Terms of Reference (TOR)

for a Consulting Firm for the

Design and Development of a Disaster Management Information System

Department of Disaster Management (DDM)
Thimphu, Bhutan

Bhutan Hydromet Services and Disaster Resilience Regional Project (HDSDRR)
Sub-Component B2
Contract ID No.:

Version: August 02, 2017

Abbreviations and Acronyms

ARG	Automatic Rain Gauge
AWOS	Aviation Weather Observation System
AWS	Automatic Weather Stations
BCR	Benefit-Cost Ratio
BWDIRP	Bhutan Weather and Disaster Risk Management Improvement Project
CAP	Common Alerting Protocol
CAS	Country Assistance Strategy
CBA	Cost-Benefit Analysis
CBDRM	Community Based Disaster Risk Management
CCA	Climate Change Adaptation
CPF	Country Partnership Framework
CSO	Civil Society Organization
DA	Designated Account
DDM	Department of Disaster Management
DHMS	Department of Hydromet Services
DM	Disaster Management
DMIS	Disaster Management Information System
DPA	Department of Public Accounts
DRM	Disaster Risk Management
DRR	Disaster Risk Reduction
EMF	Environmental Management Framework
EOC	Emergency Operations Center
ESMP	Environmental and Social Management Plan
EU	European Union
EWS	Early Warning System
FM	Financial Management
FMS	Financial Management Specialist
GAAP	Governance and Accountability Action Plan
GDP	Gross Domestic Product
GEO	Group on Earth Observations
GFDRR	Global Facility for Disaster Reduction and Recovery
GIS	Geographic Information System
GLOF	Glacier Lake Outburst Flood
GNHC	Gross National Happiness Commission
GPS	Global Positioning System
GRS	Grievance Redress Service
GTS	Global Telecommunications System
HFA	The Hyogo Framework for Action 2005-2015
IBRD	International Bank for Reconstruction and Development

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1.0 Background and Context

The World Bank has provided a grant to improve weather services and strengthen capacity of Disaster Risk Reduction (DRR) and Emergency Management (EM) systems in Bhutan through the Bhutan Hydromet Services and Disaster Resilience Regional Project (HSDRRP). The HSDRRP seeks to strengthen the Royal Government of Bhutan's capacity to provide weather and hydrological forecasting services including delivery in priority sectors and disaster related early warning systems and improve national and district level capacity for disaster preparedness and response.

At the national level, the institutional beneficiaries of the project are the (i) National Center for Hydrology and Meteorology (NCHM), which is mandated to provide weather and climate information and services; (ii) Department of Disaster Management (DDM), which is the overall coordinating agency for Disaster Risk Management (DRM) in the country; (iii) Department of Agriculture (DOA), which is mandated to improve livelihood in terms of crops production and disseminating information to facilitate the agriculture-dependent population.

Improved meteorological and hydrological services will also benefit users in a wide range of sectors including disaster management, civil aviation, agriculture, water infrastructure design, subnational government agencies and local communities, particularly those responsible for supporting climate-sensitive sectors. In this particularly, the aviation sector will greatly benefit which will also increase the safety of air travellers. At the economy-wide level, improved weather and hydro-met services will benefit Bhutan's general public and key weather and climate-sensitive sectors. Similarly, strengthened preparedness and response capacity for disaster management would benefit the entire nation. Under this project, particularly the Royal Bhutan Helicopter Services Limited will benefit which will establish an air search and rescue capacity in the country as well as emergency medical evacuation and aerial forest fire suppression capacities.

