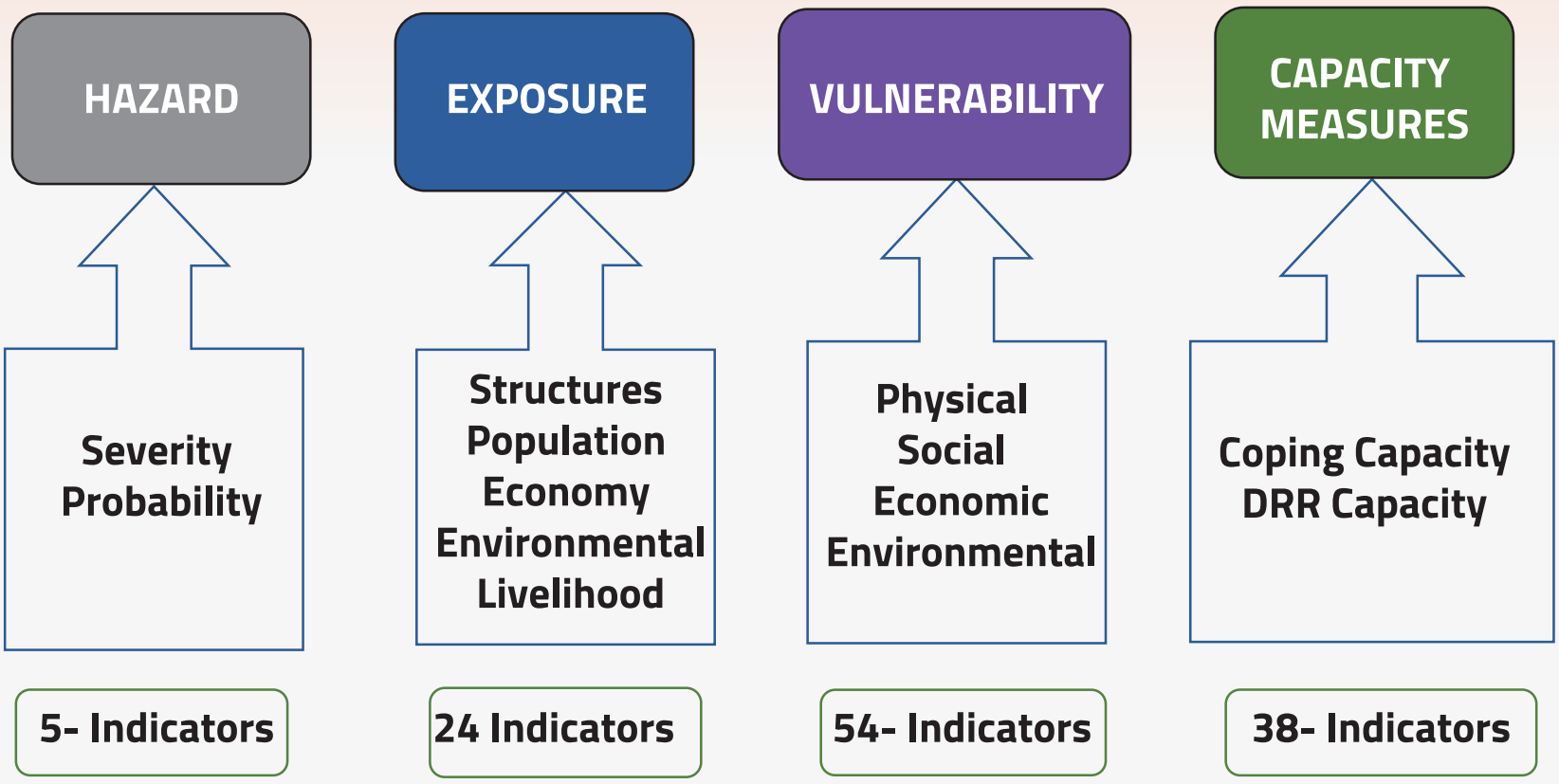
| Capacity Scoring Scale | |
|---|---|
| 1 | No to Negligible |
| 2 | Low |
| 3 | Medium |
| 4 | High |
| 5 | Extremely High |

## Disaster Risk Impact Factor



# 29 RISK ASSESSMENT BY HAZARD TYPE

## Cumulative Risk - Factor Components




$$Risk = \frac{(\text{Hazard} \times \text{Exposure} \times \text{Vulnerabilty})}{\text{Capacity}}$$

| Zones | Hazard | Exposure | Vulnerability | Capacity | Risk | | | Overall |
|---|---|---|---|---|---|---|---|---|
| | | | | | Flood | Drought | Earthquake | |
| Zone 1 | 2 | 1 | 2 | 4 | 2 | 1 | 3 | 2 |
| Zone 2 | 2 | 1 | 2 | 4 | 2 | 1 | 3 | 2 |
| Zone 3 | 2 | 1 | 2 | 4 | 1 | 1 | 3 | 2 |
| Zone 4 | 3 | 1 | 2 | 4 | 2 | 2 | 3 | 2 |
| Zone 5 | 3 | 1 | 2 | 4 | 3 | 2 | 3 | 3 |

