



वाष्कोस लिमिटेड WAPCOS LIMITED

(भारत सरकार का उपक्रम)
जल शक्ति मंत्रालय
(A Government of India Undertaking)
Ministry of Jal Shakti



No.WAP/WRD/All India/LiDAR/DPR/2020/3730A

Date: 10.02.2020

To,

Sh.Sanjay Kumar Ojha
Joint Chief Executive Officer
Ministry of Environment Forest and Climate Change
Indira Paryavaran Bhawan
Jor Bagh Road, New Delhi

Sub: Preparation of DPR's by using LiDAR technology for Design of Micro Water & Soil Conservation Interventions for Assisted Natural Regeneration of Forests - one major ridge in forest area in every state/UT in the country - Techno-Commercial Offer – Reg.

Ref: F.No. 4-60/2019-NA Dated 5th February 2020 vide email

Sir,

This is in connection with the above mentioned reference, regarding captioned project, we hereby submit our Techno-commercial offer for the above consultancy assignment.

1.0 Introduction

As you are already aware that WAPCOS Limited (WAPCOS) is one of the front-ranking international consultants in Water Resources and Irrigation Development. WAPCOS is a 'Mini Ratna' and ISO: 9001 certified, Govt. of India Undertaking under the Ministry of Water Resources providing consultancy services in India and abroad since 1969 in all the relevant fields of planning & evaluation of water resources, detailed hydraulic and structural designs of dams and irrigation structures, monitoring and evaluation of participatory irrigation schemes, macro & micro-canalization, irrigation water management, irrigation & drainage including rehabilitation & modernization of irrigation schemes, water supply & sanitation, rural and urban infrastructure development, water audit, energy audit, project management and 3rd party QA & QC works, roads and highway engineering, land reclamation, topographical surveys & investigation, river morphological studies, sedimentation studies, soil studies, flood control studies including structural and non-structural measures covering flood forecasting and warning system, disaster management, environmental management, erosion control, embankment stabilization, construction



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supervision, quality control, integrated agricultural and rural development, agricultural support services, watershed management, dam safety, surveys, geological & geo-technical investigations, transfer of technology, socio-economic studies, human resources development and related organizational & institutional issues. Besides, being a Government of India Organization, we have the unique facility to draw upon from the vast reserve of experts from specialized Government Departments, Semi-Government Agencies, Autonomous Bodies and Academic/Research and Development Institutions working at Union and State levels which are our constituents and associates.

WAPCOS is registered with funding agencies like the World Bank, Asian Development Bank (“DACON No. 00576”), African Development Bank, besides other international agencies and possesses the requisite competence to deliver the goods to the entire satisfaction of the client.

WAPCOS possesses state-of-the-art expertise in the various areas of its operation and has successfully completed a large number of assignments in the fields of Agriculture, survey and investigations, irrigation, flood control, erosion control, dam safety, planning and institutional development etc. many of which are located overseas in African and South East Asian countries namely Vietnam, Mozambique, Ethiopia, Nigeria, Tanzania, Algeria, Zimbabwe, Zambia, Cambodia, Nepal, Philippines, Indonesia, Georgia, Myanmar, & Middle East countries namely Iraq, Iran, Republic of Yemen, Syria, Oman etc.

2.0 Scope of Work

With the objective of undertaking comprehensive water and soil Conservation in the forest areas, it is proposed by MoEF & CC, Government of India that preparation of DPR's will be done by using LiDAR technology in one major ridge inside forest areas in every state/UT in India. Three dimensional digital elevation models (3-DEM) will be prepared from this LiDAR survey and will be used to prepare the detailed project reports (DPR's) for design of micro water and soil conservation interventions. Once implemented in the field, these interventions will not only help in the increase of groundwater and soil moisture but will also help in the assisted natural regeneration of forests. As India has multiple states with varied soil and rock strata, features and resultant forest types, it is proposed that this demonstration project will cover all states of India. During the preliminary study, it was estimated that the average size of each project area would be about 8,000 hectares, one in each of about 30 states (/UT) in the country.

