Terms of Reference

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Terms of Reference: Development of Central Ground Water Data Centre and Monitoring Dashboard

**1. Background**

India's Water Vision 2047 outlines an ambitious roadmap for sustainable water management, recognizing groundwater as a critical resource. The Central Ground Water Board (CGWB), under the Ministry of Jal Shakti, plays a pivotal role in achieving this vision. Recognizing the urgent need for improved groundwater monitoring and data dissemination, CGWB has initiated a project to establish a state-of-the-art Central Ground Water Data Centre and develop a real-time monitoring dashboard. This project aims to consolidate data from existing and expanding networks of Digital Water Level Recorders (DWLRs), supplemented by manual data collection efforts, creating a unified platform for informed decision-making. The establishment of this infrastructure will significantly enhance CGWB's ability to understand aquifer dynamics, predict water stress, and implement targeted interventions for groundwater conservation and sustainable use. The data centre will serve as a national repository, ensuring data integrity, accessibility, and utilization by various stakeholders, including government agencies, researchers, and the public. The real-time monitoring dashboard will provide a user-friendly interface for visualizing groundwater levels and trends, facilitating proactive management and timely response to emerging challenges. The project represents a significant investment in India's water security and aligns directly with the national Water Vision 2047. The project's success will depend on the expertise and collaboration of key partners, including Project SuWaVi, and the agency providing technical support. This Terms of Reference outlines the scope of work, deliverables, timeline, and expert requirements for the agency's contribution to this critical initiative.

**2. Context**

The project entails the design, development, and implementation of a comprehensive ground water data management system. This system will integrate data from the existing 5260 DWLRs, with a target of 30,000 installations over the next two years, and supplement it with data collected through periodic surveys by local, regional, and national CGWB officials. The agency’s role will encompass technical assistance throughout the project lifecycle, from the design of data centre specifications to the development of the monitoring dashboard. The data centre will be designed to meet international standards for data security, reliability, and scalability. The dashboard will be developed using Python, incorporating Artificial Intelligence (AI) for data analysis, predictive modeling, and anomaly detection. The agency will work closely with GIZ to ensure alignment with best practices and international guidelines. The methodology will involve a phased approach, beginning with a detailed assessment of existing infrastructure and data collection processes, followed by the design of the data centre architecture and dashboard functionalities. Data migration and integration will be carefully managed to ensure data integrity and accuracy. The agency will provide training to CGWB personnel on the operation and maintenance of the data centre and dashboard, fostering local capacity building and ensuring long-term sustainability. The project's success hinges on effective communication, collaboration, and a commitment to delivering a robust and user-friendly solution that meets the evolving needs of CGWB and contributes to India’s water security goals.

**3. Need of the Assignment**

India faces a growing water crisis, exacerbated by climate change, population growth, and unsustainable groundwater extraction practices. Effective groundwater management is paramount to ensuring water security and livelihoods for millions of people. The current fragmented data collection and reporting systems hinder timely decision-making and limit the effectiveness of groundwater conservation efforts. The establishment of a Central Ground Water Data Centre and a real-time monitoring dashboard directly addresses this critical need by providing a unified platform for data collection, analysis, and dissemination. This infrastructure will empower CGWB to proactively monitor groundwater levels, identify areas of stress, and implement targeted interventions to promote sustainable use. The agency’s role is crucial in providing the technical expertise to design, develop, and implement this system, ensuring it meets international standards and effectively serves the needs of CGWB. The agency’s contributions will include designing tenderable technical specifications for equipment, developing the data centre architecture, building the monitoring dashboard, and providing training to CGWB personnel. The agency will work closely with CGWB and GIZ to ensure alignment with national water policies and best practices. The successful completion of this project will significantly enhance CGWB's capacity to manage groundwater resources sustainably, contributing directly to India's Water Vision 2047 and safeguarding the nation's water security for future generations. The agency's expertise will be instrumental in bridging the gap between current data collection methods and a future-ready, data-driven approach to groundwater management.

**4. Work Package**

The project will be divided into two main work packages: Data Centre Development and Dashboard Development.

Work Package 1: Data Centre Development (18 Months)

This work package focuses on the design, construction, and commissioning of the Central Ground Water Data Centre. It will be further divided into sub-packages:

Data Centre Infrastructure Design:

This sub-package involves the creation of detailed architectural and engineering designs for the data centre, including power, cooling, security, and network infrastructure. The agency will develop technical specifications for hardware and software, ensuring scalability, reliability, and data security. This will include developing a comprehensive disaster recovery plan.

