Technical Proposal

CTBTO RFQ No. 2024-0108

Introduction

Overview:

CDGA Engineering Consultants Limited (CDGA) is pleased to submit this technical proposal in response to CTBTO RFQ No. 2024-0108 for the rehabilitation and/or replacement of the seismic borehole at the IMS Auxiliary Seismic Station AS97 in Babate, Senegal. Our proposal addresses all technical and operational requirements set forth by CTBTO, ensuring compliance and a commitment to delivering the project in a timely manner, as described in the provided Terms of Reference, and to the highest standards.

Company Profile and Competencies

Organizational Capacity:

CDGA, established in 1998, is an Irish-based technical consultancy with global operations, servicing a wide range of industries and international organizations. With over 25 years of experience, CDGA has built a robust portfolio, including complex projects in conflict zones and remote locations. Our expertise spans engineering design, consultancy, and training services, making us a trusted partner for large companies and international organizations.

CTBTO Experience:

Since 2015, CDGA has been an important service provider to CTBTO, contributing to projects at IMS stations across the network. Our familiarity with CTBTO's operational standards and our track record of delivering high-quality solutions on time make us an ideal partner for this project. CDGA has completed projects for infrasound, seismic and RN stations. Reference is made to appendix C for project datasheet with CTBTO.

Experience with Similar Clients:

In addition to our extensive work with CTBTO, CDGA has successfully completed related engineering projects for leading energy companies such as Clarke Oil, Wood Group, and Total Energy. These projects involved maintenance of critical infrastructure in challenging environments, underscoring our capability to meet stringent industry standards and timelines.

Expertise in Borehole Drilling and Rehabilitation:

CDGA staff member available for this project includes specialists in construction, installation and testing of remote seismic monitoring stations, that participated in certification, revalidation or upgrade of IMS station, including seismic station with boreholes. The nominated CDGA's project team includes one personnel with fluent French This engineer has previous work experience worldwide, on seismic acoustic stations executed for the Commission and other scientific agencies. Reference is made to appendix B for Key personnel CVs.

The onsite work and expertise will be completed by company SIPA DRILLING SENEGAL SARL located in Dakar, Senegal. SIPA is specialized in borehole drilling for water access with a proven track record of successful project delivery throughout Senegal. SIPA have partnered with IPGP Geoscope (Insitut Française Physique du Globe de Paris) for the drilling and borehole installation for installation of a broadband seismic sensor in late 2022. The company

is therefore very acquainted with specific drilling requirements. Reference is made to appendix D for final report of said project.

CDGA expertise is completed with a partnership which has been agreed for this scope of Work with Company New Britain Drillers (NBD), responsible for installation and recent upgrade of seismic station KRVT, Est New Britain Province, Papua New Guinea. NBD is licensed under the Australian water drilling licensing act, License #2806, Class 2, & members of " Australian Drilling Industry Association" and therefore all their work is completed to the exacting same standard, " Minimum Completion Requirements for water bores in Australia and New Zealand".

Technical Approach

LOT 1: Rehabilitation of the Existing Borehole

CDGA agrees to deliver the Services in accordance with the specifications provided in the Terms of Reference, while doing so in the most cost-effective manner possible. CDGA will also ensure that the work is performed in compliance with the laws, norms, regulations in force in Senegal, while at the same time ensuring the labour-safety of personnel at all stages of the work.

CDGA's approach to rehabilitating the existing borehole involves several carefully planned stages to ensure the borehole is restored to optimal functionality. The following tasks will be undertaken:

- **Initial Site Assessment:**
    - Conduct a preliminary site visit to evaluate the current condition of the borehole.
    - Collect data on the borehole's dimensions, depth, and structural soundness.
- **Cleaning and Flushing:**
    - Remove any debris, mud/soil, or blockages from the borehole using high-pressure pumping equipment (water).
    - Perform a preliminary water test to determine the clarity and flow rate, ensuring no residual contaminants remain.
- **Casing Inspection and:**
    - Use down-hole camera technology to assess the condition of the borehole casing from the inside, throughout the entire length.
- **Casing Cleaning:**
    - Brushing and scraping of internal casing walls.
    - Removal of any residual solids or liquids inside the casing.
    - Repair sections (where possible) of the casing that show signs of corrosion, damage, or structural weakness.
    - Seal any identified leaks (where possible) using high-grade cement and or/sealant typically used in borehole applications. In the limit of provided raw material (300 kg cement).
- **Cementing and Sealing Bottom of the Well:**

- Inject high-grade, corrosion-resistant cement to the bottom of the well to prevent future leaks.
- Cement used with be high-early/fast-setting, Type III Portland cement.

