

**Democratic Socialist Republic of Sri Lanka
Ministry of Defence**



National Building Research Institute (NBRI)



**Reduction of Landslide Vulnerability by Mitigation Measures Project (RLVMMP)
funded
by Asian Infrastructure Investment Bank (AIIB)
(Loan No: L0124A)**

Terms of Reference (TOR)

Consultancy Services

for

**The Development of a Landslide Asset Management System
(LAMS) for the National Building Research Institute (NBRI)
under the AIIB-funded Reduction of Landslide Vulnerability by
Mitigation Measures Project (RLVMMP)**

Contract No: RLVMMP / CONSUL / Comp.04 / Asst.M / 10

Consultant's Name:

September 29, 2026.

GLOSSARY AND ACRONYMS

AIIB	Asian Infrastructure Investment Bank
CPCC	Cabinet Appointed Consultant Procurement Committee
EOI	Expression of Interest
GOSL	Government of Sri Lanka
JV	Joint Venture
LAMS	Landslide Asset Management System
MDBs	Multilateral Development Banks
MoD	Ministry of Defence
NBRI	National Building Research Institute
NPA	National Procurement Agency
PMU	Project Management Unit
QCBS	Quality and Cost Based Selection
REOI	Request for Expressions of Interest
RLVMMP	Reduction of Landslide Vulnerability by Mitigation Measures Project
SC	Supervision Consultant
TOR	Terms of Reference

Terms of Reference (ToR)

Development of a Landslide Asset Management System (LAMS) for the National Building Research Organisation (NBRI)

1. Introduction

- 1.1. The Government of Sri Lanka (GOSL) is funding the implementation of the “Reduction of Landslide Vulnerability by Mitigation Measures Project (RLVMMP)” through a loan facility obtained from the Asian Infrastructure Investment Bank (AIIB). The Ministry of Defence (MoD) is the Executing Agency (EA) for the RLVMMP, which is represented by the Project Management Unit (PMU) of RLVMMP, and the National Building Research Institute (NBRI) is the Implementing Agency (IA) for the project. The RLVMMP is identified as one of the positive steps taken by the Ministry of Defence (MoD) to achieve its “vision 2025”.
- 1.2. The Ministry of Defence, which is represented by the Project Management Unit (PMU) of RLVMMP is seeking proposals from qualified consultants to design, develop, and implement a Landslide Asset Management System (LAMS). This system will serve as an innovative, technology-driven solution to enhance the management, monitoring, and maintenance of mitigation measures deployed to reduce landslide risks across the country. The LAMS aims to improve operational efficiency, ensure the longevity and effectiveness of mitigation assets, and provide NBRI with a scalable tool to adapt to future needs. The MoD, represented by the PMU of RLVMMP, invites consultants with proven technical expertise and a deep understanding of asset management systems to deliver a tailored, robust, and user-friendly solution that aligns with its mission to safeguard communities from landslide hazards.

2. Background

- 2.1. As a leading authority in landslide risk mitigation, NBRI has deployed a range of structural measures including earth retaining systems, surface and subsurface drainage management systems, rock fall protection systems, and debris flow barriers as well as monitoring instruments such as groundwater level meters, inclinometers, and extensometers to protect vulnerable areas. The continued functionality of these assets, implemented across diverse terrains and climatic conditions, is vital to ensuring the effectiveness of the mitigation measures. Consistent monitoring and timely maintenance are necessary for these systems to remain functional effectively and efficiently. Historically, NBRI has relied on manual processes and fragmented data systems, which have posed challenges in tracking asset conditions, scheduling maintenance, and generating actionable insights. The LAMS will address these gaps by providing a centralized digital platform to consolidate asset data, automate workflows, and enable evidence-based decision-making. This initiative aligns with NBRI’s broader goal of enhancing disaster resilience through technology and innovation.
- 2.2. **Landslide Information Management System (LIMS):** The LIMS, maintained by the NBRI, serves as the central repository for landslide-related information in Sri Lanka, including incident records, investigation reports, geospatial data, hazard assessments, and administrative information. LIMS provides a centralized digital platform through which district officers and authorized personnel record and manage data collected during field investigations. When a landslide incident is reported to NBRI, the incident details, site

observations, and technical assessment parameters are documented and entered the system. These records undergo quality assurance procedures and formal approval workflows at both district and national levels before becoming available to authorized users. In addition to securely managing landslide information, LIMS facilitates automated report generation, advanced data retrieval, and visualization of landslide incidents through interactive dashboards, thereby supporting efficient decision-making, research, and disaster risk management.