Data Migration and Integration:

This sub-package focuses on migrating existing data from various sources into the new data centre and integrating it with real-time data streams from the DWLR network. The agency will develop data cleansing and validation procedures to ensure data accuracy and consistency.

System Testing and Commissioning:

This sub-package involves rigorous testing of all data centre components and systems to ensure they meet performance requirements and data security standards. The agency will develop comprehensive documentation and training materials for CGWB personnel.

Work Package 2: Dashboard Development (12 Months)

This work package focuses on the development of the real-time groundwater monitoring dashboard. It will be further divided into sub-packages:

User Interface (UI) and User Experience (UX) Design:

This sub-package involves designing a user-friendly and intuitive interface for the dashboard, ensuring ease of navigation and data visualization. The agency will conduct user testing to gather feedback and refine the design.

Data Analysis and Visualization:

This sub-package focuses on developing algorithms and visualizations to effectively communicate groundwater trends and anomalies. The agency will utilize AI techniques for predictive modeling and anomaly detection.

System Integration and Testing:

This sub-package involves integrating the dashboard with the data centre infrastructure and conducting thorough testing to ensure functionality and performance. The agency will develop comprehensive documentation and training materials for CGWB personnel.

**5. Deliverables**

\* Detailed Data Centre Design Specifications

\* Data Migration and Integration Plan

\* Fully Functional Central Ground Water Data Centre

\* User-Friendly Groundwater Monitoring Dashboard

\* Comprehensive Documentation and Training Materials

\* Disaster Recovery Plan

\* Regular Progress Reports

**6. Timeline**

\* \*\*Phase 1 (3 Months):\*\* Assessment, Planning, and Design

\* \*\*Phase 2 (12 Months):\*\* Data Centre Development and Infrastructure Setup

\* \*\*Phase 2 (6 Months):\*\* Dashboard Development and Integration

\* \*\*Phase 3 (3 Months):\*\* Testing, Training, and Commissioning

**7. Expert Requirements**

\* Data Centre Architects (2)

\* Software Developers (4) (Python Expertise)

\* Database Administrators (2)

\* UI/UX Designers (1)

\* AI/Machine Learning Specialists (1)

\* Project Manager (1)

**8. Reporting**

The agency will provide regular progress reports to CGWB and GIZ, detailing accomplishments, challenges, and planned activities.

**9. Person Days**

\* Approximately 10,000 person days will be required for the successful completion of this project.

Appendices

Appendix A: Original Context

context:

Project SuWaVi supports india's water vision 2047 and have partnered with Ministry of Jal Shakti to contribute towards the water vision 2047. Central Ground Water Board (CGWB) is the apex body on groundwater management under the Ministry of Jal Shakti. CGWB has installed 5260 Digital Water Level Recorder (DWLRs) / Piezometers at various locations across India with a target of total 30000 installations in the next two years. The DWLRs provide 6 hourly data everyday to monitor the status of respective aquifers. CGWB intents to develop a central command and control data centre for receiving and disseminating national ground water data from these DWLRs as well as manual data gathered from periodical surveys carried out by the local, regional and national ground water board officials. The data center will be one of its kind world class infrastructure of international standards. In addition, CGWB intents to develop a ground water monitoring dashboard with the high frequency real time DWLR data. The monitoring dashboard will use spatial and non-spatial information to display the real time information on the dashboard. The software application dashboard will be developed on python and utilise AI for inference and analysis. The agency will extend technical support to CGWB in consultation with GIZ for the contract period of 30 months starting 01 Aug 2025 to 31 Jan 2028. The agency will provide long term and short term experts to complete the task. The long term experts will include one NRM expert, one hydrologist, two software developers and one team leader (with background of computer science). The short term experts will be untilised to develop tenderable technical specifications for equipment and design of data center. The short term experts shall include electrical engineers, civil engineers and hvac engineers in addition to computer hardware experts with background in server specifications and date center equipment.

instructions: Please develop a terms of reference based on the context

Appendix B: Review Feedback

Okay, here's a detailed feedback on the provided Terms of Reference (TOR), broken down by section, with strengths, weaknesses, suggested improvements, and a rating. I've aimed to be constructive and provide actionable advice. I'm also providing an overall assessment and prioritized list of improvements at the end.

\*\*1. Background\*\*

\* \*\*Strengths:\*\* The section establishes the context well, linking the project to India's Water Vision 2047 and CGWB's role. It clearly identifies the core problem – the need for a centralized data center and monitoring dashboard. The mention of DWLR installations and their frequency of data transmission is important.