3.0 Objectives

Main objectives of the present consultancy assignment will be to perform LiDAR survey in the project areas identified in every state and generate the three dimensional elevation model with the required outputs as mentioned in **Annexure-C**. The criteria for selection of project areas are enclosed in **Annexure-E**. Using this output data generated by the LiDAR survey, the detailed



project reports (DPR's) shall to be prepared as per the specifications given in **Annexure-D** and with the below details.

1. Planning and site/location identification for construction of appropriate and feasible micro soil and water conservation structures consistent with the site geography and topography.
2. Design of the above structures with Latitude/Longitude location, catchment area and submergence area of intervention.
3. Dimensioning of the above structures with length, width, height and cost estimation.

4.0 Consultancy Fee

The consultancy fees for the preparation of detailed project report of this study will be **Rs.18,38,00,000/-(Rupees Eighteen Crores and Thirty Eight Lakhs Only) excluding GST**. GST shall be paid at the prevailing rate. The break-up details of consultancy services is enclosed as **Annexure-1** at the end of this letter.

5.0 Time Schedule

The time period of consultancy services will be 9 months. Detailed timeline for the various activities under this assignment is given as **Annexure-F**.

6.0 Deliverables

WAPCOS will submit the following reports during the course of assignment:

- (i) Preliminary Report
- (ii) Processed LiDAR data
- (iii) Draft DPR
- (iv) Final DPR

7.0 Terms of Payment

- 15% after signing of agreement as an advance payment
- 15% after selecting LiDAR Survey agency
- 20% after completion of LiDAR Survey
- 20% after completion of Vetting of survey data
- 10% after delivery of LiDAR data including imagery and GIS outputs
- 10% after submission of Draft DPR
- 10% after submission of Final DPR

7.1 Duties, taxes, levies, etc.

“All duties, taxes and levies imposed/to be imposed by the Central / State Govt. from time to time except Corporate Income Tax shall be borne by client over and above the agreed amount



of consultancy fee”.However, the consultancy fee quoted is exclusive of GST and any other taxes.

7.2 Mode of payment

All payments shall be made through demand draft in favour of “WAPCOS Limited” and shall be payable at New Delhi, Gurgaon within a period of 15 days from the date of submission of invoice by WAPCOS.

8.0 Disputes

All disputes pertaining to the contact would be referred to Arbitrator whose decision shall be final and binding on both the parties.

We trust, you will find our offer in order and acceptable and favour us with the award of work immediately.

In case if any further information is needed, we shall be glad to furnish the same.

Our postal address and details of E-mail, Telephone and Fax are given below for further communication.

Contact : Shambhu Azad
Chief Executive Director (WRD)
Postal Address : WAPCOS Limited
Plot No.76 C, Beside HIPA,
Sector 18, Gurgaon
Haryana State, India
Telephone/Fax : +91-124- 2399427 / 431
E-mail : wrd@wapcos.co.in
Website : <http://www.wapcos.co.in>

Thanking and assuring you of our best services at all times.



Very truly yours,
for and on behalf of
WAPCOS Limited

(Shambhu Azad)
Chief Executive Director (WRD)
WAPCOS Limited
M: +91-9999994151

मुख्य कार्यकारी निर्देशक/Chief Executive Director
वाफ्कोस लिमिटेड/WAPCOS LIMITED
(भारत सरकार का उपक्रम/Govt. of India Undertaking)
76-सी, सेक्टर-18, गुरुगौब-122015 (हरियाणा)
76-C, Sector-18, Gurgaon-122015 (Haryana)

COST BREAKUP FOR Preparation of DPR's by using LiDAR technology for Design of Micro Water & Soil Conservation Interventions for Assisted Natural Regeneration of Forests - one major ridge in forest area in every state/UT in the country

