

TORs for the Assignment of

“Soil investigation, Geo-hazard, landslide susceptibility and Climate Change Resilience Studies in AJ&K”.

The studies proposed under World Bank funded project namely “DCRIP” consist of following two parts:

Part-I : *Soil investigation, Geo-hazard mapping, risk analysis and landslide susceptibility mapping and Studies.*

Part-II : *Climate Change Impact Analysis of AJ&K*

Training and capacity building of Government of AJ&K technical staff on climate change risk assessment for sustainability of interventions.

Introduction:

The state of Azad Jammu and Kashmir lies between longitude 73° – 75° and latitude 33° – 36°. It mainly comprises of hilly and mountainous topography with valleys and stretches of plains. The area has highly aesthetic value, covering with thick forest, fast flowing rivers and winding streams. Main rivers are Jehlum, Neelum and Poonch. The climatic conditions are just like sub-tropical highland type with an average 130,000 mm precipitation annually. The elevation ranges from 230 meters in the south to 6325 meters in the North. It is a landlocked area situated at the base of lower Himalayas. On the western side of State’s boundary, the provinces of Khyber Pakhtunkhwa and Punjab are located; while the entire southeastern boundary is lined by the Indian Occupied Jammu & Kashmir. The total land area comprises of 13,297 km² and administratively is divided into ten districts. The AJK’s river/stream run-off are mostly influenced by two distinct weather patterns. In winters, the westerly disturbances deposit heavy loads of snow melting in early springs and contribute in the major load towards the run-off. In summers, the easterly disturbances often cited as Monsoon causes considerable increase in the surface flows. The stream flows, in the upper Northern Districts are mostly influenced by spring snow melt, while in the lower reaches of Northern Districts and Southern Districts, summer Monsoons are the major contributors.

In Azad Jammu & Kashmir along with its neighboring regions, the need to gradually shifting from the simple disaster response to a more proactive approach to disaster risk management is being felt inevitable. The increase in the frequency of disasters and their associated damages in the region is part of a worldwide trend, which results from growing vulnerability and may reflect changing climate patterns. These trends make it all the more necessary for our state to address the root causes of vulnerability, rather than merely treating its symptoms.

With the financial support from the IDA/World Bank, Program implementation Unit PIU-DCRIP, P&D (Planning and Development Department) of Government of AJ&K is implementing a four years project, titled “Disaster and Climate Resilience Improvement Project” (DCRIP). The project aims to support restoration of flood protection infrastructure and strengthen government capacity to manage disasters and climate variability through Geo-hazard studies. Strengthening of State line departments and District Disaster Management Authorities is an integral component of the project and aims at building capacity and equipping the concerned lines department to be better prepared and respond to future disasters.

In AJ&K different climatic zones adversely affected the human settlement as well as social environment caused life losses and destruction of infrastructure. Moreover, the disturbance of the ecosystem need to be addressed through GIS based climatic change studies which helped out the policy and decision makers to decide the future course of action. Keeping in view the aforementioned aim, PIU-DCRIP, LUPS, P&D department of the State Government of AJ&K is seeking to engage a relevant and suitable qualified firm/individual consultant to carry out a *Soil investigation, Geo-hazard risk analysis, landslide susceptibility mapping and Climate Change Impact Analysis. The derivatives of these studies will be incorporated in the conceived SDSS or DMIS.*

Background

AJ&K is a disaster prone area with high vulnerability to climate change effects. The region has experienced a number of unprecedented natural calamities in the recent past. AJ&K is exposed to both natural and manmade hazards. With its peculiar hazardous environment, the risks are accentuated for current state of physical, socioeconomic and organizational vulnerabilities and exposure. The history of disasters in Azad Jammu & Kashmir reveals that the State has suffered by both natural and human induced disasters which have adversely affected the economic growth as well as public infrastructure. The devastating earthquake of October 2005, flood 2010 and recently deadliest floods of 2014 are the glaring examples, where loss of precious lives and resilience infrastructure hampered the economic growth of the State.

Earthquake in 2005 and 2015, recurrent floods, heavy rains and landslides have revealed the region's population and economy's vulnerability to different hazards. Massive damages and losses could have been largely averted if accurate disaster information existed and if disaster risk management (DRM) approaches had been enacted by the Government and disaster risk reduction (DRR) measures had been integrated into physical, social and economic development. In order to minimize the damages, caused by natural calamities, especially aftermath of the recent floods, the World Bank is aimed to extend its financial and technical support to address the root causes of such devastations and to initiate the remedial measures also.

The findings and recommendations of these studies, will help relevant line departments (Forest, PDO, CDO, PP&H and SDMA) and all other line departments about the future investments on infrastructure development as well as for strengthening institutional and operational capacity of these departments. Moreover, integration of the studies results and datasets produced with SDSS will enable to train relevant line departments (Climate Change AJK, Forest, PDO, CDO, PP&H and SDMA) for use of Geohazard risk assessment model and landslide susceptibility database for future planning regarding strengthening institutional and operational capacity of these stakeholders. The system will visualize holistic picture of hazard faced by AJ&K and enable policy makers to calculate risk and understand the sustainability of interventions and investments. SDSS and DMIS must have the capability to guide the state development authorities in prioritizing climate compatible development.