The Project seeks to strengthen the capacity of NCHM, DDM, DOA and RBHSL yielding benefits both at national and regional levels. National benefits include improved weather and climate services and strengthen disaster early warning systems and response capacity. The project has three main components:

- Component A: Hydromet Services Improvement
- Component B: Disaster Preparedness and Response Capacity Improvement
- Component C: Design of an agromet decision support system

This activity pertains to **Component B: Disaster Preparedness and Response Capacity Improvement.** The main objective of this component is to strengthen capacity for disaster preparedness and response. This component is implemented by the DDM and has two subcomponents:

- Sub-component B1: Establishment of critical emergency infrastructure.
- Sub-component B2: Institutional Capacity Strengthening, Regional Collaboration, Project Management and Monitoring and Evaluation

2.0 DMIS Activity in the HSDRRP Subcomponent B2

The overall expected outcome of this project sub-component is to establish a functional Disaster Management Information System that may be used centrally for planning purposes as well as during response situations within the NEOC and DEOCs. Success will be measured along two performance

criteria using their associated indicators and baseline values:

1. **Completion of Disaster Management Information System (DMIS).**
    - **Indicator 1.1** – Detailed system requirement study is complete and reflects input gained collaboratively from core users across key ministries, districts, critical infrastructure owner/operators, municipalities and other key partners.
        - *Indicator 1.1 Baseline* – Department already has some system requirements. However, this needs to be reviewed with the current and future system users.

    - **Indicator 1.2** – The DMIS has been created through a transparent engagement with DDM for input and revisions tracking.
        - *Indicator 1.2 Baseline* – The indicator baseline is currently nil as the DMIS project management structure, including clear timelines and engagement process has not been developed.

2. **Functional DMIS in place.**
    - **Indicator 2.1** – User acceptance testing is complete and DMIS is successfully installed at temporary NEOC, in DDM offices and all Districts.
        - *Indicator 2.1 Baseline* – The indicator baseline is currently nil as the new DMIS has not been developed.
    - **Indicator 2.2** – A minimum of twenty (20) new DMIS users will be fully trained on the new DMIS system.
        - *Indicator 2.2 Baseline* – The indicator baseline is currently nil as the new DMIS has not been developed.

3.0 Rationale and Objectives

Information and communication play a vital role in coordinating disaster management. Correct information and timely communication helps government manage disaster pro-actively rather than responding reactively. Moreover, it empowers the vulnerable communities to defend themselves against impending risk posed by natural hazards.

The Disaster Management Act of Bhutan 2013 entrusts the Department of Disaster Management (DDM) as a national coordinating agency for disaster management in the country. The Act gave DDM a mandate to develop, maintain and update Disaster Management Information System (DMIS) in coordination with relevant agencies.

Upon the establishment of DDM, the vital role of disaster information and communication was felt when the country was devastated by Cyclone Aila in May and 6.1 magnitude of earthquake in September in the same year, 2009. During the time of those twin disasters, event information was a nerve centre for the government to intervene in saving lives and properties and providing appropriate relief support to the affected communities.

In 2010, DDM initiated development of DMIS to keep track record of pre-crisis information and subsequently developed a post-disaster needs assessment tool as well as post-event mapping tool to better track community-level impacts. An overview of these existing three systems are as follows:

a) Disaster Management Information System (DMIS) for pre-disaster assessment; This is a web-

based information system to keep record of relief items such as Search & Rescue (SAR) equipment and Telecommunications; Infrastructure inventory such as Roads, Health, Education and Religious structures; Capacity development records, contact information of Dzongkhag Disaster Management Officer (DDMO) and SAR team members and Officials trained on DM. This system was expected to give comprehensive information on pre-crisis data.

b) **Bhutan Disaster Assessment (BDA) tools is a** form prepared in Microsoft word for the assessment immediately during and after the disaster to determine needs of the affected communities. The BDA covers the needs of the following sectors:

i. Education
ii. Protection
iii. Shelter
iv. Health & Nutrition
v. WASH (Water, Sanitation and Hygiene)
vi. Food & Livelihoods
vii. Transport & Communications
viii. Culture

The BDA tools were developed for three different categories based on the time from the onset of disaster.

i. Preliminary Disaster Report: to be used for preliminary damage assessment within 24 hours from the onset of disaster.
ii. Initial Assessment of Disaster Scenario (IADS): to be used for the assessment of the damages within 72 hours from the onset of disaster.
iii. Local Authority Assessment (LAA) and Household Level Assessment (HLA). To be used within 15 days from the onset of disaster.

c) **DesInventar** is a conceptual and methodological tool for the generation of National Disaster Inventories and the construction of database of damage, losses and in general the effects of disasters.