Duration of Project: 9 months

A REMUNERATION				
(a) Key Professional Staff				
S. No.	Details	Months	Manmonth	Total
			Rate	in ₹
			Rs/MM	
1	Team Leader / Project Manager	9	317745	28,59,705
2	Hydrology Expert (4 nos.)	8	235125	18,81,000
3	Topographic Survey Expert (4 nos.)	8	177435	14,19,480
4	Geological / Geotechnical Expert (4 nos.)	6	235125	14,10,750
5	Watershed Expert (4 nos.)	16	235125	37,62,000
6	Structural Design Expert (5 nos.)	10	235125	23,51,250
7	Senior GIS Expert (6 nos.)	24	235125	56,43,000
8	Ground Water Expert (4 nos.)	8	235125	18,81,000
9	Senior Software Expert (4 nos.)	16	235125	37,62,000
10	Cost Estimation Expert (4 nos.)	6	235125	14,10,750
Sub Total (a)				2,63,80,935
(b) Sub-Professional and Other Staff				
1	Project Coordinator	9	124622	11,21,598
2	Assistant GIS expert (10 nos.)	50	105678	52,83,900
3	Software Engineer (6 nos.)	30	105678	31,70,340
4	Data entry operator (8 nos.)	64	62032	39,70,048
Sub Total (b)				1,35,45,886
TOTAL A				3,99,26,821
B TRAVELLING EXPENSES				
i)	Air Fare Delhi to various states (Roundtrip)	270	15000	40,50,000
ii)	Train Fare Delhi to various states (Roundtrip)	270	5000	13,50,000
iii)	Per Diem Allowance, Boarding Lodging Expenses for Key Experts (270 trips X 3 Days X Rs. 5000)			40,50,000
iv)	Per Diem Allowance, Boarding Lodging Expenses for sub-professional Staff (270 trips X 7 Days X Rs. 4000)			75,60,000
TOTAL B				1,70,10,000
C OFFICE ESTABLISHMENT AND OTHER EXPENSES				
i	Project Office rent including maintenance, cleaning, repairs, etc.	9	75000	6,75,000
ii	Communications Costs like postage, fax, telephones etc.	9	25000	2,25,000
iii	Computers and peripherals at Project office / Head Office		LS	5,00,000
iv	Office Stationery, drawing stationery etc.,	9	50000	4,50,000
v	Misc Expenditure (office equipment/furniture etc)		LS	3,00,000
vi	Purchasing of Software		LS	3,00,000
vii	Local Conveyance (2 months for each state)	60	45000	27,00,000
TOTAL C				51,50,000
Total A to C				6,20,86,821



S. No.	Details	Months	Manmonth Rate	Total
			Rs/MM	in ₹
D	Printing of Preliminary Report, LiDAR Data/maps, Draft DPR & Final DPR			19,53,583
	Total A to D			6,40,40,404
	Contingency @ 5%			32,02,020
	Sub total			6,72,42,424
	Overheads @ 20%			1,34,48,485
	Sub total			8,06,90,909
	Company's Fee @ 10%			80,69,091
	Sub Total (i)			8,87,60,000
F	Outsourcing			
i.	Topographic Survey using LiDAR technology in one major ridge area inside forest area in every state/UT in India (30 States/UT @ 80 sqkm/state @ Rs.36,000/sqkm)			8,64,00,000
	On outsourcing, Risk and company fee @ 10%			86,40,000
	Total F			9,50,40,000
	Sub Total (ii)			9,50,40,000
	GRAND TOTAL (i + ii)			18,38,00,000
	GST Shall be extra as per prevailing rate			



Committee for preparation of DPR's by using LiDAR technology in one major ridge area
inside forest area in every state/UT in India

To,

Dated: 28th January 2020

WAPCOS

Government of India Undertaking

Ministry of Jal Shakti

Sub: Preparation of DPR's by using LiDAR technology for Design of Micro Water & Soil Conservation Interventions for Assisted Natural Regeneration of Forests - one major ridge in forest area in every state/UT in the country

The committee for "*Preparation of DPR's by using LiDAR technology in one major ridge inside forest areas in every state/UT in India*" constituted by MoEF&CC, Government of India is responsible for getting the LiDAR survey done in one major ridge in forest area in every state/UT in the country and is also responsible for getting the detailed project reports (consisting of design of micro water & soil conservation interventions for assisted natural regeneration of forests) prepared based on the output data from the LiDAR survey. In this respect, the committee is seeking a proposal from WAPCOS to perform the tasks of making the LiDAR survey and also prepare the DPR's. Please note the below attached Annexures.