Proposed Study by Land Use Planning

Land Use Planning P&DD Govt. of AJ&K is state of the art GIS mapping agency which deals and provide all kind of base maps, metadata to all line departments of AJ&K according to their requirement. Being disputed territory, AJ&K has different scenario to initiate any kind of GIS based mapping, surveys and studies by any firm or individual consultants until to get registered with Survey of Pakistan(SOP) along with security clearance.

LUP is leading agency registered with SOP having mandate to develop geo-spatial data, products, services, maps and studies in AJ&K. So, LUP is responsible to conduct proposed study through consulting firms/individual consultants according to the agreed TORs. Keeping in view, the Land Use Planning, P&DD has chalked out the plan to develop and prepare scientifically

acknowledged tools to help the government to tackle the problem. In this respect, Soil investigation, Geo-hazard risk analysis, landslide susceptibility mapping and Climate Change Impact Analysis will be carried out at an appropriate scale covering four districts of Azad Jammu & Kashmir on micro level and whole of AJ&K at macro level. The derivatives of these studies will be incorporated in the conceived SDSS or DMIS.

The foremost important aspect for disaster management is to identify the vulnerable areas to different hazards. It is surmised that spatial initiatives will bring substantial efficiency in management of natural calamities through assessment of potential hazardous areas. The resultant risk assessment and hazard micro-zonation subsequently spatial analysis will be incorporated directly in the strategies planned and promulgated by almost all concerned stakeholders including government relevant lines departments & organizations especially CDO, Forest Department, SDMA, Climate Change, NGOs, academia and researchers.

Overview of the Scope of Work

This consultancy will cover the development of flood and seismic risk assessment and Landslide data inventory for AJK. The following process is anticipated to collaboratively define the exact scope and project plan for each assessment which will be driven by the Consultancy.

Components of the scope of work

The scope of work consists of following Nine (9) components:

1. Study on soil investigation, soil profile, soil series mapping, soil erosion mapping at scale 1: 50,000 for Muzaffarabad, Bagh, Haveli and Poonch Districts in AJK.
2. Development of input datasets for Probabilistic Seismic Hazard Assessment and Seismic Induced hazards for future threat.
3. Development of input datasets for Probabilistic Flood Hazard and Risk Assessment for AJ&K
4. Development of Exposure Datasets at appropriate scales for Seismic and Flood Risk Assessment for AJ&K.
5. Probabilistic and Deterministic Seismic and Flood Hazard and Risk Analysis for AJ&K.
6. Development of Landslide data inventory, susceptibility analysis of District Muzaffarabad, Bagh, Haveli and Poonch and GLOF inventory.
7. Final Report and communication/transmission of datasets, analysis and results
8. Climate Change Impact Studies of AJ&K at Macro level.
9. Training and capacity building of Government of AJ&K technical staff on climate change risk assessment for sustainability of interventions.

All outputs (hard and soft copy) that would be produced under these studies will be provided to Land Use Planning, Government of AJ&K which will own and maintain the data for its dissemination to concerned stakeholders for efficient management of disasters.

Component 1: Study on soil investigation, soil profile, soil series mapping, soil erosion mapping at scale 1: 50,000 for Muzaffarabad, Bagh, Haveli and Poonch Districts in AJK.

Objective:

To collect soil profile of selected districts of AJK. The study will assess the soil erosion acceleration rates and provide a comprehensive picture of their impact on soil susceptibility and suitability.

Activities:

1. Desk review of earlier studies on the subject areas
2. Develop inception report at the beginning of the project which should depict methodology to be followed for the above studies. Inception report should also highlight the limitation and how to overcome these limitations
3. Develop the following required maps on two different specified scales by using Survey of Pakistan topographic sheets as well as latest satellite images
4. Maps can be included Soil type map, Soil series map, Soil erosion map, Soil landform map, Lithological map, Geomorphological map, Conventional soil map, Soil susceptibility maps, Problematic soil map and Soil land use recommended maps
5. Develop detail report on detail soil investigation/profile studies
6. Conduct state level orientation workshop at beginning and validation workshop at the end to validate the dataset developed on hazard and risk assessment

Expected Outputs:

1. Inception report
2. Geo-referenced Soil Profile layer and database with associated attributes based on standard information
3. Report on detail soil investigation/profile study
4. Develop Atlas in the form of output maps at scale 1: 50,000
 - a. Soil type map
 - b. Soil series maps
 - c. Soil erosion map
 - d. Soil landform maps
 - e. Conventional soil map
 - f. Problematic soil map
 - g. Soil land use recommended map
5. Provision of Final Report in soft and hard format with at least 50 copies on 120 gram glassing paper.
6. Provision of soft GIS datasets generated in GIS format.
7. Provision of final maps at different scales.
8. Integration of generated datasets with SDSS or DMIS

Component 2: Development of input datasets for Probabilistic Seismic Hazard Assessment and Seismic Induced hazards for AJ&K**Objective:**

To collect all earthquake input datasets, undertake Quality Assurance / Quality Checking (QA/QC) and update/modify datasets as necessary for use in Probabilistic Seismic Hazard Assessment.

