MOKOLO AND CROCODILE WATER AUGMENTATION PROJECT PHASE 2 (MCWAP-2)

TENDER NO 054/2024/PMID/MCWAP2/RFB

PART C3.1
SPECIFICATION

SECTION 45

NON-LETHAL ELECTRIC FENCE SYSTEM

PART C3.1
SPECIFICATION

SECTION 45
NON-LETHAL ELECTRIC FENCE SYSTEM

TABLE OF CONTENTS

PAGE

SECTION 45

NON-LETHAL ELECTRIC FENCE SYSTEM

45.1 SCOPE

This Section deals with the design, manufacture, supply, installation and Tests on Completion (pre-commissioning and commissioning) of a 3 m high security fence and a zoned non-lethal electric fence system, with motorised sliding gates, at the following locations:

a) Low-Lift Pumping Station; and

b) High-Lift Pumping Station.

The electric fence system shall be integrated with the pump station security system, supplied in terms of this Contract, and in accordance with the requirements of this Section.

The zoned non-lethal electric fence and gate system shall be installed between the reinforced security fences around the pump stations.

This Section shall be read in conjunction with Section 43 - Security General to confirm interface requirements with access control. Please refer to Section 38 for power supply.

The Contractor shall submit a preliminary design to the Engineer for discussion before preparing and submitting the detailed design to the Engineer for approval.

This Section shall be interpreted as follows:

a) For the Employer design aspects it shall be regarded as a Specification; and

b) For the Contractors design aspects it shall be regarded as an Employers Requirement.

45.2 APPLICABLE SPECIFICATIONS AND STANDARDS

The electrified fence shall, where applicable, be erected and tested in accordance with the following Standards, Acts and Regulations:

a) The latest issue of SANS 2220 SANS 10222-3:2006 1994: Electrical Security Systems, Part 3.1 - Perimeter Protection: Electric Fence Energizers;

b) Government Regulation R1593 published in Government Gazette No. 14350 in 1992;

c) The latest issue of SANS 10142: “Code of Practice for the Wiring of Premises”;

d) The Occupational Health and Safety Act, Act 85 of 1993, as amended;

e) The Local Government Ordinance, Ordinance 17 of 1939, as amended, and the municipal by-laws and any special requirements of the local supply authority;

f) The Fire Brigade Services Act, Act 99 of 1987, as amended;

g) The National Building Regulations and Building Standards Act, Act 103 of 1977 as amended;

h) The Post Office Act, Act 44 of 1958, as amended; and

i) The Electricity Act, Act 41 of 1984, as amended.

45.3 DEFINITIONS AND REFERENCES

45.3.1 Definitions

For the purpose of this document:

a) **"Electric fence"** shall mean a barrier, which includes one or more electric conductors, insulated from earth, into which electric pulses are induced by an energizer.

b) **"Connecting lead"** shall mean an electric conductor, used to connect the energizer to the electric fence or the earth electrode.

c) **"Pulsed conductors"** shall mean conductors, which are subjected to high voltage pulses by the energizer.

d) **"Public access area"** shall mean any area where persons are protected from inadvertent contact with pulsed conductors by a physical barrier.

e) **"Secure area"** shall mean an area where a person is not separated from pulse conductors below 1.5 m above ground level by a physical barrier.

45.3.2 References

When reference is made to a Code of Practice, Specification or Standard, the reference shall be taken to mean the latest edition or replacement at time of tender of the Code, Specification or Standard; including addenda, supplements, modifications and revisions thereto. Where a previous version is intentionally used, it will be indicated as such. Where reference is made to a Code, Specification or Standard that has subsequently been withdrawn and not replaced, the intended content will remain relevant unless confirmed otherwise in writing by the Engineer.

45.4 GENERAL REQUIREMENTS

The electric fence shall be installed and operated so that it causes no electrical hazard to persons, animals or their surroundings, unless they attempt to penetrate or are in the secure area between the outer and inner security fences without authority. The gates in the electric security fence shall be operated in the de-energised state. The motorised gates shall operate in the manner as accepted at the time of Tender.

The electric fence shall not be supplied from two different energizers or from independent fence circuits of the same energizer.

Insulated high voltage connecting cables shall be used between the fence and energizer. Connecting leads and earth wires installed underground shall be installed in conduit.