2.3. LAMS: The LAMS, as proposed under this consultancy, represents a significant advancement beyond LIMS by:

- Integrating asset management – extending beyond incident documentation to comprehensive tracking of mitigation measures (retaining walls, drainage systems, protection structures), their specifications, installation dates, and maintenance history.
- Risk-based prioritization – implementing quantitative risk assessment frameworks combining hazard analysis, consequence modeling, and spatial analysis to rank sites for mitigation investment and resource allocation.
- Preventive maintenance planning – automating maintenance scheduling, task assignment, tracking, and asset lifecycle management to extend asset functionality and reduce downtime.
- Decision support – providing analytics dashboards, visualizations, and customizable reports to support evidence-based resource allocation and investment prioritization.
- Scalability – accommodating future technological enhancements (IoT sensors, real-time monitoring, AI-based forecasting) and expanding asset type coverage.

2.4. For example, documents such as the "Operating & Maintenance Manual" submitted for the Reduction of Landslide Vulnerability by Mitigating Measures Project (RLVMMP/WORKS/05B) at the Nursing School Kandy highlight the existing reliance on hard-copy records and project-specific documentation. The LAMS will digitize and streamline such processes, ensuring seamless access to critical information across projects.

2.5. The LAMS is a critical component of RLVMMP, which aims to enhance landslide risk reduction across Sri Lanka through the implementation of mitigation measures and improved management systems. The RLVMMP is supported by AIIB, which provides financial assistance to strengthen disaster resilience in vulnerable communities. The development of the LAMS, including all associated consultancy services, system design, and implementation activities, is to be funded by the loan proceeds from the AIIB, ensuring alignment with the project's objectives and international standards for sustainable development

3. Objectives

The LAMS is envisioned as a transformative tool with the following objectives:

- **Comprehensive Asset Database:** Establish a centralized repository of all mitigation measures, capturing details such as design specifications, geographic coordinates, construction history, and current condition.

- **Systematic Monitoring:** Facilitate real-time and periodic assessment of asset health through structured data collection, analysis, and visualization tools.
- **Automated Maintenance Management:** Standardize and automate the planning, scheduling, and tracking of maintenance activities to maintain the functionality, minimize downtime and extend asset lifespan.
- **Landslide Inventory Database:** Establish a dedicated Landslide Inventory Module for all major landslide incidents investigated (location/GPS, date of occurrence, photographic evidence, investigation reports, volume/magnitude estimates, type of movement, trigger factors).
- **Decision Support:** Equip NBRI with advanced analytical tools and customizable reports to evaluate asset performance, identify risks, and prioritize resource allocation.
- **Performance Forecast:** Provide information on future maintenance needs and landslide risks based on historical data and modeling using artificial intelligence (AI).
- **Scalability and Adaptability:** Ensure the system can accommodate future enhancements, such as integration with emerging technologies (e.g., Internet of Things (IoT) sensors) or expansion to additional asset types.

4. Scope of Work

The consultant will undertake a holistic approach to deliver a fully functional LAMS. The scope includes the following key tasks, including Annexure - 01:

4.1. Requirement Analysis

- Engage with NBRI staff, field engineers, and other stakeholders through workshops, interviews, and site visits to identify functional and technical requirements.
- Analyse existing workflows, data sources (e.g., GIS databases, maintenance logs), and pain points in asset management.
- Document user stories, system specifications, and performance expectations in a detailed requirement specification report.
- Conduct a comprehensive review of NBRI's existing LIMS to ensure seamless integration with LAMS:
 - Review LIMS architecture, including data models, Application Programming Interface (API) specifications, and current workflows
 - Document existing LIMS data structures, field schemas, and reporting capabilities
 - Assess interoperability requirements and identify data synchronization gaps
 - Develop detailed integration specifications for bi-directional data exchange between LAMS and LIMS
 - Propose data mapping protocols to ensure consistency between systems
 - Identify and resolve potential conflicts in terminology, coding standards, and data validation rules
 - Recommend authentication and authorization frameworks for secure inter-system communication

- Review existing platforms similar to LAMSs in other countries and identify good practices and lessons learned to be integrated into the LAMS design for Sri Lanka.

4.2. System Design

- Design a scalable system architecture, including:
 - A relational database for asset data storage and retrieval.
 - Intuitive user interfaces (web and mobile) optimized for diverse users (e.g., engineers, administrators).
 - APIs for integrating external systems (e.g., GIS, weather forecasting tools).
- Incorporate cybersecurity measures (e.g., encryption, authentication) to protect sensitive data.
- Ensure the design supports offline functionality and scalability for future enhancements.