Activities:

1. Collect/Prepare earthquake input datasets. This will include, but will not limited to, a cleaned historical earthquake catalogue, seismic sources (fault lines and area sources) that generated events in historical times with information on activity level, depth and traces, other seismic sources (e.g.

Identified fault lines), strong ground motion records, micro-zonation studies, shearwave analysis, GPS strain measurements etc.

2. Update and modify earthquake input datasets as necessary to ensure the datasets are as complete as possible, including potential addition of global datasets such as GEM Faulted Earth, earthquake catalogues from other geophysical monitoring agencies (e.g., literature Survey; Ambraseys Eq. catalogue, India Meteorological Department, USGS, etc.).

3. Collect/prepare and integrate ancillary hazard data from a range of stakeholders including: Surface soil and geology maps, micro-zonation studies, digital elevation data (topographical maps).

4. Develop a short technical report describing the data collected, their limitations and provide recommendations on how these datasets could be progressively improved through time and the resources necessary to do this.

Expected Outputs:

1. All databases and catalogues that form inputs into PSHA, including primary datasets, value-added and QA/QC'ed datasets. These will include:

- a. Seismic Source Model:
 - i. Geo-referenced fault database with associated attributes based on existing information (including maps, activity level, depth and traces, representative slip behavior, any recurrence information);
 - ii. Consistent, statistically complete earthquake catalogue (Mw, earthquake recurrence and maximum magnitude).
 - iii. Development of Frequency-Mag. (G-R) relationships
 - iv. Active Deformation, if available
- b. Ground Motion Model:
 - i. Strong Ground Motion Data and justification of selection of Ground Motion Model based scientific debate and consensus
 - ii. Crustal velocity structure information
- c. Site Response Model:
 - i. Maps of near surface geology (site classes)
 - ii. Shear wave velocity for the top 30 m of geology (V_{s30}) – proxies can be used if no shear wave analysis exists
 - iii. Micro-zonation studies
 - iv. Other dynamic soil properties such as shear modulus and damping ratio for possible site amplification analysis when available.

2. A technical report describing the data collected its limitations and recommendations to improve datasets progressively through time.

Component 3: Development of input datasets for Probabilistic Flood Hazard and Risk Assessment for AJ&K

Objective:

To collect/prepare all flood input datasets, undertake Quality Assurance/Quality Checking (QA/QC) and update/modify datasets as necessary for use in Probabilistic Flood Hazard Assessment.

Activities:

1. Collect & prepare flood input datasets for whole AJ&K at macro level and major rivers including River Neelum, Jhelum, Poonch, Mahal and Nullahs at micro level. This will include, but will not limited to, historical and statistical rainfall analysis, hydrograph information, hydroshed data, digital elevation model, geology, land use and soil data, flood management infrastructure, historical flood extents and historical flood extents and flash flood damages.

2. Create, update and modify flood input datasets as necessary to ensure the datasets are as complete as possible, including potential addition of global and regional datasets.
3. Review downscaled climate scenarios and flood modeling for four districts selected by stakeholders on micro level and AJ&K on macro level and consider how the potential changes in the rainfall patterns which will need to be included in future climate scenarios.
4. Develop a short technical report describing the data collected, their limitations and provide recommendations on how these datasets could be progressively improved through time and the resources necessary to do this.

Expected Outputs:

1. All datasets (hard & soft format) that form inputs into probabilistic flood modelling, including primary datasets, value-added and QA/QC'ed datasets. These will include:
 - a. Hydromet input datasets: rainfall data and associated frequency analysis, extreme events data, digital hydrograph for relevant stream etc.
 - b. Base datasets: DEM/DTM showing low level areas stream cross sections, hydrosheds etc.
 - c. Flood management infrastructure: including storm drains, dams etc. for areas of relevance.
2. A technical report describing the data collected, its limitations and recommendations to improve datasets progressively through time.

Component 4: Development of Exposure Datasets at appropriate scales for landslide susceptibility, Seismic and Flood Risk Assessment for AJ&K

Objectives:

1. To build and prepare geo-spatial exposure database for integration of existing datasets such as schools, health facilities, transportation networks, land use, etc. for the city.
2. Facilitate the collection of new exposure data through crowdsourcing, use of high resolution satellite imagery or statistical analysis – depending on the most appropriate technology for different areas of AJ&K.
3. To characterize the vulnerability of key government assets and residential structures

Activities:

1. Collect and prepare all existing exposure data for AJ&K. This can be achieved through follow up meetings. Exposure data should include at minimum: demographic distribution, education, health and public administration facilities, transportation networks, critical infrastructure (such as major electricity, water and sanitation supplies), agriculture, residential types and their distribution, and land-use.

