

**PROCUREMENT OF DRONE  
MAPPING OF DUMPSITES  
(NON-CONSULTING  
SERVICES) THROUGH  
REQUEST FOR QUOTATION  
(RFQ)**

*(PACKAGE 2 comprising of 9  
Dumpsites spread across the  
Districts of Ernakulam, Thrissur  
and Palakkad)*

**MAY 2023**

**REQUEST FOR QUOTATIONS**  
**Procurement of Non-Consulting Services under RFQ**  
**E-Procurement Notice**

**Client: Kerala Solid Waste Management Project**

**Contract title: Drone Mapping of Dumpsites**

**RFQ No: IN-SUCM-360960-NC-RFQ**

**Date: 12-05-2023**

**Applicable Procurement Regulations Date: November 2020**

- The Government of India has received financing from the World Bank in various currencies towards the cost of the **Kerala Solid Waste Management Project** (KSWMP) and intends to apply part of the proceeds towards eligible payments under the contract for which this request for quotations is issued. The Kerala Solid Waste Management Project invites quotations electronically from eligible bidders for the following non-consulting services.

<b>Sl. No.</b>	<b>Brief Description of the Services</b>	<b>Specifications*</b>	<b>Unit &amp; Quantity</b>	<b>Delivery Period</b>
1	Package 2 for Drone Mapping of 9 Dumpsites spread across the Districts of Ernakulam, Thrissur and Palakkad	As per attached Terms of Reference (ToR)	Total of 30.07 acres of land in 9 sites	16 weeks

- The Bidders may submit Quotations for all nine sites in this Package 2.
- This e-Procurement notice includes the terms and conditions applicable to submission of quotations; criteria for qualification, evaluation, and for award of supply order(s); and relevant forms to be filled by the bidders. Implementing Agency has not issued a separate RFQ document for this purchase. The e-Procurement notice including the terms and conditions etc. can be downloaded free of cost by logging on to the website: <https://etenders.kerala.gov.in/nicgep/app>; The bidders would be required to register in the website, which is free of cost.
- For submission of Quotation, the Bidder is required to have Digital Signature Certificate (DSC) from one of the Certifying Authorities authorized by Government of India for issuing DSC. Bidders can see the list of licensed CA's from the link

- ([www.cca.gov.in](http://www.cca.gov.in)). Bidders who have not obtained the user ID and password for participating in e-procurement in this Project, may obtain the same from the website: <https://etenders.kerala.gov.in/nicgep/app>;
5. Quotations shall be submitted on <https://etenders.kerala.gov.in/nicgep/app>; on or before **16:00 Hrs on 22 May 2023**. Any quotation or modifications to quotation received outside e-procurement system will not be considered. The electronic bidding system would not allow late submission of quotations. The Quotations will be opened online on **22 May 2023 at 16 : 30 Hrs**, this can also be viewed by the bidders online. The electronic summary of quotation opening will be generated and uploaded online.
  6. If the Client's office happens to be closed on the date of opening of the Quotations as specified, the Quotations will be opened on the next working day at the same time.
  7. Other details can be seen in the RFQ document. The Client shall not be held liable for any delays due to system failure beyond its control. A Bidder requiring any clarification of the RFQ Document may notify the Client online or may visit the office of the Client at the address given below.

*Mohammed Y Safirulla K, IAS  
Project Director  
Address: Upper Ground Floor, Trans Towers, Vazhuthacaud,  
Thiruvananthapuram -695014, Kerala, India  
Telephone: +91 471-2333011  
E-Mail: [tenderkswmp@gmail.com](mailto:tenderkswmp@gmail.com);  
Website: [www.kswmp.org](http://www.kswmp.org);*

8. For any queries clarifications please contact

Anoop P, Project Head Infrastructure, KSWMP  
Contact No – 9633779771

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**RFQ No: IN-SUCM-360960-NC-RFQ**

**Date: 12-05-2023**

### **Terms and Conditions**

1. **Eligibility:** A Bidder (a) shall not participate in more than one Quotation; (b) shall not have conflict of interest as defined in the Bank's Procurement Regulations; and (c) should not have been (i) temporarily suspended or debarred by the World Bank Group in compliance with the Bank's Anti-Corruption Guidelines and its Sanctions Framework
2. **Clarifications & Amendments:** If the Client receives any request for clarification of this RFQ Document, it will upload its response together with any amendment to this document, on the e-procurement portal for information of all Bidders. Bidders should check on the e-procurement system, for any amendments to the terms and conditions.
3. **The Quotation shall comprise the following:**
  - (a) Letter of Quotation;
  - (b) Technical Specifications: confirmation that the offered Drone Mapping of 8 Dumpsites (Non-Consulting Services) conform to the required specifications stated in the attached Terms of Reference (ToR);
  - (c) Evidence in accordance with Clause 6 establishing Bidder's qualifications to perform the contract, if its quotation is accepted;
  - (d) Performa for Previous Experience of supplies of similar Non-Consulting Services made during the last 3 years, in the prescribed Format;
  - (e) Complete address and contact details of the Bidder having the following information:  
  