- **Final Testing and Reporting:**
  - Conduct a comprehensive leak test to confirm the integrity of the borehole:
    - Cement to have set for a minimum of 24 hours;
    - Water filled-borehole sealed and pressurized to 150 psi;
    - Pressure test to run at least 24 hours;
    - If pressure drops, re-pressurize (150 psi) and repeat;
    - If passes, borehole must be completely evacuated of water and/or debris.
    - CDGA will test whether the installed borehole is properly earthed/grounded and will provide the Commission with the results of these tests. If the borehole fails such earthing tests, CDGA can, on an optional basis, provide remedial works to correct the earthing requirements.
  - CDGA will compile a detailed final report (in English), including all test results, repairs made, and the overall condition of the rehabilitated borehole. The report will include detailed photos and any drawings/diagrams resulting from the completion of the work.

- **Contractor's Responsibilities:**
  - CDGA will be entirely responsible for the work performed as part of the borehole rehabilitation. This includes sufficient equipment (tools and test), supplies and manpower on site to complete the tasks. In particular, CDGA understands the requirement to maintain sufficient cement amounts on site to complete the work as required.
  - CDGA will be responsible for the removal of all debris that result in the testing and rehabilitation process. Extra attention will be paid to ensure that no damage is caused to the surrounding property, including the borehole structure itself.
  - After completion of the work, the site will be cleared of any residual debris. CDGA will ensure that are surrounding the borehole will be free of all items related to the tasks performed, and will clean and remove any additional debris/rubbish as necessary The surrounding are will also be smoothed to its original contours with all vehicle/tractor ruts filled in.
  - CDGA will be responsible for communicating the status/progress of the testing and rehabilitation to the Commission and will be available to the Commission for timely updates.
  - CDGA will be responsible for ensuring that the requirements of water-tightness and quality of cement used, as described within the provided Terms of Reference.

LOT 2: Drilling of a New Borehole

The drilling of a new borehole will be carried out with precision and attention to detail to meet all technical and regulatory requirements.

CDGA agrees to deliver all goods and services in accordance with the specifications provided in the Terms of Reference, while doing so in the most cost-effective manner possible. CDGA will also ensure that the work is performed in compliance with the laws, norms, regulations in force in Senegal, while at the same time ensuring the labour-safety of personnel at all stages of the work.

The scope of work for this task includes the following:

- **Site Preparation and Mobilization:**
    - Conduct a detailed geotechnical survey to select the optimal drilling location within the current station premises. The proposed location will be given to the Commission for approval prior to proceeding further with an work.
    - Once approved site is located, CDGA will clear the site and establish a secure perimeter to ensure safety during drilling operations.
    - CDGA will prepare the site, including levelling of the site, and the removal of any obstacles or other materials undesirable for or otherwise hindering the drilling process.
    - CDGA will then mobilize drilling rigs, support equipment, and personnel to the site. Mobilization will be the responsibility of CDGA.
- **Drilling Operations:**
    - The borehole will be drilled using an appropriately sized drill bit for the final choice of internal casing diameters 17.4cm which is compliant with inner diameter requirement between 14.5 cm (5.69 inches), and 17.8 cm (7.0 inches), while allowing for sufficient annular space to securely grout the casing to the rock formation.
    - Prior to any drilling activities, CDGA will notify the Commission in writing with dimensions of the chosen casing. It is noted that the Commission recommends that the borehole be drilled between 21.6 cm and 26.7 cm.
    - As part of the drilling report, soil/rock samples will be collected at roughly 5metre intervals to provide information on the geological makeup of the location of the planned casing installation.
    - CDGA will drill to the specified depth of 70 meters using rotary drilling techniques.
    - During the drilling process, the borehole's alignment will be continually monitored to ensure it remains within the allowed 2.5-degree deviation from true vertical.
- **Casing and Cementation:**
    - For the casing, a corrosion-resistant steel will be used.

    The casing will be of constant radius, seamless, straight (in the verical direction), and free of irregularities that could reduce the inner diameter. Stainless steel is proposed as first option as it is required within the TOR. A mild steel alternative of similar performances is also proposed.

- CDGA will ensure that the casing is 70m deep and that it will extend 60cm above the ground.
- The casing will be made up of multiple sections, each of which being greater than 3m in length.
- . It is envisioned that each casing will be welded from the outside to each other to ensure watertightness. The process has been used similarly in many other boreholes within the IMS.
- Prior to cementing, the borehole annulus will be flushed with a water-based cleaning solution to facilitate a robust cement bond to the casing and the outer rock wall.
- CDGA will cement the borehole from the bottom to the top using the following method Install a water-tight cement layer.
- CDGA will perform a cement bond log to verify the integrity of the cementation and will monitor the level of cement between the rock and the casing and will top off as required.
- After 24 hours of a constant, correct cement level, CDGA will ensure the inside of the casing has been brushed and scraped with any contents within the casing evacuated.
- No pressure testing will be performed prior to completion of a 24 hour cement curing period.