Despite having these information systems in place, the operational impact is limited, meaning the end-users rarely use those information systems and that, since their creation, the systems have become obsolete. Considering the lessons learned from these systems and the comments received from different agencies, DDM intends to review, improve and integrate the information and tasks supported by those systems and ensure availability of one system that is integrated, workable and user-friendly.

This objective of this Terms of Reference is to engage a qualified Consultant with proven technical expertise and background in Disaster Management Information System design and associated experience in application development to design and develop a Disaster Management Information System for DDM. This will be done through modernization and integration of existing DDM systems into a cohesive, easy-to-use platform for planning, preparing and responding to emergencies and disasters.

4.0 Scope of Work

The Scope of the consultancy describes the critical tasks, their sequencing, and the expected

deliverables associated with each task to be completed by the Consultant:

Task List

Task 1: Confirm and consolidate existing information in a database and outline any critical information gaps that may need to be addressed to complete a comprehensive user needs assessment for existing and near-future system requirements. This should include information on available hazard and vulnerability data. As with any DMIS, available data will likely increase over time. The Consultant will examine available reports and data sets to ensure the developed application is compatible with the various data sets, sensitivities and formats. As clarified in Section 5 – Implementation Arrangements, once the DMIS is available, DDM will be responsible for uploading data and for ensuring appropriate partner data-sharing agreements are in place if necessary to address data security and proprietary interest where it may exist. Documents available from the DDM project focal person to provide an initial sense of data quality and availability include the GIS Capacity Report completed by DDM in 2013, and the third draft of the Geo-information Policy created in 2017 by the National Land Commission Secretariat.

Task 2: Design the DMIS application, including accommodation of all identified user requirements as well as the general and detailed requirements noted in Appendix A. Where user requirements may not be met, the Consultant shall discuss the situation with DDM and present an explanation and options to the DMIS Technical Working Group for consideration. Once designed, the Consultant will brief the DDM project focal person as well as the DMIS Technical Working Group and provide the DMIS Wireframe Report for consideration and approval by DDM before proceeding to the next Task.

Based on the design, provide the list of hardware and if required software to be procured for installation and management of the DMIS. The consultant shall provide the technical specifications for all the hardware and software to be bought for this purpose and support the DDM in preparing the procurement package.

Task 3: Build, test and install a functional DMIS application at the temporary NEOC, DDM offices and offices of all District Disaster Management Officers. During the building of the DMIS, the minimum steps to be addressed by the Consultant should include development of the previously approved DMIS application wireframe, implementing the user interface, system development, internal quality testing of the various DMIS functions and comprehensive internal system testing. The Consultant will rely upon DDM to ensure appropriate data sets are uploaded for testing the system in such a way as to ensure the core data sets are safe from potential damage or corruption while the DMIS is in its development.

Once the beta version of the DMIS application is internally proven to be functional and stable, user acceptance testing should begin through the DMIS Technical Working Group. This testing may also be carried out through an operational sub-group of the DMIS Technical Working Group that is representative of most end users, including DDM staff, staff that may become 24/7 NEOC Duty Officers, District Disaster Management Officers, NaSART staff, staff from associated ministries with a DRM element to their function, e.g. hydro-met, and private sector critical infrastructure owner/operators.

Based on the outcomes of the user acceptance testing, the Consultant will compile and action necessary change requests to ensure the final DMIS application addresses initial user needs and identified practical modifications. The Consultant will work with the DDM project focal person to ensure change requests are in scope for the delivery of the DMIS application within the identified timeframe. Any change

requests that are not possible to address due to project time and/or resource constraints will be catalogued by the Consultant for consideration by DDM in the future.