The scale of these datasets should be appropriate to the scale of the risk assessment – and the scale should be decided in collaboration with stakeholders after receiving of initial data availability.

2. Develop and calibrate existing hazard, exposure and vulnerability data for AJ&K.
3. Input all geo-spatial data layers into the database, including appropriate metadata that meets relevant ISO standards.
4. Develop a technical report documenting the building topologies and vulnerability curves and

recommendations to systematically improve these input variables over time.

Expected Outputs:

1. A technical report that describes:
 - a. Geo-spatial exposure database indicating governance infrastructure mapping and reports
 - b. The building topologies of public schools, medical buildings, administrative and residential buildings.
 - c. The vulnerability curves with detailed mathematical formula (e.g., asset-based vulnerability curves, population based vulnerability curves) for each building topology.

2. Geo-spatial data layers for each aspect of exposure outlined above – including appropriate metadata.

Component 5: Probabilistic and Deterministic Seismic and Flood Hazard and Risk Analysis for AJ&K

Objectives:

1. Using state-of-the art earthquake risk modeling methodology and datasets compiled in earlier components, undertake:
 - Probabilistic Seismic Hazard Assessment and model for AJ&K
 - Probabilistic Seismic Risk Analysis for AJ&K
 - Three Scenarios/Deterministic Impact Analysis for AJ&K

2. Using state-of-the art risk flood hazard and risk modeling methodology and datasets compiled in components undertake:
 - Probabilistic Flood Hazard Assessment for AJ&K at macro level and for River Neelum, Jhelum, Poonch, Mahal and Nullahs at micro level.
 - Probabilistic Flood Risk Analysis for AJ&K at macro level and for River Neelum, Jhelum, Poonch, Mahal and Nullahs at micro level
 - Scenarios/Deterministic Impact Analysis for AJ&K

3. From the analysis in 1, determine the most vulnerable education, health, and public administration buildings as well as impacts on transportation/road network and critical facilities. From the analysis in 2, identify vulnerable zones, roads and infrastructure as well as impacts on transportation and critical facilities.

Activities:

1. Using commercial earthquake hazard and risk modeling software (most commonly used)¹ and datasets compiled to undertake the following analysis:
 - a) Probabilistic Seismic Hazard Assessments for AJ&K based on Peak Ground Accelerations (PGA) that are likely to be exceeded in a 100,200 year return period (or 2% chance of exceedance in 50 years return period.

 - b) Probabilistic Seismic Risk Analysis for AJ&K – looking at the risks to the exposure assets collected in Component 4. This should have an aim of determining the most ‘at risk’ buildings types and assets and undertake quantitative analysis of the potential fatalities and financial loss.

c) Scenario/Deterministic Impact Analysis for assessing resilience against earthquakes and floods in AJ&K.

2. Using state of the art flood hazard and risk modeling software¹ and datasets compiled in above components, undertake the following analysis:

a) Probabilistic analysis of rainfall and rainfall run-off to determine a range of return period flood event input parameters. Undertake 1D modeling for 1/5 year, 1/20 year, 1/100 year and 1/200-year runoff and drainage capacity.

b) Using the flood hazard results, determine the impacts to the exposure assets collected in Component 4 for 1/5 year, 1/20 year, 1/100 year and 1/200-year flood events for AJ&K. This should have an aim of determining the most ‘at risk’ buildings and assets and should include analysis of the potential population affected.

Expected Outputs:

1. Probabilistic Seismological maps and Hazard Risk Assessment for AJ&K at macro level and for River Neelum, Jhelum, Poonch, Mahal and Nullahs at micro level
2. Deterministic seismic Impact Analysis for AJ&K
3. Flood hazard (1D) and impact analysis for 1/5 year, 1/20 year, 1/100 year and 1/200-year rainfall runoff events for Lahore

Component 6: Development of Landslide data inventory, susceptibility analysis of District Muzaffarabad, Bagh, Haveli and Poonch at Micro Level and GLOF inventory.

Objectives:

To collect landslide input datasets, undertake Quality Assurance/Quality checking (QA/QC) and update/modify datasets as necessary for Landslide susceptibility analysis for Muzaffarabad, Bagh, Haveli and Poonch District.

Activities:

1. Collect and QA/QC landslide input datasets. This will include, but will not limited to, a cleaned historical landslide events data, Seismic and hydrological induced landslides that generated events in historical times with information on activity level, identification of different types of landslides prevailing in the area. Collect and investigate soil and geological maps of an area which may trigger or increase landslide risks.
2. Update and modify landslide input datasets as necessary to ensure the datasets are as complete as possible, addition of landslides events from different researches and previous studies conducted in the region.
3. Develop a tailor made methodology for landslide susceptibility analysis based on the data availability for the region.
4. Develop a short technical report describing methodology adopted for landslide susceptibility analysis the data collected, their limitations and provide recommendations on how these datasets could be progressively improved through time and the resources necessary to do this.