4.3. Development

- Build a web-based application with mobile compatibility, featuring:
 - **Asset Inventory Management:** Record details such as asset type (e.g., retaining wall, drainage system), location (GPS coordinates), materials used, installation date, and photographic documentation.
 - **Landslide Inventory Module:** Integrate with NBRI's existing LIMS for all major landslide incidents investigated, capturing location/GPS coordinates, date of occurrence, photographic evidence, investigation reports, volume/magnitude estimates, type of movement, and trigger factors. The module shall support a prioritization engine to rank sites for mitigation works based on hazard scores and risk levels, enabling evidence-based allocation of resources for mitigation interventions.
 - **Monitoring Module:** Enable manual data entry (e.g., inspection reports) and, where feasible, automated data feeds (e.g., from sensors measuring soil moisture or field instrument readings).
 - **Maintenance Scheduler:** Automate maintenance reminders, assign tasks to teams, and track completion status with audit trails.
 - **Analytics Dashboard:** Provide visualizations (e.g., graphs, heatmaps, risk curves) and reports on asset conditions, maintenance history, hazard (magnitude-frequency relations and annual probabilities/return periods), consequence (monetary losses), and overall risk levels to support evidence-based prioritization of mitigation-ready sites.
 - **User Management:** Implement role-based access (e.g., admin, field staff, analyst) with customizable permissions.

4.4. Integration

- Integrate with NBRI's Landslide Resilience Analytical and Advisory System (LA-Res)¹ platform for spatial visualization of mitigation assets on maps. Ensure LAMS asset locations and mitigation measures are displayed within the LA-Res spatial framework, enabling map-based asset queries, geographic distribution analysis, and seamless integration with the broader landslide risk reduction monitoring and decision-support infrastructure.
- Explore compatibility with external data sources, such as meteorological data, for predictive maintenance.
- Bi-directional data exchange with NBRI's existing LIMS for landslide incident records and investigation reports to enable seamless import of potential landslide locations and export of prioritized mitigation candidates.

4.5. Field Data Collection

- Develop offline-capable mobile tools for field staff to record observations, upload photos, and log maintenance activities in remote areas.
- Support NBRI to collect field data to be utilized during the subsequent testing.
- Enable automatic synchronization of offline data when connectivity is restored.

4.6. Testing

- Conduct rigorous testing, including:
 - Functional testing to verify that all features work as intended.
 - Performance testing to ensure the system handles large datasets and concurrent users.
 - Security testing to safeguard against breaches or unauthorized access.
 - User acceptance testing (UAT) with NBRI staff to confirm usability and reliability.

4.7. Deployment

- Deploy the system on NBRI's preferred infrastructure (on-premises servers or a secure cloud platform).
- Ensure a smooth transition by migrating existing data and validating system performance in a live environment.

¹ The Landslide Resilience Analytical and Advisory System (LA-Res) is a platform being developed by NBRI to support landslide risk analysis and decision-making in Sri Lanka. It integrates high-resolution LiDAR-based 2D/3D terrain visualization, demographic and infrastructure data overlays (demographic, infrastructure, hazard layers), real-time monitoring dashboards (weather, IoT sensors, early warnings), and stakeholder coordination tools to strengthen landslide risk management across national and sub national-level agencies.

4.8. Training

- Deliver comprehensive, physical, hands-on training sessions for 50 Nos of NBRI staff, tailored to different user roles (e.g., field inspectors, data analysts, administrators).
- Provide ongoing support during the initial adoption phase to build confidence and proficiency.

4.9. Documentation

- Produce comprehensive guides, including:
 - User manuals with step-by-step instructions and troubleshooting tips.
 - Technical documentation detailing system architecture, code structure, and APIs.
 - Maintenance protocols for NBRI's IT team to ensure long-term system health.

4.10. Support

- Offer a minimum of 12 months of post-implementation support, including bug fixes, minor updates, and technical assistance within a 30-month comprehensive warranty period.
- Propose a plan for optional long-term maintenance and system evolution.

4.11. Hardware Recommendations

- Assess the feasibility of integrating real-time monitoring hardware (e.g., IoT sensors for slope stability or water levels) and recommend specific solutions, including cost estimates and installation considerations.