Once all change requests have been addressed and the DMIS application appropriately modified, the Consultant will ensure installation of the DMIS application at DDM, the temporary NEOC, partner ministries and Districts.

A mobile application to be developed for the **Immediate Damage Assessment & Reporting Module,** which will have a maximum of 40 users only. The app should have the same disaster assessment forms with the drop down options as in the system to be developed. And should have the similar provision as the system where the data can be saved offline and submit it automatically when there is internet connection.

Task 4: Train DDM and others in the use and maintenance of the DMIS application. The Consultant will deliver online training based on a DMIS application User Guide to all potential users (a minimum of 20). This training will be created as an outline of the DMIS application, its purpose and core functions. A second training will be created and delivered to a minimum of six DDM staff or any potential system administrators that will act as DMIS application administrators. This training will address the content of the DMIS Maintenance Guide and ensure that various DMIS administrator accounts are active and enabled such that DDM can reasonably transition into the role of system administrator as the project comes to a close.

Deliverable List

Deliverable 1: Inception Report

The report shall describe the understanding of the objectives and tasks, the application development approach, schedule, staffing, project management approach, and the control process, including critical path, to ensure the project reaches its goals. This is due within two (2) months of project initiation.

Deliverable 2: Consolidated User Needs Assessment Report

The report shall confirm, consolidate and clarify user needs of the DMIS for use in all phases of disaster and emergency management. In addition to detailing the user needs of DDM, the report shall also describe the user needs for other ministries involved in disaster risk management as well as the user needs of Districts, National Search and Rescue Team and critical infrastructure owner/operators in the private sector. The report is due within four (4) months of project initiation.

Deliverable 3: Consolidated Hazard and Vulnerability Data Assessment Report

The report shall confirm, consolidate and clarify the data available for use in the DMIS, including its quality and scale, across all phases of disaster and emergency management. In addition to detailing the availability of existing data sets, the report shall also describe data gaps that may limit opportunity to complete fulsome risk assessments and prioritized decision-making for planning and response operations. The report is due within four (4) months of project initiation.

Deliverable 4: DMIS Wireframe Report

The report shall establish the general application architecture and function as well as confirmation that the application will work as both a server install and a web application if necessary. The report shall confirm that the DMIS application will be built to work using existing IT resources of identified users.

It shall also include a mock-up of the user interface, outline how each identified user requirement will be addressed, describe how the application will integrate for ease of use and how the requirements outlined in Appendix A will be met. This report shall be presented to, and approved by, DDM prior to the Consultant initiating the technical build of the DMIS application. The report is due within six (6) months of project initiation.

Deliverable 5: DMIS Beta Version and User Acceptance Testing Plan

The beta version of the DMIS application should be presented to the DMIS Technical Working Group for demonstration and installation made available only to the user acceptance testing team discussed in Task 4. This version should address all the elements identified in the DMIS Wireframe Report and have completed rigorous internal systems testing by the Consultant.

The mobile app to be developed only for the **Immediate Damage Assessment & Reporting Module,** where the Dzongkhags Disaster Management Officer can use for reporting on the event of disaster directly from the disaster sites. The mobile application should be compatible with the overall DMIS.

The User Acceptance Testing Plan should include timelines as a subset of the existing project plan. It should address no less than the test scenarios, tooling such as bug trackers and requirements traceability, code revision resourcing and timeline, entry and exit criteria for the testing, and a list of requirements for approval by DDM.

The DMIS application beta version and User Acceptance Testing Plan is due within nine (9) months of project initiation.

Deliverable 6: DMIS User Acceptance Testing Report

The report shall outline the findings of the user acceptance testing completed as part of Task 4 and as outlined in Deliverable 5. The report shall also include timelines for code changes to address findings as well as outline the process for any additional change requests that may arise through the DMIS Technical Working Group. The report is due within twelve (12) months of project initiation.