# DROUGHT RISK

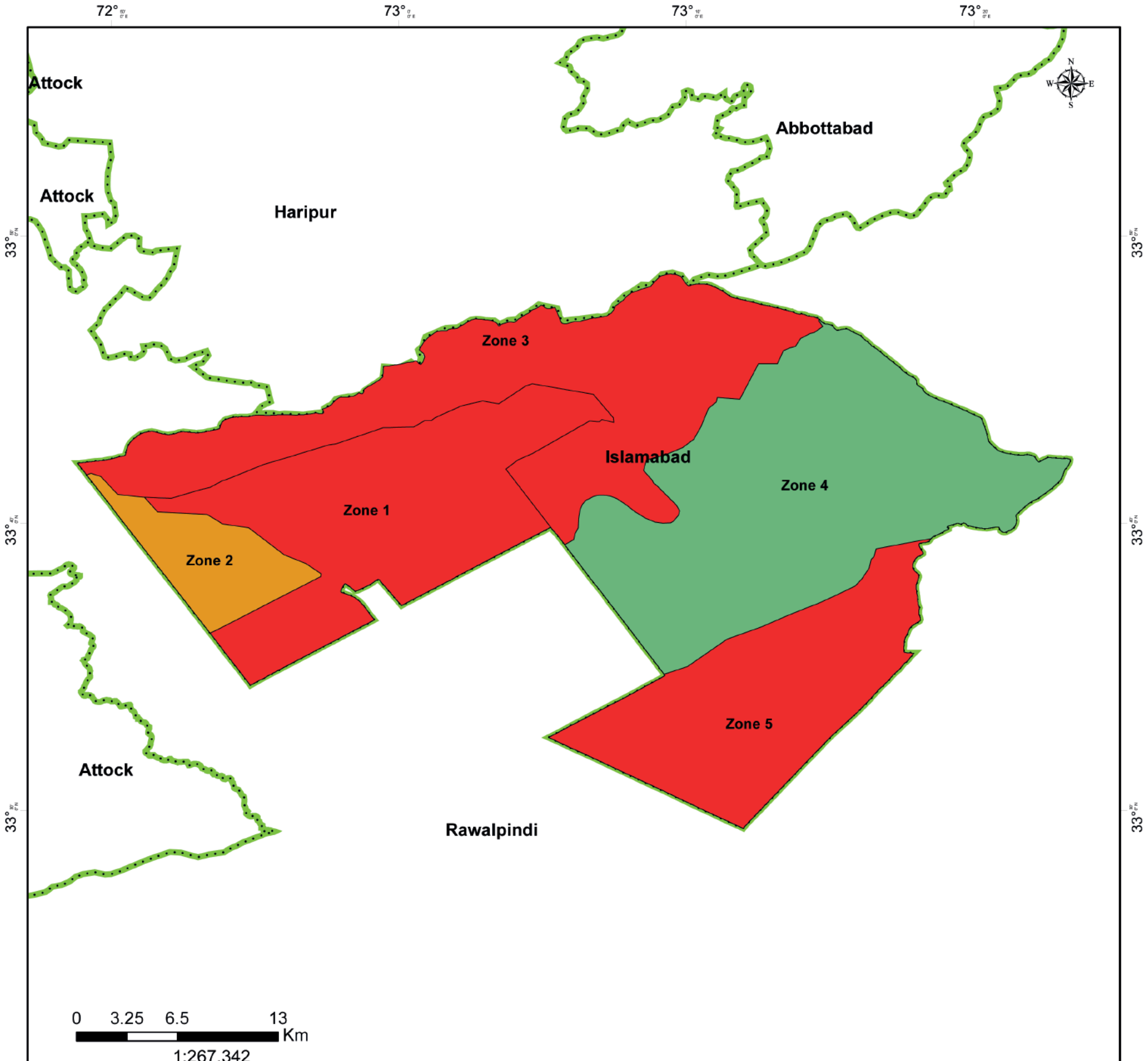

## Legend

**Drought Risk**

- Low
- Medium
- District Boundary

## Multi Hazard Vulnerability & Risk Assessment, Islamabad, Pakistan

# EARTHQUAKE RISK




## Legend

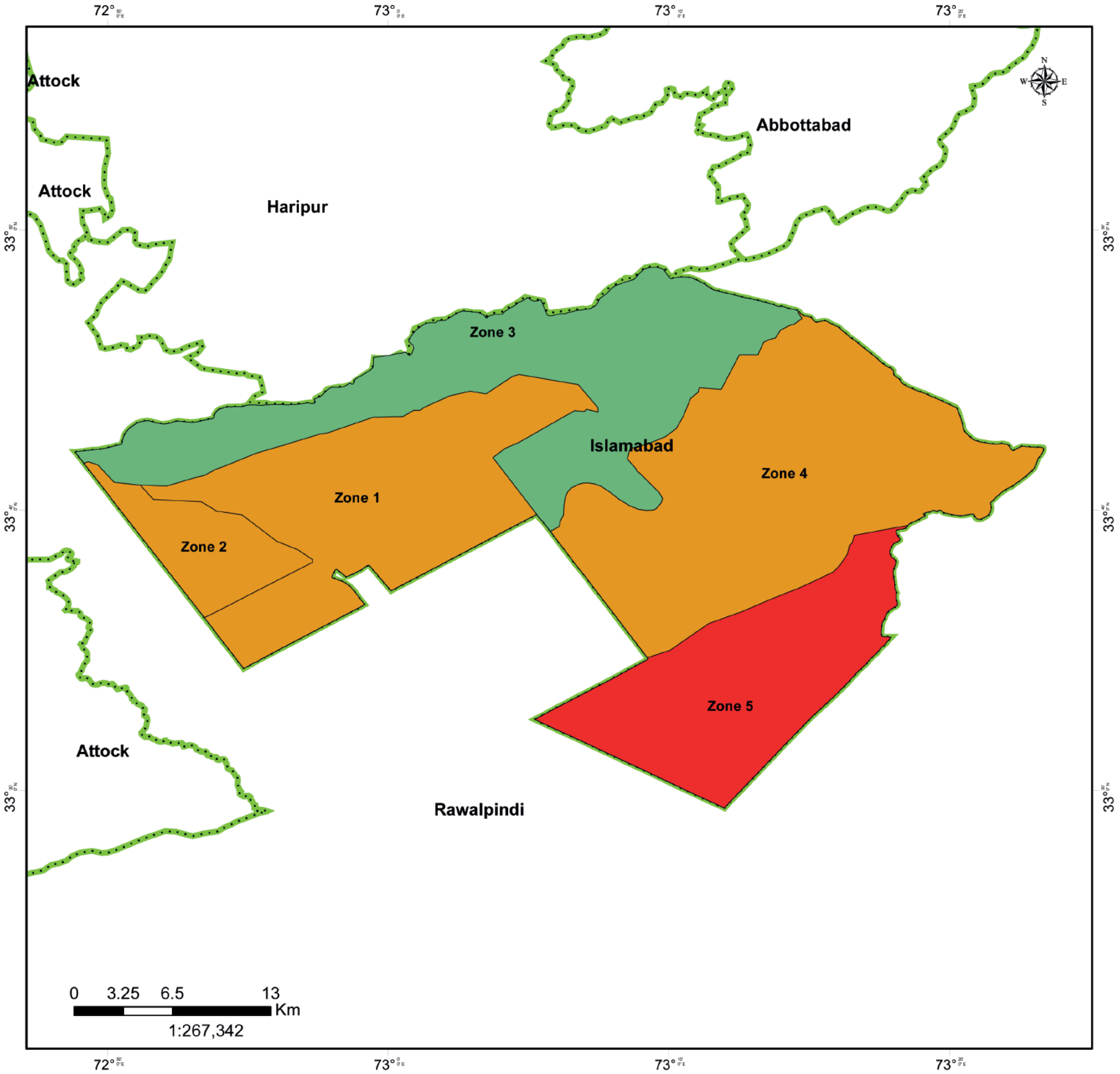
**Earthquake Risk**

- Low
- Medium
- Very High
- District Boundary

## Multi Hazard Vulnerability & Risk Assessment, Islamabad, Pakistan

UN-HABITAT

# FLOOD RISK




## Legend

**Flood Risk**

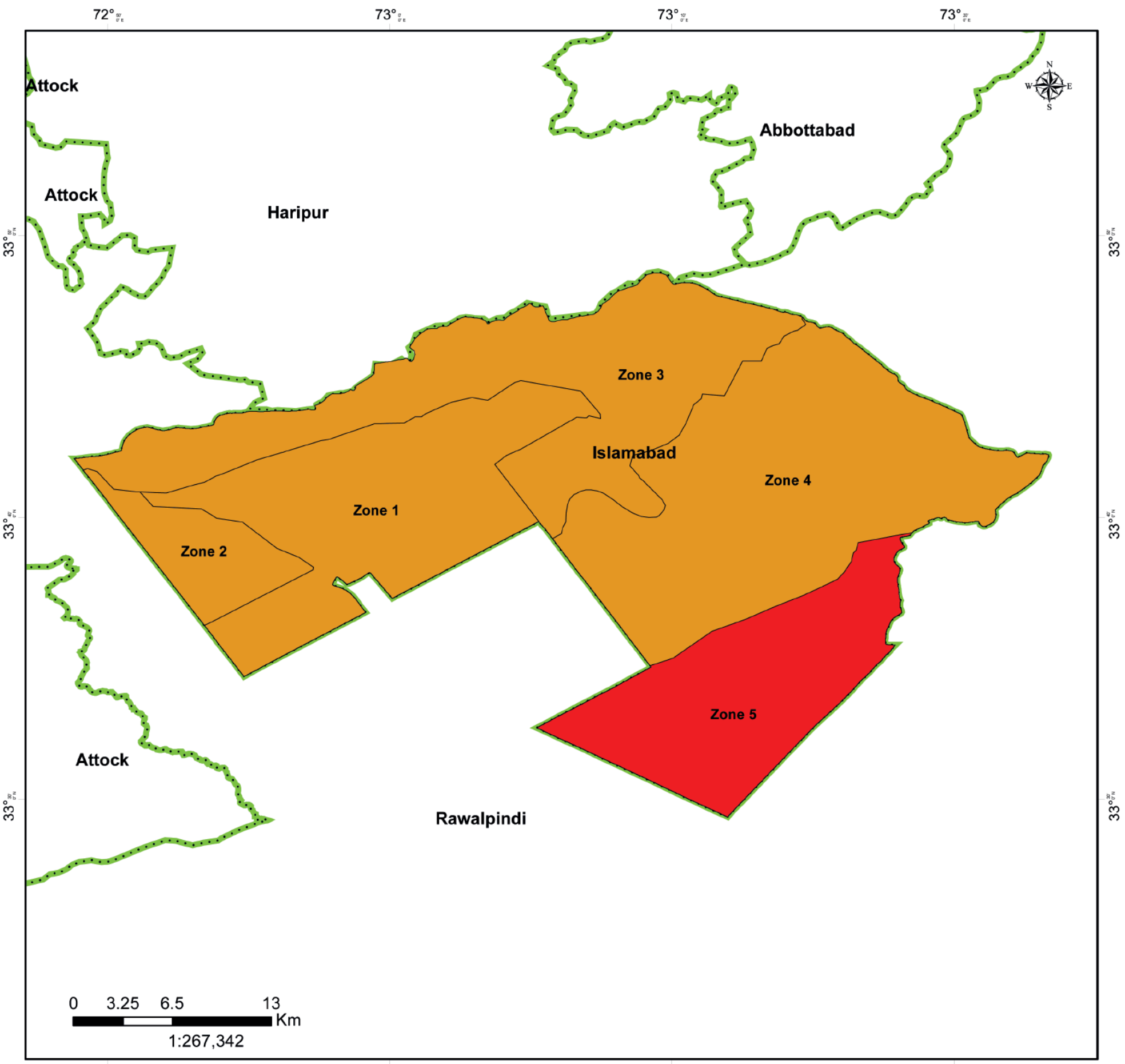
- Low
- Medium
- Very High
- District Boundary

## Multi Hazard Vulnerability & Risk Assessment, Islamabad, Pakistan

PAKISTAN National Disaster Management Authority NDMA

UN-HABITAT

# COMPOSITE RISK




## Legend

**Composite Risk**

- Medium
- High
- District Boundary

**Multi Hazard Vulnerability & Risk Assessment, Islamabad, Pakistan**

# GLOSSARY OF TERMS

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|---|---|
| **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".<br><br>(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 |

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| | 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.<br>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. |

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| **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:<br>i. Data on the disastrous phenomena (e.g. landslides, floods, earthquakes), their location, frequency, magnitude etc.<br>ii. Data on the environment in which the disastrous events might take place: topography, geology, geomorphology, soils, hydrology, land use, vegetation etc.<br>iii. Data on the elements that might be destroyed if the event takes place: infrastructure, settlements, population, socioeconomic data etc.<br>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. |

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| **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.<br>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 $5^{th}$ to $8^{th}$ 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. |

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| **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. |

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| **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. 12$^{th}$ 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.<br>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. |

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| **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

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| **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 |

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|---|---|
| **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<br>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**