5. Deliverables

The consultant will provide the following outputs:

- A detailed Requirement Specification Document outlining user needs and system functionality.
- A System Design Document with architecture diagrams, database schemas, and integration plans.
- An offline-capable mobile tool to gather field data.
- A fully functional Landslide Asset Management System (web and mobile versions), including source code and deployment scripts.
- Test Reports documenting results from functional, performance, security, and user acceptance tests.
- User Manuals and Technical Documentation for end-users and IT staff.
- Training Materials (e.g., slides, videos) and evidence of completed training sessions.
- A Post-Implementation Support Plan specifying response times and support scope.
- A Hardware Integration Proposal if sensors or other devices are recommended.

6. Qualifications and Experience

The consultant or firm must demonstrate:

- Proven success in developing asset management systems, ideally for infrastructure, landslides, or disaster mitigation contexts.
- Experience in designing and implementing at least three similar systems.
- Technical proficiency in web development (e.g., JavaScript, Python), database management (e.g., PostgreSQL, MySQL), and mobile app frameworks.
- Expertise in GIS integration and, preferably, experience with IoT or real-time data systems.
- Expertise in AI-based forecast modelling in the infrastructure sector.
- A skilled team with expertise in:
 - Project management/Asset Management.
 - Software engineering (full-stack developers).
 - UI/UX design for intuitive interfaces.
 - Quality assurance and testing.
 - Capacity building for technical staff.
- Familiarity with landslide mitigation or civil engineering concepts is highly desirable.
- Experience working in developing countries in Asia is desirable.
- Experience working on technical assignments or projects funded by bilateral and/or multilateral agencies is desirable.

7. Deliverables, which are linked to the Payment Schedule for LAMS

Below are the deliverables linked to the payment schedule for the LAMS, based on the Terms of Reference (ToR). The schedule aligns with the project's key phases and milestones, ensuring that payments are tied to the completion and approval of critical deliverables. The total payment adds up to 100% of the contract value, covering all aspects of the project, including the 12-month post-implementation support.

Table 01 - Deliverables and Payment Schedule

No	Expected Deliverable	Month	Payment (%)	Cumulative (%)
1	Inception Report & Project Quality Assurance Management Manual (PQAMM)	1.5	10%	10%
2	Requirement Specification Document	3	10%	20%
3	Development of Fully Functional LAMS System (Web & Mobile Versions) • Offline-capable mobile tool • Source code • Deployment scripts • Enhanced modules per Section 4.3	10	40%	60%
4	Testing Phase Completion • Test Reports (functional, performance, security, user acceptance testing)	11	15%	75%

No	Expected Deliverable	Month	Payment (%)	Cumulative (%)
5	Deployment & Training Completion Deployed system • Migrated data • User Manuals • Technical Documentation • Training Materials • Evidence of training sessions • Post-Implementation Support Plan	12	20%	95%
6	Post-Implementation Support (12 months) • Bug fixes • Minor updates • Technical assistance • System monitoring	24	5%	100%
	Total		100%	100%

Table 2 Deliverables and Timeline Schedule

	Milestone and deliverable	Timeline (Approximate)
01	Inception Report	Within 04 weeks of commencement of the Service / Contract.
02	Monthly Progress Reports	Monthly, by the 04th day of each month, starting from the end of the 01 st Month of commencement of the Service / Contract.
03	Quarterly Progress Reports	Quarterly, by the 15th day of the following month
04	Briefing Reports	As required
05	Project Quality Assurance Management Manual (PQAMM)	Within 06 weeks of commencement of the Service / Contract.
06	Requirement Specification Document: Approval of Requirement Specification Document	12 th Week from the commencement of the Service / Contract.
07	• Offline-capable mobile tool • Fully functional LAMS (web and mobile versions) • Source code Deployment scripts • Shall include the enhanced modules described in Section 4.3. Completion of Development Phase	40 th Week from the commencement of the Service / Contract.
08	• Test Reports (functional, performance, security, user acceptance testing)	44 th Week from the commencement of the Service / Contract.

	Milestone and deliverable	Timeline (Approximate)
	Completion of Testing Phase	
09	• Deployed system • Migrated data • User Manuals • Technical Documentation • Training Materials • Evidence of training sessions • Post-Implementation Support Plan. Completion of Deployment and Training.	End of the 52 nd Week from the commencement of the Service / Contract.