\* \*\*Weaknesses:\*\* It's a bit dry and lacks a compelling narrative. It doesn't clearly articulate the \*impact\* of the project – why is this important for India beyond simply meeting the Water Vision? The term "world class infrastructure" is vague and needs substantiation. It feels like a description rather than an explanation of the \*why\*.

\* \*\*Suggested Improvements:\*\*

\* Start with a more engaging sentence that highlights the challenges India faces regarding groundwater management and how this project addresses them.

\* Quantify the benefits: "This project will improve groundwater monitoring capabilities by X%, enabling more informed decision-making and potentially preventing Y amount of water scarcity."

\* Expand on the "world class" claim: Specify what "world class" means in this context (e.g., adherence to international data security standards, real-time analytics capabilities, scalability for future DWLR installations).

\* Briefly mention the role of GIZ and Project SuWaVi in more detail. What specific expertise or support do they provide?

\* \*\*Rating:\*\* 3/5

\*\*2. Context\*\*

\* \*\*Strengths:\*\* Provides a good overview of the technical aspects – DWLR data, piezometers, data frequency. It highlights the need for both a data center \*and\* a dashboard.

\* \*\*Weaknesses:\*\* Similar to the Background, it's very technical and lacks a broader perspective. The description is a bit dense and could be simplified for a wider audience (even if the primary audience is CGWB and GIZ, clarity is important). The sentence about the dashboard using "spatial and non-spatial information" is vague and needs elaboration.

\* \*\*Suggested Improvements:\*\*

\* Provide a simplified explanation of DWLRs and piezometers for clarity.

\* Explain what "spatial and non-spatial information" \*means\* in the context of the dashboard. Examples: "Spatial data will include groundwater maps showing aquifer distribution; non-spatial data will include water quality parameters and pumping rates."

\* Consider adding a visual aid (e.g., a diagram showing the data flow from DWLRs to the data center and then to the dashboard).

\* \*\*Rating:\*\* 3/5

\*\*3. Need of the Assignment\*\*

\* \*\*Strengths:\*\* It correctly identifies the core need – a centralized command and control data center and a real-time groundwater monitoring dashboard.

\* \*\*Weaknesses:\*\* This is the weakest section. It's too brief and doesn't adequately explain the \*critical\* importance of this project. It doesn's explain the risks of \*not\* undertaking this project. The description of the agency's role is generic. It doesn't connect the project to broader national goals beyond the Water Vision.

\* \*\*Suggested Improvements:\*\*

\* Expand significantly. Explain the current limitations of groundwater management in India due to the decentralized nature of data collection.

\* Highlight the risks of inaction: "Without a centralized system, India risks… [e.g., unsustainable groundwater extraction, inequitable distribution of water resources, inability to respond effectively to droughts]."

\* Clearly articulate the agency's role as a \*partner\* – what specific expertise and support will they bring to the table beyond simply providing personnel? Will they be involved in training, capacity building, or technology transfer?

\* Connect the project to broader national priorities: "This project will contribute to India’s goals of [e.g., food security, rural development, climate resilience]."

\* Quantify the expected outcomes: "The agency will work with CGWB to develop a system that can monitor groundwater levels with an accuracy of X% and provide early warnings for drought conditions Y days in advance."

\* \*\*Rating:\*\* 2/5

\*\*4. Work Package\*\*

\* \*\*Strengths:\*\* The structure is good – dividing the assignment into work packages. The example sub-package description is well-written.

\* \*\*Weaknesses:\*\* The provided structure is too high-level. The description of each work package needs to be \*much\* more detailed. It's crucial to specify deliverables, timelines, and key performance indicators (KPIs) for each work package. The example provided is great, but needs to be replicated for \*all\* work packages.

\* \*\*Suggested Improvements:\*\*

\* \*\*Define Specific Work Packages:\*\* Examples:

\* \*\*WP1: Data Center Establishment:\*\* (Detailed tasks: Site selection, hardware procurement, software installation, network configuration, data security protocols)

\* \*\*WP2: Dashboard Development:\*\* (Detailed tasks: User interface design, data visualization, reporting functionalities, integration with data center)

\* \*\*WP3: Capacity Building & Training:\*\* (Detailed tasks: Training CGWB personnel on data center operations, dashboard usage, data analysis techniques)

\* \*\*WP4: Data Quality Assurance & Validation:\*\* (Detailed tasks: Develop protocols for data validation, implement quality control measures)

\* \*\*Include Deliverables:\*\* For each task, specify what will be produced (e.g., "Data Center Design Document," "Dashboard Prototype," "Training Manual").

\* \*\*Define Timelines:\*\* Provide estimated durations for each task.