- 1) Project Background is given in Annexure-A.
- 2) Project Scope and Objectives are given in Annexure-B.
- 3) The specifications for performing the LiDAR survey are given in Annexure-C.
- 4) The specifications for preparation of DPR's are given in Annexure-D.
- 5) The criteria for selection of areas (in which the LiDAR survey has to be done and DPR's are to be prepared) are given in Annexure-E.
- 6) The scope of work and timelines for performing both the survey and preparation of DPR's are given in Annexure-F.

Above attached annexures can be perused while preparing the proposal and it is requested that WAPCOS submit the proposal to ICFRE, Dehradun at the earliest.



(SRIRAM VEDIRE)

Chairman

Committee for Preparation of DPR's
using LiDAR Technology

Committee for preparation of DPR's by using LiDAR technology in one major ridge area
inside forest area in every state/UT in India

Annexure-A: Project Background

Forests are important for sustainability of life on Earth. There has been significant pressure on the forests to meet the demand of development projects. Implementation of forest management principles with adequate geo-spatial information backed decisions can facilitate sustainable forest growth while maintaining the human needs. India faces a very high seasonal variation in rainfall whereby more than 75% of rainfall occurs during the monsoon season. The intensity of rainfall causes severe soil erosion in unprotected regions. Due to lack of water holding structures, most of the rainwater flows off as surface runoff. This lack of recharging of ground water causes high deficit in soil moisture during the summer seasons which in turn has adverse effect on the ability of forest to regenerate naturally. Hence, Water and Soil conservation are among the key intervention areas for Forest Management in India which can help in natural regeneration of forests through recharging ground water and increasing soil moisture the year around. This in turn, over a period of four to five years, will ensure a visible natural growth of the Forest. Scientifically designed and constructed micro water and soil interventions based on principles of watershed management through 'Ridge to Valley' approach can help in increasing ground water table and soil moisture. Each such micro water and soil conservation intervention is specifically designed as per the topography and soil characteristics of the local area. Hence, for designing these interventions, a detailed topographical survey of the forest area is required to generate the three dimensional digital elevation model of the forest floor. This needs to be complemented through other parameters such as soil/strata characteristics and other local information. Accurate digital elevation model of forest floor is essential for design of accurate water and soil conservation interventions. Aerial LiDAR survey helps in capturing highly detailed and accurate information for very large areas in a very short time. Most importantly, since LiDAR technology has the ability to penetrate vegetation foliage, it is able to provide true Digital Elevation Model (DEM) of forest floor. Additionally, this data is also useful for detailed forest studies helping in many forest management activities.

Committee for preparation of DPR's by using LiDAR technology in one major ridge area
inside forest area in every state/UT in India

Annexure-B: Project Scope & Objectives

Scope:

With the objective of undertaking comprehensive water and soil Conservation in forest areas, it is proposed by MoEF&CC, Government of India through this committee that preparation of DPR's will be done by using LiDAR technology in one major ridge inside forest areas in every state/UT in India. LiDAR technology will be used to survey one ridge area in the forest, one in each state in the country. Three dimensional digital elevation models (3-DEM) will be prepared from this LiDAR survey and will be used to prepare the detailed project reports (DPR's) for design of micro water and soil conservation interventions. Once implemented in the field, these interventions will not only help in the increase of groundwater and soil moisture but will also help in the assisted natural regeneration of forests. As India has multiple states with varied soil and rock strata, features and resultant forest types, it is proposed that this demonstration project will cover all states of India. The list of areas of interest that will be included in this project will be provided very soon. The criteria for selection of project areas are enclosed in Annexure-E. For WAPCOS to have an idea of the size of the project so they can submit a proposal, it is estimated that the average size of each project area would be about 8,000 hectares, one in each of about 30 states(/UT) in the country.