- **Intellectual Property:** NBRI will retain full system ownership, including source code and documentation.
- **Compliance:** The consultant must adhere to data security standards (e.g., ISO 27001), privacy laws, and NBRI's confidentiality policies.
- **System Standards:** The LAMS must be scalable, maintainable, and built using modern frameworks, with a minimum uptime of 99.5% post-deployment.
- **Warranty:** 30-month comprehensive warranty, including a 12-month post-implementation support period for bug fixes and minor enhancements, which is mandatory. Price indications for the next two years of post-implementation support should be provided (the 18-month cost shall not be included in the financial proposal).

9. Development Team

9.1. Development Team Composition

- 9.1.1.** Lump-Sum: CVs for the key experts shown in Tables 03 must be included in the technical proposal, and they will be evaluated. Preferably, only one expert is to be nominated for positions common to more than one task. In the technical proposal, the firm should also include a list of proposed additional non-key positions (international and national), provide justification for their inclusion, and include the CVs of proposed experts for each of the positions.
- 9.1.2.** The Consultant shall field a multi-disciplinary team capable of delivering the full scope of work across all project deliverables and phases. The team shall comprise both domain experts (landslide risk management) and technical specialists (software development) to ensure successful delivery of the LAMS.
- 9.1.3.** It is the Consultant's responsibility to provide all required inputs in terms of Key Professionals and necessary logistic arrangements to render requested services efficiently and diligently. There might be instances where some training events, awareness programs, etc. are conducted in two national languages (Sinhala, and Tamil) in addition to English language. The Consultant shall make suitable arrangements and keep provisions for addressing such needs.
- 9.1.4.** A minimum of the following professionals is required to ensure the successful delivery of the project. Each role aligns with the technical, functional, and operational requirements outlined in the ToRs of each expert.

Table 03 - Summary of Consulting Services – Key Experts Lump Sum Tasks

Key Staff	Position	Person-Months
K - 01	Project Manager / Asset Valuation & Management Expert (Team Leader)	12
K - 02	Full Stack Developer	7
K - 03	Database Administrator	3.5
K - 04	UI/UX Designer	1.75
K - 05	Landslide Risk & Inventory Expert / Geotechnical Engineer (Countermeasures Design & DRR)	4.5
Note: The Team Leader shall be engaged on a full-time basis for the Consultancy		28.75

Note: The Team Leader (K-01) shall be engaged on a full-time basis for the Consultancy. Person-months for Non-Key Experts and support staff are additional to this total and shall be proposed by the Consultant based on the requirements of the assignment.

Table 04 - The minimum qualification and experience requirements of the Key Experts

Key-Expert	Educational, Professional Qualifications and Experiences
K – 01 – Project Manager / Asset Valuation & Management Expert (Team Leader)	<i>Responsibilities:</i> Oversee project execution, manage timelines, coordinate team activities, liaise with NBRI stakeholders, and ensure deliverables meet quality standards. Responsible for creating and updating the Gantt chart and handling risk management, among many others including economic valuation of landslide risks and consequence analysis. <i>Qualifications:</i> • PMP or equivalent certification. • Minimum 10 years of total experience, out of which at least 3 years of international experience in managing software development projects for infrastructure or disaster-risk asset management systems. • Demonstrated expertise in asset valuation (including direct/indirect loss estimation and cost-benefit analysis for DRR projects), quantitative risk assessment, and implementation of asset/inventory management systems for public sector or infrastructure projects, preferably in landslide/disaster mitigation contexts. • Proven ability to lead multidisciplinary teams and successfully deliver projects with budgets exceeding USD 700,000 within scope, time, and quality. • Strong communication skills and experience working with public sector clients in disaster risk reduction. • Familiarity with GIS, IoT integration, or AI-based forecasting is desirable.
K – 02 – Full Stack Developer (01)	<i>Responsibilities:</i> Develop the web-based application and mobile-compatible components, including asset inventory management, monitoring module,