Connecting leads shall not be installed in the same conduit as the mains supply wiring, communication cables, or data cables. Mains supply wiring shall not be installed in the same conduit as signalling leads associated with the electric security fence installation.

The fence shall be earthed properly with at least one earth electrode as close as possible to the energizer. The minimum distance between the fence earth electrode and other earth systems shall be at least 10 m.

Connecting leads inside buildings shall be effectively insulated from the earthed structural parts of the building. Connecting leads should not run parallel to the fence wires.

Protection from the weather shall be provided for the ancillary Plant items, unless these Plant items are certified by the manufacturer as being suitable for outdoor use, and has an ingress protection rating of at least IP65.

Ferrules or line clamps of similar materials shall be used to connect two high voltage wires together.

45.5 ELECTRIC FENCE

The electric fence shall be a full height, 3 m, and 30-strand freestanding fence. The design of straining and intermediate posts shall be such to provide sufficient support to the fence structure without bowing or bending.

A minimum of one straining post shall be installed at the beginning of each zone, at any bend in the fence line and no more than 48 m apart. All straining posts shall be designed as self-supporting and in such a way as not to rely on the new inner or outer security fences for any horizontal support. Posts shall be buried at a minimum of 600 mm below the surface and fixed in concrete of 300 x 300 x 800 mm deep and of 10 MPa strength. Fence zones shall have a maximum length of 200 metres per zone. The posts shall be of steel construction at least 75 x 75 x 2.5 mm section, fitted with a welded base plate 100 x 100 x 4 mm, hot dipped galvanised and painted in accordance with Section 37 – Painting and Corrosion Protection.

Intermediate posts shall be installed maximum 2.4 m apart and shall be buried a minimum of 600 mm below the ground surface and fixed in concrete of 300 x 300 x 800 mm deep and of 10 MPa strength. They shall be of steel construction, at least 50 X 50 X 2.5 mm section, fitted with a welded base plate 100 x 100 x 4 mm, all hot dipped galvanised and painted in accordance with Section 37 – Painting Corrosion Protection.

Straining and intermediate posts, including all metal components shall be hot-dipped galvanised and painted in accordance with Section 37 – Painting and Corrosion Protection. All necessary holes and welding shall be completed prior to galvanising. Cold galvanising will not be allowed except for minor repairs as specified in Section 37 – Painting and Corrosion Protection.

Wire strands shall be a minimum of 1.6 mm solid stainless steel. Spacing of wires to be 100 mm. The bottom wire shall not be more than 100 mm from the ground at any place. All wires shall be tensioned. No sagging of wires will be permitted.

Insulators shall be UV stabilised and black in colour. Only through-line intermediate insulators will be permissible. (The wire must not be able to be removed from the insulator unless the wire is cut or pulled through).

Wires shall be tensioned using suitable tensioners (Donaldson Tensioners). Tensioning springs will not be allowed.

Final fence design and components shall be approved by the Engineer prior to manufacture.

Cable connections and junctions shall be joined with stainless steel line clamps. Stainless steel ferrules may be used for 1.2 mm wire interconnections. All interconnections shall be neat and uniform with sufficient spacing to prevent arcing of the high tension (HT) wires to posts. All crimp connections shall be crimped with the correct Lobster crimping tool.

45.6 FENCE INTERCONNECTIONS

All looping and fence interconnections shall be bonded with crimped stainless steel ferrules. All connections shall be sprayed with anti-corrosive spray (Tactol) to prevent bi-metallic corrosion.

The HT cabling shall be of a high grade with sufficient insulation spacing to prevent arcing or leaking currents. Cable insulation shall be hard, black, UV stabilised (No slim-line HT cable will be allowed).

Interconnecting cables and loops to be consistently neat and orderly tide where applicable with cable ties.

45.7 DETECTION - WALL BREAK / CLIMB

The Contractor shall propose a detection system, installed along the electric fence line, which shall be fully integrated with the CCTV and access control system specified in Section 43 - Security General, which will alert the guardhouse of the following conditions:

a) A person climbing the fence;

b) A person breaking the fence; and

c) A person burrowing under the fence.

The detection medium shall either be buried alongside or attached to the fence in 200 m (maximum) zone sections corresponding to the electric fence zoning. When a detection medium is activated, the PTZ camera shall focus in on that area and the images shall be automatically displayed on a screen in the CCTV viewing room of the guard house.