Name of Firm  
Address for communication  
Telephone No(s): Office  
Mobile No.  
Facsimile (FAX) No.  
Electronic Mail Identification (E-mail ID)
  - (f) Price Schedule (using the Schedule uploaded with the RFQ document)

### **4 Quotation Prices**

- a) The contract shall be for the full value of all the Dumpsites ty of each item, as specified in the Price Quotation Form. Corrections, if any, can be carried out by editing the information before electronic submission.
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- b) All duties, taxes and other levies payable on the raw materials and components shall be included in the total price.
  - c) GST and any other taxes, which will be payable on the Non-Consulting at the time of invoicing in connection with the sale, shall be shown separately. If these are only stated to be extra, such quotations are liable to be rejected. Wherever these taxes are not shown, these will be assumed to have been included in the quoted price.
  - d) The rates quoted by the bidder shall be fixed for the duration of the contract and shall not be subject to adjustment on any account.
  - e) The Prices shall be quoted in Indian Rupees only.
5. **Conformity of Non-Consulting Services offered:** Bidder shall furnish, documentary evidence that the Non-Consulting Services offered conform to the technical specifications and standards, laid down in the attached Terms of Reference (ToR)
6. **Qualification of the Bidder: This Drone Survey is estimated to cost an indicative sum of INR 18.00 Lakhs.**
- (a) Bidder should have undertaken and completed similar Drone Mapping (Non-Consulting Services) of **at least 50 %** value of the estimated in any one of last 3 years. Details of such Drone Mapping Services delivered during the last 3 years shall be submitted in the specified Proforma.
  - (b) Bidder should have had an average annual income of more than **INR 10 lakhs** in any three of the previous five financial years (i.e. FY2017-18, FY 2018-19, FY 2019-20, FY 2020-21 and FY 2021-22).
7. **Validity of Quotation:** Quotation shall remain valid for a period not less than 30 days after the deadline date specified for submission.
8. **Signing of Quotations:** The name and position held by the person signing the quotation and related documents must be mentioned in the Letter of Quotation.
9. **Quotation Submission:** The Letter of Quotation shall be filled, signed and scanned copies shall be uploaded along with the Price Schedules that shall be furnished using the Forms available online without any alterations. All blank spaces shall be filled in with the information requested. Scanned copies of all other documents shall also be uploaded on this website.
10. **Online Opening and Evaluation of Quotations:** The Quotations will be opened online on the specified date and time. This can also be viewed by the bidders online, and electronic summary of quotation opening will be generated and uploaded online.
- (a) The Client shall examine the quotation to determine whether the quotation
    - (a) has been properly signed (Clause 8);
    - b) meets the eligibility criteria (Clause 1);
    - (c) conforms to all terms, conditions and technical specifications as laid down in the Terms of Reference (ToR); and
    - (d) the bidder has accepted the delivery schedule (Client's Requirement Form 1).

- (b) Only Quotations that are substantially responsive to the RFQ document, and meet all Qualification Criteria shall qualify.
- (c) The evaluation shall be based on the total price of Drone Mapping of 8 Dumpsites (Non-Consulting Services) including GST and any other taxes, which will be payable for these non-consulting services at the time of invoicing.
11. **Award of contract:** The Client will award the contract to the bidder whose quotation has been determined to be substantially responsive and who has offered the lowest evaluated quotation price.
- (a) Notwithstanding the above, the Client reserves the right to accept or reject any quotations and to cancel the bidding process and reject all quotations at any time prior to the award of contract.
- (b) The bidder whose quotation is accepted will be notified of the award of contract by the Client prior to expiration of the quotation validity period. The terms of the accepted offer shall be incorporated in the supply order (sample form attached).
- (c) Milestones payments shall be made against each deliverable mentioned in the ToR after certification by the Client's Representative. Payment of GST and other taxes payable for the Non-Consulting Services at the time of invoicing, although already included in the total cost, will be at actuals or the rate/amount of these taxes specified in the supply order, whichever is lower.
- (d) Payment Milestones

No.	Deliverables for package 2	Expected date	Payment Milestones
1	Implementation report	2 weeks after NTP	10 %
2	Site maps and pictures	7 weeks after NTP	40 %
3	Data hosting system operational	10 weeks after NTP	10 %
4	Draft final report	14 weeks after NTP	10 %
5	Final report	16 weeks after NTP	30 %

## **Quotation Forms**

## Letter of Quotation

*The Bidder must prepare the Letter of Quotation on stationery with its letterhead clearly showing the Bidder's complete name and address. The italicized text is for Bidder's guidance in preparing these forms and shall be deleted from the final products.*

RFQ No.: *[insert identification]*

Our Reference: No..... Dated.....