Key-Expert	Educational, Professional Qualifications and Experiences
	maintenance scheduler, analytics dashboard, and user management. Implement APIs for GIS and external data integration, among many others. <i>Qualifications:</i> Bachelor's degree in computer science or related field, 5+ years of experience preferably with International experiences in full-stack development with proficiency in JavaScript, Python, and database management. Expertise in building offline-capable mobile frameworks and responsive web applications. Experience with GIS integration and at least one prior project involving asset management systems or disaster mitigation tools is highly desirable. Familiarity with agile development methodologies and version control systems
K – 03 – Database Administrator	<i>Responsibilities:</i> Design and implement a relational database schema for asset data storage, ensuring scalability and performance. Optimize queries and manage data migration from existing NBRI systems, among many others. <i>Qualifications:</i> Bachelor's degree in computer science, information systems, or related field, 5+ years of experience in database design and administration for asset management systems. Expertise in PostgreSQL or MySQL, including schema design, query optimization, and data migration. Familiarity with GIS data structures and experience handling large datasets. Certification in database management is desirable. Knowledge of landslide mitigation data workflows is a plus.
K – 04 – UI/UX Designer	<i>Responsibilities:</i> Create intuitive, user-friendly interfaces for web and mobile platforms tailored to diverse users (engineers, administrators, field staff). Ensure accessibility and responsive designs, among many others. <i>Qualifications:</i> Bachelor's degree in design, human-computer interaction, or related field, 3+ years of experience, preferably with International experiences in UI/UX design for technical applications. Proficiency with design tools like Figma, Adobe XD, or Sketch, with a portfolio demonstrating responsive and accessible interfaces. Experience designing for diverse user groups, including non-technical field staff, and familiarity with usability testing methodologies. Knowledge of web accessibility standards (e.g., WCAG 2.1) and experience with disaster management or GIS-based applications are desirable.
K – 05 – Landslide Risk & Inventory Expert / Geotechnical Engineer (Countermeasures Design & DRR)	<i>Responsibilities:</i> Provide specialized domain expertise in landslide countermeasures, geotechnical engineering, disaster risk reduction (DRR), landslide inventory development, mitigation efficacy tracking, and quantitative risk assessment. Advise on the design and implementation of the landslide asset inventory, LIMS integration, risk assessment, and countermeasures database within LAMS. Ensure integration of geotechnical data, and DRR best practices. Support database schema design for landslide-specific data, facilitate data migration from LIMS and existing NBRI records, contribute to requirement specification, system validation, training, and post-implementation support from a technical DRR perspective.

Key-Expert	Educational, Professional Qualifications and Experiences
	<i>Qualifications:</i> Bachelor's degree or higher in Geotechnical Engineering, Civil Engineering, Geology, Disaster Risk Management, or related field with specialization in landslide mitigation and DRR. Minimum 8 years of experience in landslide countermeasures, geotechnical investigations, landslide inventory development, quantitative risk assessment (including hazard modelling, power-law magnitude-frequency relations, AOI segmentation, and risk curve generation), and DRR projects in infrastructure contexts. Demonstrated experience in database management for landslide data, asset/inventory management systems, or disaster mitigation tools. Familiarity with GIS integration for landslide mapping and risk modeling. Proven track record in multidisciplinary teams for disaster risk reduction initiatives.

9.1.5. Non-Key Experts

(a) In addition to the above mandatory Key Experts, the Consultant shall propose and mobilise appropriate Non-Key Experts as required to deliver the full scope of work efficiently across all Work Packages and project phases. Non-Key Experts will not be evaluated at the technical evaluation stage; however, the proposed NK Experts staffing plan and its adequacy will be assessed as part of the evaluation of the Consultant's methodology, work plan and organisation.

(b) To ensure that adequate specialist inputs are provided, the Client has established the following indicative Non-Key Expert staffing plan. The positions, scopes and person-month allocations below are indicative, not mandatory:

Table 5 - Indicative Non-Key Expert Staffing Plan

Ref.	Indicative Non-Key Expert Position	Indicative Person-Months	Indicative Scope of Input	Principal Phase(s) of Input
NK-01	GIS / Spatial Analysis Specialist	4.0	Spatial database design; integration of landslide inventory, hazard zonation and asset layers; map services and geospatial analytics for the LAMS dashboard	Requirement Analysis & Design; Development (Weeks 5–40)
NK-02	Mobile Application Developer	4.0	Development of the offline-capable mobile field data collection tool and its synchronisation with the LAMS web platform	Development; Testing (Weeks 27–44)
NK-03	QA / Software Testing Specialist	4.0	Test planning; functional, performance and user-acceptance testing; defect management and test reporting	Development; Testing (Weeks 27–44)
NK-04	Cloud Infrastructure / DevOps Engineer	3.0	Cloud architecture, deployment pipelines, environment management,	Development; Deployment (Weeks 27–52)

Ref.	Indicative Non-Key Expert Position	Indicative Person-Months	Indicative Scope of Input	Principal Phase(s) of Input
			system hardening and handover to the production environment	
NK-05	Data Security / Compliance Specialist	2.0	Information security design and review in line with ISO 27001, data privacy requirements and NBRI confidentiality policies; security testing support	Design; Testing (Weeks 5–44)
NK-06	Landslide Risk / DRR Domain Expert (National)	3.0	National-level domain input on landslide asset typologies, inventory attributes, risk-based prioritisation logic and validation of system outputs	All phases (Weeks 1–52)
	Total Indicative Non-Key Expert Input	20.0		

(c) The Consultant remains free to propose an alternative composition of Non-Key Experts (including combining, splitting, adding or omitting positions) that best suits its methodology. However, the total Non-Key Expert input proposed shall in aggregate be not less than the indicative total of twenty (20) person-months, unless the Consultant demonstrates in its technical proposal, with a clear and convincing justification, that the full scope of services can be delivered with a lower level of effort without compromising quality, timelines or deliverables.