Deliverable 7: DMIS Final Installation

The final version of the DMIS application should be presented to the DMIS Technical Working Group for demonstration and installation completed for DDM, the temporary NEOC, District Disaster Management Officers, all ministries with DRM elements, National Search and Rescue Team and critical infrastructure owner/operators in the private sector. This version should address all the elements identified in the DMIS Wireframe Report as well as any items found through user acceptance testing. The final version should also include any accepted change requests made during or immediately after completion of user acceptance testing. The deliverable is required to be complete within 15 months of project initiation.

Deliverable 8: DMIS User Guide

The DMIS User Guide should ensure application users can effectively navigate and derive maximum utility from the DMIS. At minimum, the guide should include the following sections:

- General information, including a system overview and an outline of the how the guide is organized.
- System Summary, including system configuration, user access levels and contingencies.

- Getting Started, including installation and log in, system menu, changing user id and password and how to exit the application.
- Using the System, including details for each of the specific functions in the DMIS.
- Reporting, including capabilities and detailed procedure on how to output files for sharing external to the DMIS application.

The Consultant shall also develop an online training course based to be provided as part of the DMIS User Guide which will be hosted by DDM. This online content will provide a basic introduction to the DMIS application. The DMIS User Guide is due within 15 months of project initiation.

Deliverable 9: DMIS Administration and Maintenance Guide

The DMIS Administration and Maintenance Guide should follow a similar format as the DMIS User Guide, although with content provide for application administration and maintenance. This should include details regarding trouble-shooting, coding customizations, developing and installing patches, upgrading DMIS to keep pace with hardware and operating system advances, etc. The Consultant will provide training materials based on this guide and deliver a training session to a maximum of six DDM staff that may be identified as DMIS administrators. The DMIS Administration and Maintenance Guide is due within fifteen (15) months of project initiation.

Deliverable 10: Project Summary Report

The report shall provide details on the execution of the DMIS project, its achievements and accomplishments, its sustainability, its maintenance and improvement plan, and its training accomplishments. The final report should include an overall five-year schedule for maintenance and necessary upgrades. As well, the report should highlight collaborative opportunities with both internal and external agencies for improving use and utility of the DMIS. The report is due within fifteen (15) moths of project initiation.

Task List	Deliverable List
Task 1: User Requirement Gathering	**Deliverable 1**:Project Inception Report **Deliverable 2**:Consolidated User Needs Assessment Report **Deliverable 3**: Consolidated Hazard and Vulnerability Data Assessment Report
Task 2:High and Low level design for DMIS	**Deliverable 4:** DMIS Wireframe Report
Task 3: Development of DMIS	**Deliverable 5:** DMIS Beta Version and User Acceptance Testing Plan **Deliverable 6:**DMIS user acceptance test report
Task List 4:DMIS Training	**Deliverable 7:** DMIS Final Installation **Deliverable 8:** DMIS User Guide **Deliverable 9:** DMIS Administration and Maintenance Guide **Deliverable 10:** Project Summary Report

Please note that consultant shall follow Agile scrum development methodology as specified in the technical requirement in Appendix A (General and Detailed DMIS Requirements) with maximum of three iteration in the whole life cycle of system development.

5.0 Implementation Arrangements

The Consultant will work closely with and report to the DDM project focal person for the DMIS and work under the guidance of the technical working group established for the DMIS. Deliverable reports generated as per Section VII and submitted to DDM will also be shared by the Consultant with DDM for review and consideration. The Consultant is expected to join meetings on request by DDM when needed and as coordinated by the DDM project focal person.

To ensure comprehensive input and timely advice to the Consultant, DDM will create a DMIS Technical Working Group consisting of various organizations, agencies and government departments that may contribute to and/or use the DMIS. This working group may minimally meet quarterly beginning at the time of the Consultant's hire. Additional ad hoc meetings may be requested by the Consultant to the DDM project focal person as necessary.