- **Completion and Equipment Installation:**
  - The extended portion of the casing (60 cm above ground level) will have installed sealed cap to protect the borehole from contamination and will be painted to prevent corrosion. The cap will appropriate conduit (u-shaped) to allow for entry of a sensor cable.
  - The borehole will be equipped with an appropriate electrical earthing ground.
  - A 1mx1m square concrete slab, 20cm thick, will be floated around the top portion of the casing extending out of the round.
  - CDGA will construct a small enclosure to protect the exposed casing section from the elements.
  - CDGA will prepare the borehole for the installation of monitoring equipment, ensuring all dimensions match the specifications provided by the Commission.
  - After completion of the work, the site will be cleared of any residual debris. CDGA will esure that are surrounding the borehole will be free of all items related to the tasks performed, and will clean and remove any additional debris/rubbish as necessary The surrounding are will also be smoothed to its original contours with all vehicle/tractor ruts filled in

- **Acceptance Testing:**
  - Conduct a series of acceptance tests, including:
    - **Verticality Test**: CDGA will ensure the borehole remains within the vertical tolerance limits. Measurements will be made of the deviation from the vertical

at 15m depth intervals and from the base of the borehole. A specific ranger survey tool will be used

- **Leak Test**: CDGA will confirm that the borehole is sealed and water-tight by filling the casing with water and ensuring the water level has not dropped over a 24hour period. All water will be removed from the borehole after successful testing.
- **Obstruction Test**: CDGA will verify that the borehole is free of any blockages or debris and will confirm that a test cylinder of 812mm length and 95mm diameter can pass the entire length of the borehole casing.
- **Continued Monitoring**: CDGA will provide for weekly monitoring over a 30 day period, to ensure that borehole remains watertight.

- **Drilling Report**
  - CDGA document all test results and prepare a final drilling report, detailing the borehole's specifications, test outcomes, and readiness for use. Documents (two copies) will be provided in English and will be delivered within 2 months of completion of the drilling.
    - **Daily Log of Drilling Operations:** The log should include details of all operations, including times, a record of the drill bit diameter used, the lithology or composition of the material being drilled, whether any water zones or lost-circulation zones are encountered, etc.
    - **Casing Tally:** A casing tally showing the length of each section of casing used and the depth-from-surface of each casing joint will be provided by CDGA.
    - **Acceptance Test Results:** All tests results that are recorded during acceptance testing will be provided in a report format to the Commission.
    - **Photo-documentation:** Photographic documentation, with appropriate captioning will be made prior, during and after borehole installation and provided in a report format to the Commission.

Project Management and Reporting

Project Timeline:

CDGA commits to completing the project within the timelines set by the Commission, with key milestones including the submission of the Design Report within one month of contract award and the completion of drilling and rehabilitation works within two months of design approval.

Coordination and Communication:

- **Initial Coordination Meeting:** Organize a kickoff meeting with the Commission and local partners to finalize the project plan, address any potential issues, and ensure alignment on objectives and timelines.
- **Progress Monitoring:** Establish a system for regular progress updates to the Commission, including weekly briefings, monthly reports, and immediate alerts for any significant issues.

Final Reporting:

- **Final Report:** In addition to the reporting described in the Terms of Reference, CDGA will compile a comprehensive final report upon project completion, covering all activities performed, technical specifications, test results, and any challenges encountered. The report will include detailed schematics, photos, and documentation of the borehole's condition and functionality.

Team Composition

Key Personnel:

CDGA will deploy a team of highly experienced professionals, each with a strong background in borehole drilling and rehabilitation. Key team members include James Robertson and Leopold Riom who have extensive experience with the Commission and are specialists in geotechnical engineering and project management.

Local Partnerships:

CDGA will collaborate with local contractors SIPA DRILLING SENEGAL SARL in Senegal to ensure compliance with local regulations and to leverage their knowledge of the area. These partnerships will be crucial for the timely and efficient completion of the project.

Quality Assurance and Risk Management

Quality Control:

CDGA's quality control plan includes regular inspections, adherence to international standards, and thorough testing at each project stage. All work will be documented, and any deviations from the plan will be addressed immediately to maintain the highest quality standards.

Risk Management:

Potential risks, such as unexpected geological conditions or equipment delays, have been identified and mitigated through detailed planning and the selection of reliable suppliers and partners.

Warranty and After-Sales Service

Warranty Terms:

CDGA offers a two-year warranty on all work performed and equipment installed, covering defects in materials and workmanship. This warranty will begin upon the successful commissioning of the borehole.

After-Sales Support:

CDGA will provide ongoing support, including maintenance services and access to spare parts, to ensure the long-term functionality of the borehole.

Conclusion

Commitment to Success:

CDGA is fully committed to delivering this project on time, within budget, and to the highest standards. Our extensive experience with similar projects and our deep understanding of CTBTO's requirements position us as the ideal partner for this critical infrastructure project in Senegal.

Attachments

- **Appendix A - Technical Specifications:** Datasheets for equipment and materials.

- **Appendix B -Resumes of Key Personnel:** Detailed CVs of team members
- **Appendix C - Past Project References:** CDGA within the IMS
- **Appendix D – Contractors :** SIPA drilling past references and company profile