(d) For each proposed Non-Key Expert, the Consultant shall provide in its technical proposal:

- the position title, proposed role and specific responsibilities, and the tasks/deliverables the expert will support;
- the necessity of the position for successful project delivery and how the expertise fills a gap in the Key Expert team;
- the expected duration and level of effort, expressed in person-months (or percentage allocation) mapped against the Activity Schedule;
- the minimum qualifications and experience proposed for the position; and
- the name and CV of the nominated expert, where already identified.

(e) All Non-Key Experts mobilised during implementation, and any subsequent replacement, shall be subject to the prior review and no-objection of the Client (PMU). Replacements shall possess qualifications and experience equal to or better than those of the expert originally proposed.

9. The Consultant shall keep all records, workshop/training concept notes, attendance sheets of participants, proceedings of meetings/workshops/training events, and any other types of records.

11. The Consultant shall submit the following reports:

(i). Project Quality Assurance Management Manual (PQAMM)

This shall describe all quality assurance aspects of the technical services provided under the assignment, among which: methods and procedures for quality control of technical services, resource inputs by various subject experts, delivery of training, development of manuals and guidelines, etc. This report shall be submitted in two (2) hard copies and two (2) copies in electronic format (on CD-ROM/ cloud).

(ii). Reports, manuals, guideline documents, training material, and other project outputs.

(Please follow the ToR and deliverables, which summarize all requirements, for submission of outputs such as reports, manuals, guideline documents, training material, etc., under each deliverable).

The deliverable schedule and reporting requirements under each task are provided in **Table 01** and Table 02 above. Each deliverable will be tested/evaluated by the Technical Advisory Committee (TAC), and comments will be forwarded to the Consultant within 2 weeks. The deliverable/report should be resubmitted, incorporating the revisions within a reasonable time after receiving the comments. The Client will provide necessary assistance in obtaining certain services, information, and facilities to the Consultant (unless otherwise indicated in the RFP) when and where necessary, as follows

a) The Client shall provide the following support to ensure successful project delivery:

LIMS Access

- Provide timely access to NBRI's Landslide Incident Management System, including database queries, data exports, schema documentation, and API specifications
- Grant the Consultant appropriate credentials for LIMS assessment and integration testing
- Assign dedicated LIMS technical staff to support integration activities
- Ensure data access protocols are clearly documented and agreed upon

Landslide Resilience Analytical and Advisory System (LA-Res) GIS Platform Access

- Provide technical documentation of NBRI's LA-Res's system GIS platform, including architecture, data layers, APIs, and access controls
- Assign dedicated GIS staff to coordinate integration requirements with LAMS development team
- Ensure GIS server capacity planning accommodates concurrent LAMS queries

- Facilitate testing and validation of LAMS-LA-Res's integration.

Stakeholder Coordination

- Issue authorization letters for field surveys, site visits, and community engagements in landslide-prone districts
 - Facilitate scheduling and coordination of stakeholder workshops at national and sub-national levels
 - Allocate staff time for participation in project meetings, requirement workshops, and testing activities
- b) Authorization letters for obtaining relevant information from other stakeholder agencies, visiting selected communities/sites/locations when and where necessary. However, such requests should be provided in writing with a clear justification.
- c) Access to key relevant documents published by other institutions, depending on the availability and subject to the conditions for release, payments, copyright, and other restrictions.
- d) Issue of authorization letters when and where necessary, for carrying out field surveys and studies in selected communities/assets/etc in landslide-prone districts,
- e) Assistance in organizing stakeholder meetings at the National/sub-national level, if required
- f) Assistance in organizing field-level workshops and meetings with stakeholders' agencies
- g) Facilitating inviting participants for project-related meetings, workshops, etc. and in obtaining permission to allocate required working time, to enable staff to prepare for and participate in project-related workshops, meetings, etc.
- h) However, for any additional requirements, the Consultant shall have its own arrangement, for which the cost shall be included in the Consultant's Cost proposal.
- i) The NBRI will provide a minimum of 40m2 Office space for the Consultants, where the Consultant is responsible for providing office equipment and all other facilities for the provision of the whole Service.