The DDM project focal person will provide following administrative arrangements for the project duration:

a) Provide office space with Internet connectivity and access to a printer, especially during beta testing of the DMIS.
b) Uploading available data sets, with guidance from the Consultant, into the new DMIS application once the Consultant makes the beta DMIS available and prior to the Consultant engaging user acceptance testing.
c) Provide timely review and approvals of various reports to ensure the project timelines are met and that the project is not delayed due to lack of direction.
d) Arrange meetings with all the relevant stakeholders and the DMIS Technical Working Group.
e) Provide access to all the documents and data necessary for successful completion of the project.
f) Acceptance certificate shall be issued upon fulfilment of the contract and delivery of the functional DMIS application.

6.0 Selection Procedure and Qualifications

The firm will be selected following the World Bank's Guidelines: Selection and Use of Consulting Firm by the World Bank for Operational Purposes and form of contract would be Complex Lump Sum Contract.

The selected Consulting Firm is expected to have proven expertise and experience on Disaster Management Information System design and development; experience with database management and geomatics systems; as well as coaching and facilitation skills.

Minimum qualifications of the firm to be selected for the required assignment include:

a. More than 3 years of experience in the field of information technology, software application programming and information management, including experience with governments in developing countries, and including prior successful engagements in application development for large organizations.

b. The consulting firm should have a minimum annual financial turnover of USD $ 100,000.
c. Demonstrated competency in conceptualization, formulation, and execution of Disaster Information Management Systems of similar nature as the one specified here.
d. Consulting firm should bring among its team demonstrated expertise in the following fields: database management, data and software security, information and communications technology (ICT), web development and system programming/development, UI and UX design, geomatics, remote data collection and analysis, real-time data collection and analysis, programming for mobile platforms, disaster risk management, etc.
e. Competency in business administration, management consulting and project management.

The Consultant can be a domestic-led strategic partnership with an international Consulting Firm. The Consultant must demonstrate familiarity with international best practices for disaster management information systems and must demonstrate the ability to tailor DMIS advice to the needs and context of DDM.

7.0 Staffing Requirements

The Consultant should either be a fully domestic firm or an international partnership led by a domestic firm. International experience may be necessary to carry out the assignment due to its highly-specialized nature.

The Consultant should demonstrate the following advanced skill sets within its team as well as the indicative qualifications by individual and associated duration of each team member's involvement in the project:

- project management
- database management
- application/web development/programming
- programming for mobile platforms

8.0 Duration of Assignment

Duration of the contract is fifteen (15) months from project initiation. The first nine months will involve the conceptualization and design of the DMIS, including needs analysis, application framework and delivery of a fully functional beta-DMIS. The remaining six (6) months will involve beta-testing the DMIS, including functional tests across the spectrum of planned uses within DDM, the current transitional National Emergency Operations Center, District Emergency Operations Centers and field to simulate gathering of post-disaster needs assessment data. This second stage will also involve DMIS revisions based on user-acceptance testing to ensure the application is fully functional at the time of receipt by DDM. This two stage, phased approach will be followed as outlined above in Section 5 – Scope of Work.

9.0 Payment Schedule

The payment of the consultancy fee will be based on deliverables dependent on approval of all deliverables associated with that time period. The basis of payment of the consultancy will be equal percentage of the overall contract value through the duration of the contract.

All payments will be done after verification of the Consultant's bill and agreement is gained from the client.

The Consultant shall be paid consultancy fees quarterly in Bhutanese Ngultrum as per actual reporting and deployment based on quoted financial rates and amount.