To:  
(Client's name and address)

Subject: Services for.....

Sir,

1. We, the undersigned, hereby submit our Quotation. In submitting our Quotation, we make the following declarations:

- (a) **No reservations:** We have examined and have no reservations to the RFQ Document;
- (b) **Conformity:** We offer to provide in conformity with the RFQ Document and in accordance with the Delivery Schedules specified in the Schedule of Requirements the following Non-Consulting Services and Related Services *[insert a brief description of the Non-Consulting Services and Related Services]*;
- (c) The total price of our Quotation, including any unconditional discounts offered is:  
Total price of the Quotation *[insert the total price of the quotation including GST and any other taxes, which will be payable on the finished Non-Consulting Services, in words and figures]*;
- (d) **Commissions, gratuities and fees:** We have paid, or will pay the following commissions, gratuities, or fees with respect to the Bidding process or execution of the Contract: *[insert complete name of each Recipient, its full address, the reason for which each commission or gratuity was paid and the amount and currency of each such commission or gratuity. If none has been paid or is to be paid, indicate "none."]*
- (e) **Quotation Validity Period:** Our Quotation shall be valid for the period of 15 days, from the deadline fixed for the Quotation submission;
- (f) **Eligibility:** We meet the eligibility requirements and have no conflict of interest, we are not participating in more than one quotation in this bidding process, and we have not been temporarily suspended or debarred by the World Bank.
- (e) **Fraud and Corruption:** We hereby certify that we have taken steps to ensure that no person acting for us or on our behalf will engage in any type of corrupt, fraudulent, collusive, coercive, or obstructive practices.

Yours faithfully,

Authorized Signature

Name & Title of Signatory \_\_\_\_\_

In the capacity of *[insert legal capacity of person signing the Letter of Quotation]*

Name of Bidder \_\_\_\_\_

Address \_\_\_\_\_

Dated on \_\_\_\_\_ day of \_\_\_\_\_, \_\_\_\_\_ *[insert date of signing]*

**FORMAT OF QUOTATION**

<b>Sl. No.</b>	<b>District</b>	<b>ULB</b>	<b>Dumpsite Location</b>	<b>Area of Dumpsite (Qty). in Acres</b>	
1	Ernakulam	Kothamangalam	Kumbalathumuri	2.60	
2		Kalamassery	Kalamassery	0.75	
3		Muvattupuzha	Kurianmala	5.47	
4		North Paravoor	Vedimara	2.40	
5	Thrissur	Kunnamkulam	Kunnamkulam	3.93	
6		Thrissur Corporation	Shakthan	0.92	
7		Wadakanchery	Kumbalangad	2.86	
8	Palakkad	Ottapalam	Panamanna	2.64	
9		Palakkad	BPL Junction, Koottupatha,Kodum ba	8.50	
<b>Total (a)</b>				<b>30.07</b>	
<b>Quoted Unit Rate per Acre (b)</b>					
<b>Quoted Amount (c) = (a)*(b)</b>				In Figures	In Words
<b>GST</b>					
<b>Total Including GST</b>				In Figures	In Words

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**Note:** Evaluation shall be done for *all sites together*

*\* Payment of GST and other taxes payable for the Non-Consulting Services at the time of invoicing, although already included in the total cost, will be at actuals or the rate/amount of these taxes specified in the supply order, whichever is lower.*

We agree to supply the above Non-Consulting Services in accordance with the technical specifications as laid down in the Terms for a total contract price (including all taxes and duties) of Rs. .... (Amount in figures) (Rs... amount in words) within the period specified in the Request for Quotations.

We hereby certify that we have taken steps to ensure that no person acting for us or on our behalf has engaged in corrupt, fraudulent, collusive, coercive, or obstructive practices (as defined in the prevailing World Bank's sanctions procedures) in competing for or in performing the Contract.

**Signature of Bidder**

## PROFORMA FOR PREVIOUS EXPERIENCE

Proforma for Previous Experience (for a period of last 3 years)

RFQ No. \_\_\_\_\_

Date of opening \_\_\_\_\_

Time \_\_\_\_\_ Hours

Name of the Bidder \_\_\_\_\_

Assignment Name:	Approx Value of contract (in INR):
Location:	Duration of Assignment:
Name of Client:	Approx Value of the services provided by your firm under the contract (in currency in INR):
Start Date: Completion Date:	No of Staffs for the assignment:
Description of Project:	Description of Service provided by the firm:

**Signature and seal of the Bidder**

## *Client's Requirement*

Detailed Terms of Reference is attached as **Annexure 1** of this RFQ

## **2. TECHNICAL SPECIFICATIONS**

Detailed Terms of Reference is attached as **Annexure 1** of this RFQ

# *Annexure 1*

**Kerala Solid Waste Management Project (KSWMP)**

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*Terms of Reference for Consulting Services  
for the drone mapping of 9 dumpsites in Kerala – Package 2*