45.8 FIELD ELECTRONICS

45.8.1 Field Electronics – Enclosure

45.8.1.1 Location

An IP66 enclosure shall be provided in the guard house.

45.8.1.2 Electrical and Electronics

All associated electronic and electrical Plant items shall be housed in this enclosure. Provision for sufficient surge and lightning protection shall be provided. All Plant items shall be securely mounted to the back plate in such a manner as not to interfere with each other and to be modular in design for easy access for testing and removal. All copper wire cables shall be terminated with crimp type lugs or associated Plant termination plugs. All interconnections shall be made on a labelled rail mount termination block. No joining or soldering of connecting cables between components will be permitted.

45.8.2 Field Electronics, Electric Fence and Energiser

45.8.2.1 Design and Installation

The fence design will be of a series design with a feed from and return path to the energiser per 200-metre zone with alternative earth wires.

45.8.2.2 Fence Energiser

The unit shall emit a minimum of 7.6 Joules of energy pulsed at one pulse per second (500 ohms at max settings). Voltage levels shall be a minimum of 6 kV and a maximum of 8.5 kV at any live wire section on the fence with relation to ground. The energiser shall have electronic circuits to measure and report the following conditions by dry contact outputs and via a serial interface: on or off, mains fail, low battery, fence open alarm condition, fence short to ground alarm condition, device tamper, and fence low voltage (voltage leaking condition).

Complete details of the serial interface shall be provided to the Engineer for approval, including details for:

a) Hardware;

b) Communication protocol software; and

c) Data that can be transferred.

The energiser shall have an alarm condition memory and shall be installed in such a manner as to provide for both remote and local indication and re-setting of the alarm condition as well as activating and de-activating the unit. The fence energiser shall be installed in the electronics enclosure, in such a manner as not to interfere with any other electronic Plant items in the enclosure. The energiser shall be supplied with its own sealed lead acid battery to provide back-up power to the energiser in the event of a mains power failure. The battery shall provide the energiser with enough power to maintain normal operation for a minimum of 4 hours under normal operating conditions. The energiser and battery installation shall be of such a nature as to provide for easy access and removal during field service checks and module replacement. The energiser will be equipped with mains, line surge, and lightning protection.

45.8.2.3 Earthing

One-metre long earth spikes shall be driven into the soil every 50 m and bonded to the nearest straining post and to each ground wire.

45.8.2.4 Inline Ground Loops

Three inline ground loops shall be attached to the fence wires between each vertical or angled post, one at the top, one in the centre, and one at the bottom of the fence.

45.9 DESIGN DETAIL

The electric fence system shall comprise the manufacturer’s standard Plant that is modified only as required to meet the requirements of this Section using standard components and materials.

The electric fence system shall conform to the following:

a) Alarms can be isolated, de-isolated, acknowledged and reset by operating or maintenance personnel with training, but without detailed technical knowledge of the system operation;

b) System testing shall not result in inadvertent shut down of Plant;

c) De-isolation of circuits which have an alarm condition present shall not result in inadvertent shut down of Plant;

d) Suitable interlocks, indicating lamps, screen messages, and unambiguous systematic operating procedures shall be provided on the panel for the above;

e) The detection system specified in Clause 45.7 above shall have an interface with certain PTZ cameras of the CCTV system, as specified in Section 43 – Security General; and

f) The intrusion sensor signals of the detection system shall be used as inputs to certain PTZ cameras on the perimeter to enable the CCTV system to record the person or animal attempting to breach the fence, as specified in Section 43 – Security General.

45.10 SIGNAGE

The electric fence shall be identified as such at frequent intervals by prominently placed warning signs securely fastened to the fence posts or firmly clamped to the fence wires. The size of the warning signs shall be at least 100 x 200 mm. The background colour of both sides of the warning plate shall be yellow. The inscription on the plate shall be black. The inscription shall be indelible, inscribed on both sides of the warning plate and have a height of at least 25 mm.

Warning signs shall be placed at:

a) Each gate;

b) Each access point;

c) Intervals not exceeding 10 m; and

d) Adjacent to each sign relating to chemical hazards for the information of emergency services.

45.11 CROSSING POWER AND COMMUNICATION LINES

Connecting leads and electric fence wires shall not cross above overhead power or communication lines.