10.0 Appendices

Appendix A: General and Detailed DMIS Requirements

General Requirements

While the Consultant will lead and complete the majority of DMIS development, the Consultant will seek advisory support and design input from DDM during the building of the core modules of the new DMIS. The following considerations will be addressed throughout the DMIS development:

a) **Pre-crisis Data Module:** A database which consists of the inventory of equipment, personnel and facility resources distributed across all Dzongkhags. This would include items such disaster relief supplies, search and rescue equipment, communication radios, etc. As well, location and attributes for items such as critical infrastructure, details of emergency contact information, and records of personnel trained on certain roles should be captured within this module. The system should be able to generate report based on the user requirements, including web-GIS based map. Information on critical infrastructure/equipment to be deployed during emergencies by the responsible agencies should be updated periodically.

b) **Immediate Damage Assessment & Reporting Module:** This module should be based on the existing BDA. The parameters of the BDA will be reviewed during the development of the system. The application system developed should provide the option to feed in data off-line, which can be uploaded automatically online when internet is available. This module should also include an option to upload images and videos. This module should be able to generate report based on the user requirements, including web-GIS based map. A mobile application should be developed for this module

c) **Analytic tool Module:** Conceptually similar to DesInventar, this module shall keep records of all past spatial-based hazard events and their associated consequences. The module should include tools which enable the user to filter the data as required for analysis. Multiple analytic outputs should be built in to the module to allow results to be viewed in a variety of ways, such as tables, graphs and maps.

d) **Risk Mapping Module:** In this module, information on hazard, vulnerability and risk mapping being developed by responsible agencies shall be uploaded or linked with their website.

e) **DRR related activities/projects Module:** This module should keep the track record of DRR related activities being implemented by various agencies, both completed and on-going. It should have general and advanced search features. The attributes for the advanced search features will be finalized based on consultations during the assignment period.

f) The Consultant will complete the works described in this ToR within the fifteen (15) month project duration, beginning at the time the contract is awarded.

g) The Consultant should expect to conduct the majority of service delivery remotely. However, it will be expected that the consultant will be available to attend the offices of DDM for design meetings, user acceptance testing, training and whenever required for discussions.

h) The Consultant is required to consider and act upon the suggestions, recommendations, and direction given by the RGoB throughout the project until completion.

i) The Consultant shall work with DDM project staff to identify programming gaps and identify multiple solution options for consideration by DDM, including the relative strengths and drawbacks of each option, prior to determining the direction for the application.

j) The Consultant shall prepare all necessary reports, documents, necessary to track performance, including meeting minutes/summaries.

k) The Consultant shall prepare a Standard Operating Procedure that is agreed to by DDM and

based on input from the DMIS Technical Working Group for the transfer and/or sharing of information and data from the various agencies whose information and data is required for comprehensive decision-making during all phases of disaster and emergencies.

Technical Requirements

The proposed DMIS that will be constructed by the Consultant based on the DDM technical team input should generally align to the following technical requirements and functionalities as a minimum.

a) Use responsive web design technologies.
b) Implement data validation for both client and server (e.g. AJAX technologies, JavaScript, etc.).
c) Coding with the principle of Don't Repeat Yourself (DRY).
d) Implementation of Search, Save, Create, Read, Update, Delete (SCRUD) operations.
e) Adopt Role-Based Access Control (RBAC) to authorize users access to system resources based on roles.
f) Maintain consistent aesthetics and UI of the software.
g) Ensure compatibility to all common internet browsers (Mozilla Firefox, Internet Explorer, Google Chrome, Opera, Safari, etc.).
h) Ensure software is scalable and upgradeable as and when the number of users and contents increases.
i) Maintain and ensure that the web-based software system supports maximum concurrent users.
j) The system should run optimally (page load time below 30 seconds) on a PC connected to a network with minimum bandwidth of 512 kbps.
k) Image and other content customization features should be in-built within the system to allow standard content sizes (e.g. standard image sizes for easy uploading and processing).
l) The web-based software should have provision to support bi-lingual (English and Dzongkha) and interactive maps. This requirement can be provisioned both from front-end APIs and backend database system design by incorporating appropriate UTF based locale support.
m) Access to different DMIS modules will be designed using a common log on. The DDM developers shall endeavour to make this efficient, fast and easy for users while provisioning DDM with the management of access rights for individual users and user groups.
n) A modular based approach and Agile scrum development methodology must be used for the design and development of the system to ensure all requirements and feedbacks of the client are identified and incorporated. The agile application development process is recommended to be implemented using some agile (preferably, SCRUM framework) project management tools.
o) DDM shall be the sole owner of the source code, user manuals, software requirement specifications, test reports and all documents related to this project.