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*May 2023*

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## 1. BACKGROUND TO THE STUDY

Kerala has been urbanizing more rapidly than the national average. According to the last census, from 2001 to 2011 the percentage of urban population nearly doubled, with an Annual Growth Rate of urban population of 6.5 percent and a population density - 859 persons/sq. km, thrice the national average - 382 persons/sq.km. About 48 percent of the state's population lives in urban areas (covered under 93 ULBs, and notified urban agglomerations), with 52 percent of population concentrated in mid-small sized ULBs between 20,000-100,000 people, and the remaining 48 percent in bigger ULBs of over 100,000 people. Government of Kerala has enabled policies and established agencies to support SWM activities across the state. Still SWM services in the state need improvement particularly in various infrastructure and service delivery systems across the value chain. This includes the closure of existing dumpsites and development of engineered landfills.

The Project Development Objective of the Kerala Solid Waste Management Project (KSWMP) is to strengthen the institutional and service delivery systems for solid waste management in Kerala<sup>1</sup>. The project envisages comprehensive upgradation and development of solid waste management activities at various levels under three components:

**Component 1-** Institutional Development, Capacity Building and Project Management

**Component 2-** Grant support to ULBs for SWM.

**Component 3 -** Development of regional SWM facilities.

Under Component 2, and 3 as detailed below, KSWMP provides for the closure of existing dumpsites:

- a. regional sanitary landfills (SLF) and transfer stations (TS) for municipal solid waste disposal;
- b. regional C&D waste management facilities;
- c. regional processing and recycling facilities; and
- d. closure/remediation of existing dumpsites**

The project envisages hiring the services of a technical Bidder (firm) for conducting the drone mapping of selected dumpsites across Kerala.

This document gives lists the scope of the work to be considered by the Bidder for conducting this mapping/survey.

### OBJECTIVE

The objective of the assignment is to gather topographic and aerial imagery of selected dumpsites and their surroundings across Kerala and estimate the volumes of waste accumulated at each site.

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<sup>1</sup> More details about KSWMP can be found at <https://kswmp.org>

## **SCOPE OF WORK**

### **Broad scope of work**

The Bidder will survey/map a total of 25 locations across 14 districts with a total surface area of approximately 100 acres which were identified by the State Project Management Unit (SPMU). Work is divided into 3 separate packages to be executed in parallel. This ToR pertains to package 2 which includes 9 dumpsites

The scope of work, for each site, in each package is as follows:

1. Capture video materials and still photographs that will show a clear bird's-eye view of the entire site and the adjacent surrounding lands over a distance of 100m; showing, at each site, a clear view of the topography, areas covered with waste, natural vegetation, streams/waterways, ongoing property development, farming/gardening activities, location of physical public infrastructure (like transmission networks) of the utilities and other public agencies, settlements, photographs of workers and rag-pickers at the dumpsites etc;
2. Produce survey drawings including delineating the boundaries of each plot;
3. Compile a report explaining the processes and tools used to conduct the survey and present a detailed description of the findings from the survey;
4. Store survey data in a secured online repository, in the standard formats as described in the TOR, and share access with the SPMU.

### **Detailed scope of work**

The drone mapping data capture should be divided into three stages; flight planning, the establishment of Ground Control Points (GCPs) and Check Points (CPs) and data capture.

- **Flight Planning**

Flight plans need to be developed for all mapping activities prior to field work. Preliminary desk studies will characterize all sites to survey using KMZ files shared by the SPMU. The KMZ files will show the total area (polygons) for all sites to be mapped. The polygons of the sites will be broken down into smaller segments with similar relief to ensure efficient and effective mapping and to ensure the drone is always within visual line of sight (VLOS).

These smaller segments will be used as the basis of flight polygons and exported as KMLs for import into the specific drone app(s) to generate flight plans. Once the flight plans are created drone pilots will carefully review each flight plan to check flight parameters were set correctly to ensure the flight would capture the desired data. Flight plans should take into consideration the following parameters:

- a. Flight Pattern Type: Grid, Double Grid, Circular, Perimeter 3D, Linear as required by the environment;
- b. Altitude: height the drone will fly above ground level (AGL) to ensure optimal final resolution of ortho mosaic maps;

- c. Ground Sampling Distance (GSD): selected to ensure that all required details as stated above are visible (**5 cm**)
- d. Overlap: Endlap and sidelap to maximize success of success by processing software when reconstructing models. Indicative values to ensure the capture of optimal pictures with enough overlap; flight altitudes could range between 80-105 m to ensure the GSD was lower than or as close to **5 cm GSD**, taking into consideration topography and landforms present within the AOIs and overlap.

- Establishment of Ground Control Points (GCPs) and Check Points (CPs)

GCPs will be used to georeference the model and CPs will be used to assess the absolute accuracy of the model. GCPs and CPs should be established shortly before the survey under the form of large targets in the shape of an X spray-painted onto the ground using high contrast colors.