Crossings with power and communication lines shall be avoided wherever possible. If such a crossing cannot be avoided, the crossing shall be made as near as possible at right angles to it.

45.12 ELECTRICAL DRAWINGS

Electrical drawings for the electric fence shall be provided all in accordance with Clause 38.35.7 for the Engineer's approval as follows:

a) Functional logic charts or diagrams;

b) Schematic wiring diagrams;

c) Termination diagrams;

d) General arrangement drawings;

e) Construction detail drawings and Plant list; and

f) Label details.

45.13 TESTING AND TESTS ON COMPLETION

All factory testing certificates, including routine and type testing, shall be submitted to the Engineer before the Plant is delivered to Site.

Tests on Completion and site testing shall be performed by the Contractor. A testing plan shall be submitted to the Engineer for approval before the start of such testing as per the requirements of Section 48.

45.14 OPERATION AND MAINTENANCE MANUAL AND AS-BUILT DRAWINGS

The Contractor shall prepare and submit for approval an Operation and Maintenance (O&M) Manual incorporating “as-built” drawings for the complete system prior to Tests on Completion, all in accordance with Clause 48.9 - Operation and Maintenance Manuals.

45.15 CORROSION PROTECTION

Corrosion protection shall be done in accordance with Section 37 – Painting and Corrosion Protection.

45.16 TRAINING

The Contractor shall be responsible for training the designated operational personnel of the Employer as per the requirements of Clause 48.6.3 – Operational Staff Training. All training shall be carried out on Site, unless otherwise requested by the Engineer. The Employer will nominate three Operators for this training.

45.17 QUALITY CONTROL FOR ELECTRICAL WORKS

Refer to Section 38 - Electrical General.

45.18 MEASUREMENT AND PAYMENT

The rates tendered under this Section shall not include for the general obligations, Contractor’s Equipment and work deemed to be covered by the items provided in Section 1 - General.

45.001 Design and Documentation — Unit: lump sum (Sum)

Measurement of the design of the fence and electrical system will be by lump sum.

The rates tendered shall include for full compensation of all costs incurred in the preparation of the design and calculations, detail drawings for all systems, schematic diagrams, electrical drawings and wiring diagrams, layout drawings, programmes of work and any other works as specified for the design of the complete fence and electrical system. Payment will only be effected after the design and associated documentation has been approved by the Engineer.

Measurement and Payment for the preparation and submission of O&M Manuals shall be covered under Clause 48.11 of Section 48 – Tests on Completion and paid elsewhere.

45.002 Supply and Deliver to Site Unit: lump sum (Sum)

The rates tendered shall include full compensation for the supply and delivery of the Plant to Site including the:

a) Supply of raw materials and bought-out items and associated Plant items (i.e. cabling and electrical system);

b) Fabrication, manufacture and assembly;

c) Application of finishes (painting and corrosion protection);

d) Quality assurance and quality control;

e) Inspection and Factory Acceptance Testing (including attendance on inspections and tests witnessed by the Engineer); type and routine tests;

f) Preparation and packing for transport; transport from place of manufacture to site; insurance, etc., during transport;

g) Loading and unloading; storage under appropriate conditions from date of delivery until commencement of erection; and

h) Any other work as specified.

Payment will be made by lump sum. Payment will only be effected after full compliance of the Plant items with this Section and associated documentation has been approved by the Engineer.

45.003 Installation of Plant Unit: lump sum (Sum)

The rates tendered shall include for the full compensation for the installation of the Plant on Site including the:

a) Provision of all labour, transport, materials and Temporary Works necessary to install the complete works;

b) The installation of all auxiliary Plant items, electrical cables, panels etc.; necessary for the operation of the installation until taken over by the Employer;

c) Supply of all consumables (electricity, fuel, oil and lubricants etc.) necessary for the operation of the installation until taken over by the Employer;

d) On-site quality assurance and quality control, inspection, testing (including attendance at tests witnessed by the Engineer);

e) The putting into service of the complete installation of the Plant; and

f) Any other work as specified required to render the fence and electrical system complete in every way as specified.

The rates shall also include for all pre-commissioning testing and the provision of equipment therefore.

Measurement for installation, testing and commissioning will be by lump sum. Payment will only be effected after full compliance of the Plant items with this Section and associated documentation has been approved by the Engineer.