Outputs of the Component:

1. Development of data required for landslide susceptibility analysis of 4 districts:
 - a. Maps required for landslide susceptibility analysis:

- i. Geological maps
- ii. Landuse and landcover maps
- iii. Lithological map
- iv. Soil susceptibility maps
- v. Landslide susceptibility map
- vi. Landcover classes
- vii. NDVI map
- viii. Slope categorization map
- ix. Stream order mapping
- x. Geomorphology of an area
- b. Processing of 10m digital elevation models for deriving different parameter which will be used for landslide susceptibility analysis
- c. Methodology and results:
 - i. Tailor made methodology based on availability of data for the study area
 - ii. Susceptibility analysis based on biased statistical techniques and ground truthing
 - iii. Field verified, and historical events ad-on landslide susceptibility resultant maps for region

A technical report describing the data collected, methodology adopted its limitations and recommendations to improve datasets progressively through time.

Component 7: Final Report and communication and provision of datasets, analysis, and results

Objectives:

1. To finalize reporting.
2. To upload all datasets, analysis and results that were used, developed or resulted from this study to a database on a platform to be selected jointly by the firm, LUP Government of AJ&K and World Bank.
3. To assist Land Use Planning team Government of AJ&K in defining the architecture of the database to ensure its compatibility with the datasets generated.
4. To work with stakeholders in AJ&K to communicate the results of the climate risk analysis
5. To work with relevant departments to communicate the results of the climate risk assessment

Activities:

1. Develop final report that articulates the following:
 - a) Description of input datasets and models used in this study, their limitations and recommendations for how these datasets can be improved with time and resources. This includes the vulnerability models, replacement costs, loss data etc.
 - b) the development of the probabilistic seismic hazard and risk assessments and flood hazard/impact assessments, including assumptions made, justification of modeling choices, and description of uncertainty
 - c) results of all the analysis
2. Facilitating in uploading all datasets, analysis and results that were used, developed or resulted from this study database. This also includes development of metadata and output files, in-line with the guidance provided in this document.
3. Undertake Stakeholder Meetings with the concerned to share the results of the risk assessment. This should include production of dissemination material such as brochures with results and illustrative material (e.g., visuals, hazard maps, risk maps and all types of Geo-hazard maps) that will inform various stakeholders on the risk results.

Expected Outputs:

1. Final Report indicating component 1-6
2. Datasets uploaded onto the database

Component 8 : Climate Change Impact Analysis of AJ&K**Objectives:**

AJ&K falls in a strategic geographical region where its forest and other natural resources are severally vulnerable due to climate change impacts. To tackle these impacts, the climate impact studies will be carried out to find out the intensity of extreme and uncertain weather events cause frequent and intense floods including glacier lake outburst, land-sliding, avalanches, wind storms, heat wave and droughts at macro level in AJ&K

Activities:

1. Desk review of earlier studies on the subject climate change.
2. Develop inception report at the beginning of the study which should depict methodology to be followed for the study. Inception report should also highlight the limitation and how to overcome these limitations.
3. To access climate change impacts on agriculture through accessing vulnerability and suitability of existing and proposed cropping patterns for different ago-ecological zones of AJ&K.
4. To access climate change impacts due to decrease of forests cover which caused to increase in natural disasters.
5. To find the root causes of shrinkage of glaciers and erratic and unreliable rains and dry-spell cycles interrupt the continuous flow of water in rivers and nullahs/streams.
6. Prepare a comprehensive inventory of all water resources, including surface and ground water its quantity and quality.
7. To identify the disease symptoms on human health vulnerabilities of communities including men, women and children in areas most likely to be affected by the adverse impact of climate change in AJ&K.
8. Map and assess vulnerability of climate change disasters/ hazards of whole AJK.
9. Collect climate change related data. This will include, but will not be limited to, Historical/temporal and statistical temperature variation, rainfall/ precipitation analyses hydrograph information, hydro-shed data, digital elevation model, geology, land use, soil profile/ characteristics data, stream ordering, vegetation cover and slope categorization. Conduct a survey on the impacts of climate change on the livelihoods of local communities in AJK and its further complication in financial sector.
10. Assess past, present and future impacts of climate change on water resources, communication, physical infrastructure, power, transport, irrigation, rangeland, livestock, fisheries, wetlands, human health, housing, tourism, mining and industries sectors using techniques like Climate scenarios, biophysical models, socio-economic baseline models or scenarios, impact models, decision-making and choice models, and integrated system models; Empirical studies; Expert and stakeholder judgment and participation, Remote sensing and GIS by taking secondary as well as primary data/ information from both male and female members of communities, other stakeholders and experts.