Annexure 01

1. Organizational Structure

The successful operation of the LAMS requires a clear organisational structure to ensure efficient field data collection, maintenance activities, dashboard sharing, and overall supervision. This section outlines the roles and responsibilities of the NBRI and other stakeholders, including field officers, asset owners, and external agencies, in the management and maintenance of landslide mitigation assets.

1.1. NBRI Field Officers

NBRI field officers are responsible for collecting data from monitoring equipment deployed at landslide mitigation sites. This data collection will be performed through:

- **Manual Data Collection:** Field officers will conduct periodic inspections and manually record observations, such as asset conditions, inspection reports, and photographic documentation. These records will be entered into the LAMS via offline-capable mobile tools, ensuring accessibility in remote areas with limited connectivity.
- **Automated Data Collection:** Where feasible, field officers will oversee the integration of data from automated sensors (e.g., groundwater level meters, inclinometers, extensometers) into the LAMS. They will ensure that sensor data is accurately transmitted to the system and validate automated feeds to maintain data integrity. Field officers will synchronize offline data with the LAMS central database upon restoration of connectivity, ensuring seamless data integration across all mitigation sites.

1.2. Asset Owners

The owners of mitigated locations, such as schools, hospitals, the Provincial Road Development Authority, or local authorities, are responsible for performing minor maintenance works to ensure the continued functionality of landslide mitigation assets. These tasks include:

- **Bush Cutting:** Regular clearing of vegetation around mitigation assets to prevent obstruction and maintain accessibility.
- **Surface Drainage Cleaning:** Routine cleaning of surface drainage systems to ensure proper water flow and prevent blockages that could compromise asset performance.

Asset owners will receive maintenance alerts from the LAMS via multichannel communication (e.g., SMS, email) to schedule and perform these tasks. They are expected to report completion of maintenance activities through the LAMS platform for audit and tracking purposes.

1.3. NBRI Maintenance Teams

NBRI will oversee and execute major maintenance works critical to the structural integrity and long-term functionality of landslide mitigation assets. These tasks include:

- **Horizontal Drainage Cleaning:** Periodic cleaning and maintenance of subsurface drainage systems to ensure effective water management and slope stability.
- **Structural Repairs:** Addressing significant damage or wear to assets such as earth retaining systems, rock fall protection systems, or debris flow barriers.

NBRI maintenance teams will use the LAMS maintenance scheduler to receive automated reminders, assign tasks, and track completion status. All major maintenance activities will be logged in the system with detailed audit trails to support accountability and performance monitoring.

1.4. Stakeholder Agencies

The LAMS analytics dashboard will be shared with relevant stakeholder agencies, such as schools, hospitals, the Provincial Road Development Authority, and local authorities. The dashboard will provide:

- **Visualisations:** Graphs, heatmaps, and spatial maps displaying asset conditions, maintenance history, and risk levels.
- **Reports:** Customizable reports to support decision-making and resource allocation.
- **Maintenance Alerts:** Notifications sent via multichannel communication (e.g., SMS, email) to inform stakeholders of required maintenance actions and deadlines.

Access to the dashboard will be role-based, ensuring that stakeholder agencies can view relevant data while maintaining data security and confidentiality. NBRI will manage access permissions and ensure that stakeholders are trained to use the dashboard effectively.

1.5. NBRI Supervisory Role

PMU/NBRI will maintain overall supervision of the LAMS and its operations to ensure alignment with its mission to reduce landslide risks and enhance disaster resilience. This supervisory role includes:

- **System Oversight:** Monitoring the performance and uptime of the LAMS to ensure a minimum uptime of 99.5%, as specified in the system standards.
- **Data Quality Control:** Reviewing and validating data entered by field officers and automated sensors to ensure accuracy and reliability.
- **Coordination with Stakeholders:** Facilitating communication between NBRI, asset owners and stakeholder agencies to ensure timely maintenance and effective use of the LAMS.

Improvement: Evaluating system performance and stakeholder feedback to identify opportunities for enhancements, such as integration with emerging technologies (e.g., IoT sensors) or expansion to additional asset types. NBRI's supervisory role will be supported by the LAMS analytics dashboard and reporting tools, which will provide actionable insights to guide strategic decision-making and resource prioritization.