Objectives:

Perform LiDAR survey in the project areas identified in every state and generate the three dimensional elevation model with the outputs as mentioned in Annexure-C. Using this output data generated by the LiDAR survey, the detailed project reports (DPR's) are to be prepared as per the specifications given in Annexure-D and with the below details.

1. Planning and site/location identification for construction of appropriate and feasible micro soil and water conservation structures consistent with the site geography and topography.
2. Design of the above structures with Latitude/Longitude location, catchment area and submergence area of intervention.
3. Dimensioning of the above structures with length, width, height and cost estimation.

Committee for preparation of DPR's by using LiDAR technology in one major ridge area
inside forest area in every state/UT in India

Annexure -C: The specifications for performing the LiDAR survey - Deliverables &
Outputs

I. Raw Data Capture

1. Undertake Aerial Survey permissions from DGCA and MoD as required.
2. Capture of baseline Aerial LiDAR data at 100 points per sq. m. with a Fundamental Horizontal Accuracy of 10 cm at 90% confidence interval and a Fundamental Vertical Accuracy of 10 cm at 90% confidence interval.
3. Capture of Aerial Imagery data with a resolution of 10 cm GSD.

II. LiDAR, Imagery & GIS Outputs

1. Geo-referenced 3D point cloud (32 bit real) with real texture and relative accuracy within 10 cm. in all the three axes and point density at least 100 points per square meter.
2. Geo-referenced Orthomosaic stereo images of 10 cm/pixel resolution & relative accuracy up to 10 cm.
3. Bare Earth Digital Elevation Model (Digital Terrain Model) in a 30 cm x 30 cm grid, i.e., forest floor topography
4. Digital Surface Model in a 30 cm x 30 cm grid
5. Contours at 30 cm interval
6. Orthophoto of 10 cm GSD
7. L section of 1st and Higher Order Drains
8. Geo-referenced ortho rectified digital Khasra (Revenue) Maps and forest boundary maps in vector form with associated attributes.
9. GIS Layers:
 - a. Macro Watershed Boundary
 - b. Micro Watershed Boundary
 - c. Forest Boundary
 - d. Transport Networks
 - e. Habitations/Settlements
 - f. Drainage Lines of various orders by Strahler stream order method
 - g. Water bodies i.e. Nala, Stream, ponds, lakes, canals etc.
 - h. Existing Water Harvesting Structures, if any
 - i. Slope range layers in following categories: (a) 0-1% (b) 1-3% (c) 3-8% (d) 8-10% (e) >10%

Committee for preparation of DPR's by using LiDAR technology in one major ridge area
inside forest area in every state/UT in India

- j. Stream delineation at the condition of ≥ 2 , ≥ 5 , ≥ 10 , ≥ 20 , ≥ 30 , ≥ 40 , ≥ 50 , ≥ 100 , ≥ 250 , ≥ 500 , ≥ 1000 Ha contributing area.
- k. DEM Layer @ 30cm and @1meter
- l. Aspect Map layer
- m. Layer of identified locations with required attributes, common symbology and color.
- n. Land use and land cover map using at least LISS IV satellite data

Description	Area (sq. km)
Gullied/Ravines	
Land with Scrub	
Land without Scrub	
Barren Rocky/Stony Waste/Sheet Rocks	
Wetland	
Forest	
Water Body/River	

Feature Class of Spatial data desired is as follows:

S. No	Spatial data layer	Feature class
1.	Macro Watershed Boundary	Poly
2.	Micro Watershed Boundary	Poly
3.	Village Boundary	Poly
4.	Gram Panchayat Boundary	Poly
5.	Transport Network Rail/Road	Poly/ Line

Committee for preparation of DPR's by using LiDAR technology in one major ridge area
inside forest area in every state/UT in India

6.	Contour	Poly
7.	Slopes	Poly
8.	Drainage Line	Poly
9.	Drainage polygon	Poly
10.	Water body	Poly
11.	Khasara land Parcel Layer	Poly
12.	Land use/ Land cover	Poly
13.	Flow accumulation	Poly
14.	DEM	Poly
15.	Aspect	Poly