\* \*\*Specify KPIs:\*\* How will success be measured? (e.g., "Data latency < X minutes," "Dashboard user satisfaction > Y%").

\* \*\*Rating:\*\* 3/5

\*\*5. (Missing Sections)\*\*

\* \*\*Budget:\*\* A critical omission. Provide a high-level budget breakdown.

\* \*\*Project Management:\*\* How will the project be managed? Who are the key stakeholders? What is the reporting structure?

\* \*\*Risk Management:\*\* Identify potential risks and mitigation strategies.

\* \*\*Sustainability:\*\* How will the system be maintained and updated after the agency's involvement ends?

\*\*Overall Assessment\*\*

The TOR provides a basic framework for the project, but it needs significant expansion and refinement to be truly effective. The biggest weaknesses are the lack of detail, the absence of a compelling narrative, and the omission of key sections like budget and risk management. The language is too technical in places and needs to be more accessible.

\*\*Prioritized List of Improvements\*\*

1. \*\*Expand the "Need of the Assignment" section:\*\* This is the most critical area for improvement.

2. \*\*Add a Budget Section:\*\* Essential for any project proposal.

3. \*\*Develop Detailed Work Packages:\*\* Include deliverables, timelines, and KPIs.

4. \*\*Add a Risk Management Section:\*\* Identify potential challenges and mitigation strategies.

5. \*\*Refine the Narrative:\*\* Make the project more compelling by highlighting its impact on India's water security.

6. \*\*Add a Project Management Section:\*\* Define roles, responsibilities, and reporting structures.

By addressing these points, the TOR will be much more robust and will provide a clearer roadmap for the project's success. Good luck!

Appendix C: Evaluation

Terms of Reference: Development of a Central Groundwater Data Centre and Monitoring Dashboard for the Central Ground Water Board (CGWB)

\*\*1. Background\*\*

The Central Ground Water Board (CGWB), under the Ministry of Jal Shakti, plays a crucial role in groundwater management across India. Recognizing the escalating challenges of groundwater depletion and the increasing need for data-driven decision-making, CGWB is embarking on a transformative project to establish a state-of-the-art Central Groundwater Data Centre and develop a real-time monitoring dashboard. This initiative directly contributes to the broader vision of India's Water Vision 2047, aiming for sustainable and equitable water resource management. Currently, CGWB has deployed 5260 Digital Water Level Recorders (DWLRs) and plans to install a total of 30,000 DWLRs nationwide in the coming years. These DWLRs generate valuable, high-frequency data that, when integrated and analyzed effectively, can provide critical insights into aquifer behavior, groundwater stress, and the effectiveness of conservation efforts. The envisioned Data Centre will serve as a central repository for this data, facilitating informed policy formulation, targeted interventions, and enhanced public awareness. The accompanying monitoring dashboard will provide a user-friendly interface for visualizing real-time data, identifying trends, and alerting stakeholders to potential issues. This project represents a significant investment in India’s water security and resilience, requiring expertise in hydrogeology, data management, software development, and infrastructure design. The partnership with Project Sujal India (PSI), leveraging their technical expertise and experience, is vital to ensure the successful implementation and long-term sustainability of this crucial infrastructure. The key benefits of this project include improved groundwater management practices, enhanced water resource planning, increased resilience to climate change impacts, and strengthened institutional capacity within CGWB.

\*\*2. Context\*\*

The assignment's core methodology involves a phased approach, starting with a comprehensive assessment of existing data collection and processing systems within CGWB. This initial phase will identify gaps, inefficiencies, and areas for improvement. Subsequently, the agency will be responsible for designing and developing a robust and scalable data centre infrastructure, including server specifications, network architecture, and data storage solutions. The design will adhere to international standards for data security and disaster recovery. Concurrently, the agency will develop a user-friendly monitoring dashboard using Python, incorporating spatial and non-spatial information to provide a clear and concise overview of groundwater conditions across India. This dashboard will integrate advanced analytics and artificial intelligence algorithms to identify trends, predict future scenarios, and generate alerts for potential risks. Data integration will be a key focus, ensuring seamless connectivity between DWLR data, manual survey data, and other relevant datasets. The agency will also provide training and capacity building for CGWB personnel to ensure the long-term operational sustainability of the Data Centre and dashboard. This will include training on data management practices, dashboard utilization, and basic troubleshooting. The agency will work closely with CGWB and GIZ to ensure alignment with national policies and international best practices. The data centre will be designed to handle a massive influx of data from the expanding network of DWLRs, necessitating a highly efficient and scalable architecture. Furthermore, the agency will be responsible for developing detailed technical specifications for equipment procurement, ensuring that all hardware and software components meet the required performance and reliability standards. The project will be iterative, with regular progress reviews and opportunities for feedback from CGWB and GIZ.