GCPs and CPS should be distributed around survey locations in such a way as to prevent clustering in any one area at each project site. Once all targets are established, the location of each target should be captured using a Global Navigation Satellite System (GNSS) equipment. Resulting GCPs and CPs coordinates will be provided for each site.

All data should be collected using the World Geodetic System 1984 (WGS84) datum.

- Prepare and execute pre-flight check list.
- Data capture

Data will be collected using the state-of-the-art drone survey equipment. Drone flight plans should identify launch locations with minimal obstructions (trees, buildings and powerlines) to avoid interference and obstacles. At each of the launch locations, the base station will be set up precisely over known points either leveraging benchmarks established on-site or points previously measured to ensure that the survey has an absolute accuracy to a coordinate reference system.

- Aerial Images and Videos

Photographs and videos of the sites will be taken at strategic locations within and around the sites to provide an enhanced perspective of the sites by capturing details which may be important to capture and the adjacent surrounding lands.

- Data Processing

- Online GNSS Data Processing: GNSS data will be processed after downloading, reviewing, and editing the data.
- Drone Image Processing: Image processing will be conducted with an application for photogrammetric processing that uses images captured by drones to generate 3D models and maps, such as orthomosaics, point clouds, 3D textured mesh and other useful outputs.

- Geolocation GPS/GCP

- Point cloud and mesh

This part is required to ensure generation of Digital Surface Models (DSM and enable the computation of Volumes,) and Orthomosaics.

- Hosting of data

The hosting of data is needed for robust, scalable and timely sharing of information and data collected as part of the survey. Basic functional requirements include a web-based system for collecting, managing, visualizing, mapping, analysing, evaluating and reporting on various components of the drone survey.

As part of his proposal, the bidder should provide Managed Services for one year, the management and hosting of the system which will include operational hosting and monitoring, and technical support.

- Survey data specifications

<b>Accuracy of Static Control Points</b>	
Horizontal (X,Y) Accuracy	3 mm + 0.5 ppm (rms)
Vertical (Z) Accuracy	5 mm + 0.5 ppm (rms)
3D Accuracy	3-5 mm
<b>Coordinate System</b>	
Coordinate System	WGS84 UTM Zone 43
Horizontal Reference Datum/Grid	WGS 1984
Spheroid	WGS84
Projection	UTM Zone 43
Hemisphere	North (N)
Vertical Datum (Geoid Model/AMSL)	EGM2008

## RISK MANAGEMENT

Risk Management is an integral part of the study and comprises, without being limited to, the following points:

### Recommendations

- Operators shall be familiar with the NAA and local authority regulations. all activities should fully comply with The Drone Rules, 2021, Drone amendment rules, 2022, as well as guidelines issued by the Directorate General of Civil Aviation of India.
- Operators shall be able to liaise effectively with local and national aviation authorities, ensuring that they comply with all authorisation requirements during operation and that the RP holds the appropriate national qualifications
- As a default, the operator shall conduct a suitable risk assessment of the impact of the operation on the local populace and infrastructure, while taking into account any local cultural sensitivities (see below).
- Operators shall be able to assess and apply appropriate mitigation processes to reduce risk to ALARP (as low as reasonably practicable). Operators shall be equipped to determine when circumstances dictate that the risk presented at a task site is too great and the task shall not be flown or the mission immediately terminated.
- Operators shall be familiar with the Unmanned Aerial (UA) performance and safety features such that they can establish a risk-reduction plan that fits into the overall task picture.

- Operators should have prepared an Operations Manual
- VLOS (visual line of sight) operations shall align with recognised VLOS operational limitations, such as:
  - o UA shall be less than 25kg
  - o UA shall not operate at more than 500m radius from the pilot
  - o UA shall not operate higher than 400ft (120m) AGL
  - o UA shall not operate over, and must remain at least 50m from, any people not involved with the operation
- UA shall remain clear of other airspace users and not interfere with conventionally piloted aircraft.
- UA shall be conspicuous, particularly at night, through the application of appropriate lighting and/or coloured external surfaces.
- UA shall not fly within 5 km of an airport, including a seaport, helipad, etc.
- Operators shall fly only one UA at a time and the use of additional ground crew to manage any payload, such as operating video capture equipment, is preferred.
- Operators shall not operate UA from a moving conventional aircraft.
- Operators shall not operate UA from a moving vehicle unless the operation is over a sparsely populated area.
- Operators shall not allow the carriage of hazardous materials
- UA shall always remain clear of emergency response efforts, such as firefighting, etc.
- UA should be equipped with a “return to home” function in case the data link between UA and transmitter is lost.
- UAS should be equipped with geolimiting functions

### **Risk assessment**

- **Prior to undertaking the flights**

- Specific operation risk assessment (SORA)
 

The purpose of the SORA process is to set basic operational considerations to enable a sufficiently comprehensive risk assessment and reduction process for each task. A SORA enables the UAS operator to confirm, through documented action, that each risk has been identified and considered and that mitigation has been applied where necessary. Some key questions to be addressed in the SORA (but not limited to) are as follows

  - o Operational area and conditions – What is the terrain like? How will you get to the site? Where will you launch/recover? Where will you land in an emergency? What is the prevailing weather for the site?