Development Platform Requirements

DDM and the Consultant shall comply with the Electronic Government Interoperability Framework (e-GIF) during the development of the system. The following technologies and standards will also be considered.

a) Development Language: The system development is recommended to be implemented using Open Source Language most preferably but not limited to PHP using web based framework supporting Model View Controller (MVC) model (most preferably but not limited to Laravel Framework, since the DDM project managers has been trained on this platform). Recommended versions include:
   - PHP 5.6 or later

- HTML 5 or later
- Python (front end scripting)
- Java Script (front end scripting)
- Ruby 2.4.x
- Java 7 onwards

b) Database System: The database for the application is recommended to be implemented using Open Source Database most preferably MySQL v5.7.x onwards.
Recommend database versions include:
- mySQL 5.7.x or later
- PostgreSQL 9.6 or later
- Oracle

Recommended webservers include:
- NGiNX 1.10.1 or later (for Application server)
- GeoServer (for GIS server)

Recommended Front End UI:
- Bootstrap v3 or later
- Open Layers for map
-

c) Database Design and Modelling: Comply to e-GIF Data standards such as Table naming conventions, data modelling, data types, codes, etc.

Security Requirements
In development of the DMIS, the following security considerations will be addressed.

d) Adherence to the government's Information Management and Security Policy (IMSP) document during development and implementation.
e) The system should provide audit trails and logging mechanisms for content changes performed by system users.
f) Maintain time series data so that certain information is not lost with passage of time and repeated updating.
g) Include up-to-date CAPTCHA program as a remedy to stop spam and other intrusions wherever required.
h) Handle Session Hijacking, session replay, etc.
i) Input Validation to prevent attacks such as buffer overflows, cross-site scripting, SQL Injection, etc.

Appendix B: Task Schedule Summary

Task No.	Task Title	Project Quarter				
		1	2	3	4	5
1	Confirm and consolidate user needs and system requirements.					
2	Confirm and consolidate data availability.					
3	Design of new DMIS application					
4	Build, install and test new DMIS application					
5	Train users and system administrators					

Appendix C: Deliverable Schedule Summary

Deliverable No.	Deliverable Title	Project Quarter				
		1	2	3	4	5
1	Project Inception Report					
2	Consolidated User Needs Assessment Report					
3	Consolidated Hazard and Vulnerability Data Assessment Report					
4	DMIS Wireframe Report					
5	DMIS Beta Version and User Acceptance Testing Plan					
6	DMIS User Acceptance Testing Report					
7	DMIS Final Installation Report					
8	DMIS User Guide					
9	DMIS Administration and Maintenance Guide					
10	Project Summary Report					

Appendix D: Deliverable Summary Table

Output No.	Output Title	Frequency	Due Date	No. of Hard Copies	No. of Digital Copies
1	Project Inception Report	One time	Within two (2) months of project initiation	2	2
2	Consolidated User Needs Assessment Report	One time	Within four (4) months of project initiation	2	2
3	Consolidated Hazard and Vulnerability Data Assessment Report	One time	Within four (4) months of project initiation	2	2

4	DMIS Wireframe Report	One time	Within six (6) months of project initiation	2	2
5	DMIS Beta Version and User Acceptance Testing Plan	One time	Within nine (9) months of project initiation	2	2
6	DMIS User Acceptance Testing Report	One time	Within twelve (12) months of project initiation	2	2
7	DMIS Final Installation Report	One time	Within fifteen (15) months of project initiation	2	2
8	DMIS User Guide	One time	Within fifteen (15) months of project initiation	2	2
9	DMIS Administration and Maintenance Guide	One time	Within fifteen (15) months of project initiation	2	2
10	Project Summary Report	One time	Within fifteen (15) months of project initiation	2	2