\*\*3. Need of the Assignment\*\*

The development of a Central Groundwater Data Centre and Monitoring Dashboard for CGWB is critically needed to address the growing challenges of groundwater depletion and ensure sustainable water resource management in India. The current system relies on fragmented data collection and analysis methods, hindering effective decision-making and hindering the implementation of targeted interventions. The increasing number of DWLRs generates a vast amount of data that remains largely untapped, representing a significant opportunity to improve our understanding of groundwater dynamics. The agency’s role in this assignment is multifaceted, encompassing technical design, software development, infrastructure setup, and capacity building. They will be responsible for translating CGWB’s vision into a functional and sustainable reality, leveraging their expertise to overcome technical challenges and ensure the long-term success of the project. The agency’s contribution goes beyond simply building a data centre and dashboard; it involves establishing a foundation for data-driven decision-making, fostering a culture of continuous improvement, and empowering CGWB to effectively manage India's precious groundwater resources. The agency will be instrumental in developing robust data security protocols to protect sensitive information and ensuring the system's resilience to potential cyber threats. Furthermore, they will be responsible for integrating spatial data, such as geological maps and land use patterns, to provide a comprehensive understanding of groundwater vulnerability and potential risks. The agency’s commitment to knowledge transfer and capacity building will ensure that CGWB possesses the skills and expertise needed to operate and maintain the system independently, fostering long-term sustainability and maximizing the impact of this critical infrastructure.

\*\*4. Scope of Work\*\*

The assignment will encompass the following key activities:

\* \*\*Data Centre Design & Development:\*\* Design and implement a scalable and secure data centre infrastructure.

\* \*\*Monitoring Dashboard Development:\*\* Develop a user-friendly dashboard for real-time data visualization and analysis.

\* \*\*Data Integration:\*\* Integrate data from DWLRs, manual surveys, and other relevant sources.

\* \*\*Capacity Building:\*\* Train CGWB personnel on data management and dashboard utilization.

\* \*\*Technical Documentation:\*\* Prepare detailed technical specifications and user manuals.

\* \*\*Equipment Procurement Support:\*\* Assist CGWB in procuring necessary hardware and software.

\* \*\*Security Protocols:\*\* Implement robust data security protocols and disaster recovery plans.

\*\*5. Deliverables\*\*

\* Detailed Data Centre Design Document

\* Functional Monitoring Dashboard (Beta Version)

\* Integrated Data Management System

\* Training Manuals & Workshop Materials

\* Technical Documentation & User Manuals

\* Final Project Report

\*\*6. Project Timeline\*\*

The project is anticipated to be completed within 18 months, with phased deliverables throughout the duration.

\*\*7. Team Composition\*\*

The agency will assemble a multidisciplinary team comprising:

\* Hydrogeologist

\* Data Architect

\* Software Developers (Python)

\* GIS Specialist

\* Data Security Expert

\* Training Specialist

Assessment of the Terms of Reference

\*\*Strengths:\*\*

\* \*\*Comprehensive Scope:\*\* The ToR clearly outlines the project's objectives, scope, deliverables, and timeline.

\* \*\*Emphasis on Sustainability:\*\* The focus on capacity building and knowledge transfer demonstrates a commitment to long-term sustainability.

\* \*\*Data Security Focus:\*\* Recognizing the importance of data security is crucial for the project's success.

\* \*\*Multidisciplinary Team:\*\* The required team composition reflects the complexity of the project.

\* \*\*Phased Approach:\*\* The phased approach allows for iterative development and feedback.

\*\*Areas for Improvement:\*\*

\* \*\*Specific Performance Indicators:\*\* Defining specific, measurable, achievable, relevant, and time-bound (SMART) performance indicators would enhance accountability and allow for better progress tracking.

\* \*\*Budgetary Considerations:\*\* The ToR lacks budgetary details, which would be essential for project planning and resource allocation.

\* \*\*Stakeholder Management:\*\* While mentioning CGWB and GIZ, the ToR could explicitly outline a stakeholder management plan to ensure effective communication and collaboration with all relevant parties.

\* \*\*Risk Management:\*\* A brief section on potential risks and mitigation strategies would enhance the project's resilience.

\*\*Overall, the Terms of Reference provide a solid foundation for a successful project. Addressing the areas for improvement would further strengthen the document and contribute to the project's long-term impact.\*\*