- Category of airspace and effects on air traffic and ATM – Are we likely to encounter other air traffic? Are we close to an airfield or airport?
- Design features and performance of the UAS – What is the performance of the UA being used? What emergency features does it have and how will they be employed?
- Type of operation – Does it involve visual line of sight (VLOS), extended visual line of sight (EVLOS), or beyond visual line of sight (BVLOS)?
  - Level of competence of the RP – Is the pilot qualified? Competent? Trained on type? Current?
  - Organisational factors – Does the UAS operator have the organizational structure and competence to carry out the task safely and efficiently?
  - Effects on the environment – What effects will the task have on the local environment and population?
  - Consequences of a loss of control – What effects will an uncontrolled UA in a flyaway event have on the ATM system?
- Risk matrix. For each type of risk identified, it will be further categorized as per the following matrix, along with measures to make the risk acceptable

		SEVERITY				
		Catastrophic (5)	Hazardous (4)	Major (3)	Minor (2)	Negligible (1)
PROBABILITY	Frequent (5)	Unacceptable	Unacceptable	Unacceptable	Review	Review
	Occasional (4)	Unacceptable	Unacceptable	Review	Review	Acceptable
	Remote (3)	Unacceptable	Review	Review	Acceptable	Acceptable
	Improbable (2)	Review	Review	Acceptable	Acceptable	Acceptable
	Extremely improbable (1)	Review	Acceptable	Acceptable	Acceptable	Acceptable

In all situations, all activities should fully comply with The Drone Rules, 2021, Drone amendment rules, 2022, as well as guidelines issued by the Directorate General of Civil Aviation of India.

#### - SORA task Plan

Each SORA should be supported by a task plan that enables the UAS operator to outline how the flight will be conducted in order to achieve the task objectives. The plan of activities should include at least the following:

- Nature/objectives of the flights
- Intended dates and times for all flights •
- Name and contact details for the UAS operator points of contact and management
- Name and contact details for the UAS operations flight team
- System details and serial number of the UA to be used
- Site visit/inspection reporting (where possible)
- Description of the task activity, including:
  - Maps or diagrams of the flight area

- Planned flight path of UA
    - Planned altitudes of the UA
    - primary and backup landing site,
    - RPIC operation area
  - Planned take-off, recovery, and return-to-home locations
  - Emergency scenarios and procedures for:
    - Loss of control
    - Collision
    - Mechanical or electrical failure
    - Loss of line of sight
    - Sudden changes to environmental conditions (i.e., weather)
  - Onsite emergency situations (e.g.,
  - access for emergency services)
  - Night operations (if applicable)
  - Limited visibility operations
  - Use of VLOS
  - Use of EVLOS
  - Use of BVLOS
- **An onsite flight specific risk assessment** should be completed using the appropriate methodology to conduct the following tasks:

**(i) Flight-specific risk assessment (RA)** for each flight to reflect the differences encountered at each take-off and landing (TOL) site, and ensure that specific risks will be identified and mitigated appropriately.

Risk considerations should include:

- Predicted weather during UA operations and how it will affect conditions for the flight team
- Obstacles that present a risk to TOL operations
- Local community awareness: are they aware of the task? If not, how will you communicate and liaise prior to or on the day of flight to address local enquiries and concerns?
- How will the UA flight affect the local environment?
- How will the local environment affect the UA flight, i.e., is there terrain that will affect VLOS operations or gaps in GPS coverage to consider?

More specifically, attention will be paid to the following aspects :

- Proximity to people not involved in the operation
- Collision with adjacent infrastructure
- Air collision with conventionally piloted aircraft and other UA users
- Environmental factors
- Impact on indigenous wildlife
- Breach of privacy or data protection regulations
- Susceptibility to cyber security hacking and hijacking

**(ii) Pre-flight Checklist**

It is recommended that the following types of checklists be used during operations and reviewed, completed, and verified pre-flight, as well as during the response to other complex operations and high workload events:

- • Location/onsite inspection
- • UAS and equipment inspection and test
- • Ground control systems inspection and test
- • Non-routine operations and emergencies

**(iii) Pre-flight briefing**

The flight team should conduct a preflight briefing no more than 30 minutes prior to the beginning of UA operations, to minimise the risk of any subsequent changes to conditions and circumstances that may affect the UAS operation. The intention of the briefing should be to factor in any changes to circumstances or conditions that were not considered in the risk assessment; apply any amendments required to the flight plan and UA operations; reconfirm actions in the event of an emergency; and reconfirm flight team roles and responsibilities.