11. Conduct a detail biodiversity assessment at AJK level, to determine conservation status of the flora and fauna and assess effect and impact of Climate change on the biodiversity with emphasis on threatened species.
12. Suggest measures for proper mitigation and adaption to reduce the impacts of climate change in all the sectors.
13. Develop climate change triggered hazards, risk assessment catalogue, atlas and map for whole AJK.
14. Provide technical guidance and training to local seismic, flood and engineering experts on the topic of the climate change hazards, exposure, fragility and climate change vulnerability data and curves for AJ&K.
15. Develop a draft report of study and circulate to relevant stakeholders to take their inputs for incorporation in the study report.
16. Develop detail report on orientation workshop at beginning and validation workshop at the end to validate the study findings.

Expected Outcome:

1. Detail report of the study indicating detail description of methodology followed for the assessment.
2. Conduct state level orientation and validation workshop.
3. Future projections of availability of water resources for hydropower project.
4. Recommendations to improve the engineering aspect of future physical infrastructure and hydropower projects.
5. Following Digital GIS Map
 - a. Climate Change Vulnerability Map
 - b. The Velocity of Climate Change
 - c. Deforestation Map
 - d. Vegetative Cover and species Mapping
 - e. Surface and Ground water potential map
 - f. Environmental protection and degradation mapping
 - g. Agro-climatic zones of 10 districts
 - h. Physiographic zoning of AJ&K at Macro level and Micro Level
 - i. Agro-ecological climatic zones of AJ&K at Macro level and district-wise at micro level
 - j. Distribution of natural resources
 - k. Snow cover map
 - l. Map indicating density of Air pollution
 - m. Mineral deposits/ mineral resources
 - n. Geographical spread of major diseases

Deliverables:

The deliverables of the study are as follows:

- Inception report (25% of the total study cost)
- First draft of the study (25% of total study cost)
- Second draft of the study after incorporation comments of stakeholders (25% of the total study cost)

- Final study report after incorporating inputs from validation workshop (25% of the total study cost)

Component 9: - Training and capacity building of Government of AJ&K technical staff on climate change risk assessment for sustainability of interventions.

Objectives:

1. To train the technical officials/officers of LUP and line departments on processes for hazard and risk assessment
2. To assist and guide the technical staff on the futuristic technical needs for conducting and uploading climate hazard and risk assessment studies
3. To disseminate project results and orient staff on sustainability of processes adopted for climate hazard and risk assessments
4. To arrange disaster & risk assessment related short training course/workshop for officer of LUP in China/Japan or where available

Activities:

1. Conduct a local workshop to demonstrate and orient technical audience on the following activities:
 - a) How to conduct probabilistic seismic and flood hazard assessment
 - b) How to conduct landslide susceptibility analysis
 - c) How to conduct probabilistic risk assessment
 - d) How to do risk modeling and parameter selection for data constraint environments
2. Develop a workshop manual incorporating stakeholder feedback and lesson learnt.
3. Production of awareness materials in form of easy to understand community maps based on stakeholder feedback

Data Standards, Transfer Media and Licensing

Data formats and requirements:

The minimum requirements to be followed for all geospatial data are:

Metadata: Detailed documentation needs to be provided for each data set. This metadata must include description, source, contact, date, accuracy, restrictions. A description of attributes needs to be provided for vector and tabular data sets. Spatial data must include details of projection. There are available ISO standards commonly used in projects to guide the development of metadata.

Vector data: Geospatial vector data must be converted into a standard OGC format or well-known format. This list includes, but is not limited to, shape file, KML, GML, WKT. Additional formats may be used with approval. Where possible, styling information should be provided in SLD format. All files must include projection parameters.

Raster data: Geospatial raster data must be converted into a standard OGC or well-known format. This list includes, but is not limited to, geoTiff, JPEG, JPEG2000, ERDAS img, ArcInfo ASCII or Binary grid, MrSid. Additional formats may be used with approval. Where possible, styling information should be provided in SLD format. All files must include projection parameters.

Tabular data: Tabular data must be converted into a readily accessible or well-known format. This list includes, but is not limited to, CSV, tab delimited text file, or spreadsheet. Additional formats may be used with approval.

Media/method of transfer: All data sets must be uploaded to the database.

Licensing: All data procured and developed for this project done on the requirement of the client. Usage shall be guaranteed to the client; therefore, all licensing agreements must be made similarly. The license includes the right of client (and sub-licensees) to freely use and distribute data.

Implementation Arrangements

The Consultant firm/individual consultant will work closely with Land Use Planning, Government of AJK and World Bank through the Project Director, DCRIP.

After the inception stage, the Consultant firm shall prepare a detailed schedule and work-flow diagram to carry out the studies as per agreed TORs and mechanism of coordination with the client and other related entities. The inception stage would involve stakeholder consultations with officials, appropriate decision makers, community groups etc. to determine output requirements.