S. No	Layer	Attribute	Values	Other attributes beside auto generated fields like length & area
1	Rail	Type	Broad/metre gauge	
2	Road	Type	NH, SH, MT, Others	
		Description	National Highway No.	
5	Gram Panchayat	FP-Name	Gram Panchayat	Area as per revenue record, district
6	Village	Village-Name	Census Code	Area as per revenue record, Gram Panchayat, Block, District, Census details
7	Micro	Macro/Micro No.		Code no. as per SRSAC atlas, area as per record, Cultivated land, Pasture land, Forest land, Non arable land
8	Macro	Macro no.		Code no., name, area as per record, priority rating as per

Committee for preparation of DPR's by using LiDAR technology in one major ridge area inside forest area in every state/UT in India

				W/S atlas
9	Drainl	Line Feature		Drainage Order
10	Drainp	Name	River + Waterbody	Local name, type, capacity
12	Contour	Elevation	Mean Sea Level	
13	Slope	SLP-Code	Categories	As per mentioned in TOR

Committee for preparation of DPR's by using LiDAR technology in one major ridge area
inside forest area in every state/UT in India

Annexure-D: The specifications for preparation of DPR's - DPR Outputs

Planning and identification of Site/Location for construction of appropriate and feasible micro soil and water conservation structures consistent with site geography, topography and soil characteristics and in accordance with the Ridge to Valley Approach of Watershed Management. For each structure, the following parameters need to be defined along with background information about the watershed from the above prepared DEM, Imagery and GIS layers:

1. Location with Latitude & Longitude
2. Catchment area
3. Submergence area
4. Dimensioning of the structure (length, width, height)

After initial planning and design of the structures, the project wise list of proposed works/structures with latitude and longitude are to be verified on site with a joint team of the vendor and the designated Forest officials for the particular project. Any changes or amendments to be made after field verification are to be incorporated into the final DPR.

Committee for preparation of DPR's by using LiDAR technology in one major ridge area
inside forest area in every state/UT in India

Annexure-E: The criteria for selection of project areas

One forest area from every state/UT in India needs to be selected. To select the area, identify one major ridge inside a forest block in the state with the following criteria.

1. The selected area should have average rainfall of that particular state/UT.
(Validation: IMD data)
2. The selected area should be a single and contiguous watershed including and surrounding the ridge with up to 10,000 hectares in size (but not less than 5,000 hectares). This will help in putting the Ridge to Valley approach in action. (**Validation: SRTM, Google Earth**)
3. To the extent possible, the strata of the area should be conducive to watershed interventions. (**Validation : CGWB data**)
4. The relative completeness of the canopy closure of the selected area should be between 0.4 and 0.1 ("Open Forest" category). The area should have the potential to regenerate with the Assisted Natural Regeneration interventions.
(**Validation: Forest Density Shape Files of FSI**)
5. The area should be such where investment should help the three pillars of sustainability that is ecology, economy and society.

Committee for preparation of DPR's by using LiDAR technology in one major ridge area
inside forest area in every state/UT in India

Annexure – F: Timelines for performing both the survey and preparation of DPR's

S. No.	Activity	Timeline(All dates are for 2020)	Responsibility
1	Engage WAPCOS for performing LiDAR survey and preparation of DPRs	By 31 st January	ICFRE & National Authority, CAMPA
2	Verification of project areas (areas are as per the selection criteria). Finalized Areas of Interest to be submitted to DGCA/MoD and secure flying permissions	10 th Feb to 10 th Apr	WAPCOS - subject to inputs from WAPCOS
3	Capture of Aerial LiDAR and Aerial Imagery raw data as per guidelines and specifications	1 st Apr to 30 th Apr	
4	Security Vetting of Captured Data by Survey of India/MoD	15 th Apr to 15 th May	
5	Delivery of processed LiDAR, Imagery and GIS outputs from the raw data	1 st May to 30 th May	
6	Preparation of DPRs as per guidelines and specifications	15 th May to 30 th Sep	
7	Ground Verification and finalization of DPR reports	1 st Aug to 30 th Oct	WAPCOS & MoEF&CC
8	Submission of DPRs to MoEF&CC, Gol	31 st Oct	Committee