**Compliance with Project documentation**

Since the subproject / survey is supported by KSWMP, ESMF of KSWMP is applicable to the survey/subproject. It shall meet the ESMF and the WB Interim Guidelines on the Application of Safeguards to TA and TF-funded projects. The proposed activity shall follow screening, categorisation, assessment of probable direct/indirect/downstream Environmental, Social and Health and Safety risks and impacts of the survey, and management / mitigation measures as applicable to the survey and downstream impacts of using the survey results.

**Insurance**

It is mandatory that a UAS operator has a suitable level of coverage to ensure that the task(s) are sufficiently insured as per Drone rules 2021 (part 10) as well as

On top of the mandatory insurance policy, it is recommended that UA operator makes the following provisions in terms of insurance coverage:

- Public liability (covering the use of the UA and its impact on third parties)
- Employer liability (covering the UAS operators and associated task staff)
- Professional indemnity (covering any advice or recommendations given to the client when using the UA data)

**Other risks to be addressed in the risk assessment:**

- Public perception  
It is important that, in conducting UA operations, operator determines how receptive the local populace is to UA and immediately suspends operation in case on any adverse public reaction
- Data protection  
The use of UA for imagery capture presents numerous challenges in terms of capturing, storing, and publishing data. Data protection should protect the privacy of people, such

that any imagery should not be stored or used in a way that makes it attributable to a particular individual. This is particularly applicable for people on their private property or going about their normal daily business.

One aspect to which particular attention should be paid is that of storage. The imagery should be stored in a way that it is deemed secure and resistant to outside attempts to remove it, while access is limited to only those images that are required as part of the task.

- **Cyber security**  
To address cyber security concerns, UA operator should be fully acquainted to operational and technical specifications to prevent hacking. Data encryption should be encouraged where available and operators should seek to understand the risk of potential hacking of their system in the area in which they are flying before conducting the task.
- **Reputational risks**  
The operator should consider the consequences to the Client and its reputation, and ensure that task is executed in compliance with existing regulations and in accordance with best practice safety principles

## **DELIVERABLES**

### **Implementation report**

The report will confirm timelines as well as all elements required as per the above scope of work. It will specifically identify risks and risk management procedures to be implemented, including :

- SORA
- Template of Flight Specific Risk Assessment
- Template for flight checklist.

The document will also include sample flight plans, and sample data for validation prior to commencing the survey.

Measures regarding data protection, cyber security, reputational risk management and public perception will be detailed in the report.

Any other request or concerns that could affect the survey should be outlined within this report.

### **Site maps**

All surveyed information shall be represented by survey drawings, created in standard 3D AutoCAD format. Each drawing should include basic land use analysis to identify the following categories:

1. Waste accumulation
2. Agricultural land
3. Forest / wooded land
4. Built-up and related land such as paved roads
5. Industrial areas
6. Wet open land
7. Dry open land with special vegetation cover
8. Open land without, or with insignificant, vegetation cover

9. Waters (rivers, streams, ponds)
10. Settlements
11. Presence of workers (male/Female) and rag-pickers (male/female)

The following major components of a standard drawing must be included:

- Drawing Area with gridded Coordinates
- Title Block – Indicating Details of the Bidder, Title of Drawing, Client Details, Coordinate
- System of Drawing, Scale best suited to utilize full drawing, Drawing Units and Date of Issue
- Graphic Scale (Scale Bar/Ruler) and North Arrow
- Survey System and Control Stations
- Area of Survey Limits (In Squared Meters, Acres and Town Lots)
- Legend of all symbols and abbreviations used on Drawings

- Data formats

Data	Acceptable Formats
Map	*.dwg
High resolution single exposures / Georeferencing Drone Aerial Photography Imagery	*.jpg; Geo tiff format (Resolution 34 Megapixel)
Metadata	All metadata as described above in the survey guidelines
Aerial photographs	*.jpg; Geo tiff format (Resolution 34 Megapixel)
Overview pictures and short videos of the location	*.mpeg; *.avi or equivalent (Min 4k resolution)

### Hosting of data

The hosting of data will be made available and should be fully functional and accessible to a list of users that will be communicated to the bidder.

It should be noted that access should be possible from any standard web browser under Windows 10/11 and MacOS.

One aspect to which particular attention should be paid is that of storage. The imagery should be stored in a way that it is deemed secure and resistant to outside attempts to remove it, while access is limited to only those images that are required as part of the survey.

### Draft final and Final report

The Bidder will prepare a Draft Final Report at completion of the survey activities. The report will present the findings and results of all activities undertaken for all sites.