The consulting firm will bound to work under the supervision of Director GIS LUP to carry out desk & field based activities under assigned studies on behalf and direction of the Project Director, Project Implementation Unit, P&DD AJK. Subsequently, the form will be liable to take the technical staff of LUP on board during field interventions and data analysis stage. In response, the firm will compensate the deputed technical staff of LUP by providing them TA/DA according to the admissible govt. rates from their lump sum payment. The Project Lead from the Consultant's will be the principal contact and will be expected to be readily available during project implementation. The Consultant shall be responsible for all aspects of performance of services as set forth in the Components of this TOR.

Duration of the Assignment:

Duration of the contract would be 12 months from mobilization.

Schedule for Completion of Outputs:

Outputs	Completion date
<p>Component 1: Study on soil investigation, soil profile, soil series mapping, soil erosion mapping at scale 1: 50,000 of Muzaffarabad, Bagh, Haveli and Poonch Districts in AJK.</p> <p>Outputs</p> <ol style="list-style-type: none"> 1. Inception report 2. Geo-referenced Soil Profile layer and database with associated attributes based on standard information 3. Report on detail soil investigation/profile study 4. Develop Atlas in the form of output maps at scale 1:10,000 and 1: 50,000 5. Provision of soft GIS datasets generated in GIS format. 6. Provision of final maps at different scales. 7. Provision of Final Report in soft and hard format with at least 50 copies on 120 gram glassing paper. 	<p>Within 7-9 months of contract signing</p>

<p>Component 2:</p> <ol style="list-style-type: none"> 1. All databases, maps and catalogues that form inputs into probabilistic seismic hazard assessment 2. A technical report describing the data collected, its limitations and recommendations to improve datasets progressively through time 	<p>Within 5 months of contract signing</p>
<p>Component 3:</p> <ol style="list-style-type: none"> 2. All databases, maps and catalogues that form inputs into flood hazard assessment 3. A technical report describing the data collected, its limitations and recommendations to improve datasets progressively through time 	<p>Within 6 months of contract signing</p>
<p>Component 4:</p> <ol style="list-style-type: none"> 1. Geo-spatial data layers and exposure geo-hazard database and maps for each aspect of exposure outlined in Component 4 2. A technical report describing the data collected, its limitations and recommendations to improve datasets progressively through time. 	<p>Within 7 months of contract signing</p>
<p>Component 5:</p> <ol style="list-style-type: none"> 1. Probabilistic Seismic Hazard and Risk Assessment and model for AJ&K 2. Deterministic seismic Impact Analysis for AJ&K 3. Flood hazard (1D) and impact analysis for 1/5 year, 1/20 year, 1/100 year and 1/200-year flood events for AJ&K 	<p>Within 10 months of contract signing</p>
<p>Component 6:</p> <ol style="list-style-type: none"> 1. Landslide data inventory, susceptibility analysis and GLOF inventory. 2. A technical report describing the data collected, its limitations and recommendations to improve datasets progressively through time. 	<p>Within 4 months of contract signing</p>
<p>Component 7:</p> <ol style="list-style-type: none"> 1. Final Report of Component 1-6. 2. Datasets uploaded onto the State level GID database hosted in LUP,P&DD 	<p>Within 11 months of contract signing</p>
<p>Component 8: Climate Change Impact Analysis of AJ&K Outputs; -</p> <ol style="list-style-type: none"> 1. Detail report of the study indicating detail description of methodology followed for the assessment. 2. Conduct state level orientation and validation workshop. 3. Future projections of availability of water resources for hydropower project. 4. Recommendations to improve the engineering aspect of future physical infrastructure and hydropower projects. 5. Following Digital Maps 6. Climate Change Vulnerability Map 7. The Velocity of Climate Change 8. Deforestation Map 9. Vegetative Cover and species Mapping 10. Surface and Ground water potential map 11. Environmental protection and degradation mapping 12. Agro-climatic zones of 10 districts 13. Physiographic zoning of AJ&K at Macro level and Micro Level 14. Agro-ecological climatic zones of AJ&K at Macro level and district- 	<p>8 to 9 months will be required to carry out the study according to the TORs after completion of the component 2 to 7.</p>

wise at micro level	
Component 9: 1. Training and capacity building of Government of AJ&K technical staff. 2. Workshop manual development	Within 12 months of contract signing

Indicative Payment Structure:

The ‘Consultant’ will be paid the lump-sum amount for undertaking the assignment according to the submission of concerned lines department acceptance and client’s approval of deliverables under different components. All other costs would be considered included in the lump-sum costs. Taxes applicable in AJK will be deducted as per AJK financial rules. The consultancy firm/individual will be liable to provide the travelling allowance to deputed Land Use Planning Staff in the light of government admissible rates.