More specifically the report will include the following sections:

- Disclaimers
- Document versions
- Background

- Study area
- Drone Mapping
  - Flight Planning
  - Establishment of Ground Control Points and Check Points
- Data Capture GPS point capture and qualitative survey
  - Control Survey
  - Boundary Survey
  - Topographic Survey
  - Site Features Survey
  - Utility Survey
  - Vegetation Cover Survey
  - Route Survey
- Data processing
  - Online GNSS Data Processing
  - Drone Image Processing
  - Survey Drawing
  - GIS Mapping
  - Land Use Analysis
- Design and development of data hosting system
- Survey results and analysis

For each site:

- Survey Challenges and Limitations
- Survey Accuracy
- Drone Survey
- Boundary Survey
- Topographical Survey
- Site Features
- Utilities
- Vegetation Cover
- Land Use
- Waste footprint and waste volumes
- Survey Drawings and Maps
- Summary of key results
- Conclusions
- Appendices

After SPMU reviews this Report, the bidder will update the report with comments and inputs from the SPMU team and provide a comprehensive Final Report.

## **STUDY AREA**

The study area consists of a series of Areas of Interest (AOIs). Detailed site list information is provided in Appendix 1.

## SCHEDULE OF DELIVERABLES

For each package, the Bidder will deliver the expected outputs described above, according to the following schedule:

No.	Deliverables for package 2	Expected date
1	Implementation report	2 weeks after NTP
2	Site maps and pictures	7 weeks after NTP
3	Data hosting system operational	10 weeks after NTP
4	Draft final report	14 weeks after NTP
5	Final report	16 weeks after NTP

## STAFFING REQUIREMENTS

- Flight Crew Requirements

To safely conduct a drone survey, the team should have a licensed Remote Pilot in Command and at least two experienced visual observers as required by local Civil and/or Military Authorities in line with requirements for operating commercial drone services in India. In all situations, all activities should fully comply with The Drone Rules, 2021, Drone amendment rules, 2022, as well as guidelines issued by the Directorate General of Civil Aviation.

- Remote Pilot in Command (RPIC)

The RPIC is expected to have extensive knowledge and is responsible for making risk assessment of potential hazards, including the following aspects:

- Operating the drones to be used for survey
- Understanding of drone manufacturer instructions manual for operation and user maintenance
- Inspecting and logging information about the drone before and after each survey
- Understanding flight dynamics of the drone
- Public safety requirements before, during and after drone operation
- Abiding by federal regulations and apply for permits
- Weather forecast must be used for planning
- Emergency protocols
- Conducting safety and flight plan briefing
- Risk assessment before and during drone operation
- Detailed data logging for the drone
- Preparing a flight plan
- Applying for the necessary local aviation permits

- Brief the visual observers of the survey plan
- Making sure batteries are fully charged and back-up options are available
- A full instrument list is updated and each instrument is accounted for.

- Visual Observers

A trained visual observer is expected to support the RPIC by :

- Making sure survey area is clear of people, animals, birds, traffic or other drones
- Keep track of potential hazards of any form
- Keep track of weather conditions
- Have working knowledge of the drones to be operated.

## **INPUT FROM CLIENT**

Client will make available the following to the Bidder:

1. List of sites to be surveyed and corresponding locations
2. Introduction letters to concerned authorities regarding the scope of work of the bidders and type of supports to be provided
3. Any supporting documents at the Client's disposal necessary for the completion of the bidders's duties.
4. Facilitate access to the sites to conduct required surveys

Notice to bidder: The bidders shall verify the correctness of the data/information provided by the Client and satisfy themselves with the accuracy of data/information /material before these are used. Data/information/material provided to the bidders shall remain the property of the originating agency and shall be provided solely for the purpose of the work conducted under this contract. All such borrowed material shall be returned to the Client/concerned agency/originating agency upon completion of the assignment. Apart from data/information provided by the Client and that which the bidders could procure from other agencies, the bidders shall be responsible to collect any other data/information required for the assignment.

**ANNEXURE 1: Details of survey locations**

<b>PACKAGE 2</b>						
<b>Sl. No.</b>	<b>District</b>	<b>ULB</b>	<b>Dumpsite location</b>	<b>Longitude</b>	<b>Latitude</b>	<b>Approx. area (Acre)</b>
1	Ernakulam	Kothamangalam	Kumbalathumuri	76.6476	10.0797	2.60
2		Kalamassery	Kalamassery	76.3277	10.0652	0.75
3		Muvattupuzha	Kurianmala	76.5619	10.0030	5.47
4		North Paravoor	Vedimara	76.2422	10.1505	2.40
5	Thrissur	Kunnamkulam	Kunnamkulam	76.0586	10.6387	3.93
6		Thrissur Corporation	Shakthan	76.2146	10.5161	0.92
7		Wadakanchery	Kumbalangad	76.2234	10.6568	2.86
8	Palakkad	Ottapalam	Panamanna	76.3456	10.7867	2.64
		Palakkad	BPL Junction, Koottupatha,Kodumba	76.6880	10.7673	8.50