Event Triggering Tranche Payment	Percentage Payment of Final Contract Amount
Tranche 1: Mobilization Payment	10%
Tranche 2: Inception Report and procurement of datasets	35%
Tranche 3: Delivery of final report, maps and datasets generated under each component(Hard & Soft format)	35%
Tranche 4: Upon Acceptance of Final Report, maps and datasets as well as arrangement of specialized training for key technical staff associated with respective studies on applications of GIS & RS for managing disasters in foreign countries where available.	20%

Coordination:

1. The consulting firm will report to the Project Director, DCRIP, AJ&K.
2. The consulting firm will coordinate and keep close liaison pertaining to assigned studies and related task with LUP on behalf of the Project Director, Project Implementation Unit, P&DD AJK.
3. All studies work proposed by LUP for relevant departments and others must be accepted by their authorities and must be approved by the Project Director, PIU, DCRIP on the recommendations and certifications of LUP.
4. The consulting firm will ensure to propose staff under each component of studies which have prior experience to GIS related technical studies.
5. The interested consultants shall be a tax registered national management related or special hazard and risk assessment, Soil investigation GIS based mapping and datasets consultancy firm or an international management consultancy firm incorporated for at least five (5) years for offering similar services and have completed similar projects of this scale and complexity and in comparable organizations. Names and short CVs of principals, proprietor, managing director, partners and directors, including their individual copy of the Registration Certificate with relevant professional bodies along with Details of the technical personnel available with the firm either as permanent staff or retainer consultants with their indicative qualifications and expertise should be provided.

6. The consulting firm/individual consultant will bound to follow the instructions mentioned in Survey of Pakistan (SOP) indent form as adopted by LUP regarding usage of restricted GIS data, layers and maps. In case of misuse of restricted data/maps or documents related to the assigned study for any other purpose or personal benefit, legal action will be taken against the consulting firm/individual consultant.
7. Consulting firm should possess good knowledge of the working of the Government of AJK, as well as of all concepts, principles and approaches required for the assignment.
8. Interested consulting firm(s)/ Joint Venture(s) must provide copies of the final deliverable or any other legal documents and Data Sheets of relevant (similar and specific experiences) assignments/works, duly substantiated, by the firm(s)/ Joint Venture(s) members either completed or in progress, with the following details for last Five (05) years.
 - a. Name of the Project
 - b. Cost of the Project
 - c. Name and address of the Client
 - d. If case of association of Consultant(s), the type of association i.e. either JV or sub-consultants be mentioned clearly along with names and address of all the partners.
 - e. Consultancy services rendered along with the Start & Completion Date.
9. A firm, which was a partner in a previous joint venture(s), should furnish a statement providing details of work, component of works performed individually and its over-all share (percentage) in the works performed by the joint
10. In accordance with World Bank Guidelines, an association of consultants can take either be in the form of joint venture (JV) or a subcontract (sub-consultancy). Therefore, the consultant submitting their Expression of Interest in association should clearly mention whether their association is a Joint Venture or Sub-consultancy. In case of Sub-consultancy association, the Lead Firm must be clearly mentioned in the EOI.
11. The consultant should ensure that all submitted information are correct and should provide any further information/clarification may be sought.
12. An EOI containing significant omissions/errors may not be considered. An EOI with misrepresentation of facts may be rejected at any stage till award of assignment
13. If the EOI consists of more than one volume, the applicant must clearly number the volumes constituting the EOI and provide an indexed table of contents for each volume. All documents should be proper numbered and securely bound w.
14. In case of foreign firm/consultants/individual or staff, the visa requirement will be fulfilled by the concerned and accordingly will get clearance/ NOC form the Economic Affairs Division and other relevant Ministries.
15. Consulting firm should propose adequate approach, methodology & work plan for timely and effective completion of assignment.

Evaluation criteria

Evaluation criteria for short listing will base on following marking criteria.

1. **General Experience** (The consultant should have completed at least five (05) similar sizes of projects of the same scale and/or complexity and in comparable organization to judge capacity and performance of the firm.) **(Maximum 30 Points)**
2. **Relevant Experience** The consultant should have completed at least five (05) similar projects of the same scale and/or complexity and in comparable organization. Experience of working with Government of AJ&K as independent or through joint venture should be preferred. Specific experience includes in Soil investigation, Geo-hazard, landslide susceptibility mapping and Climate Change resilience related studies. The firm should

have and demonstrate necessary experience and capacity of conducting aforementioned components of study. The firm should have a team having expertise of more than 5 years in the following areas Soil investigation/landforms/series mapping, Geo-hazard mapping, seismic hazard risk assessment, landslide inventory and susceptibility mapping, GIS & Remote Sensing and Climate change impact analysis. **(Maximum 40 Points)**

- 3. Management Capacity** The professionals/experts for proposed study should be Master/Ph.d in Soil Sciences, Geography/GIS/Remote Sensing, Seismic Risk Assessment, Geology, Environmental Sciences & Climate Change with 5 year's experience. **(Maximum 30 Points)**