छत्तीसगढ़ विज्ञान एवं प्रौद्योगिकी परिषद
विज्ञान भवन, विधान सभा रोड, दलदल सिवनी सडडू, रायपुर, छ.ग. 492014
Chhattisgarh Council of Science & Technology
Vigyan Bhavan, Vidhan Shabha Road , Daldal Sevni Saddu, Raipur, C.G. 492014
E-mail : karmakar1962@rediffmail.com Tel: 0771-297246

M. K. Beg
Scientist 'E1'

No. _____ /CCOST/2019
Date: ___/___/2019

To,

AGM Mining
Tallaipalli coal mining
ntpc ltd.Gharghoda

Sub: Submission of DGPS report the CA land against the PO 5500033645-108-1071 Dated 15.07.2019.

Please find enclosed the following reports (soft & hard copy) against the DGPS survey of the CA land against t PO 5500033645-108-1071 Dated 15.07.2019.

1. THE REPORT ON DGPS SURVEY USING HIGH RESOLUTION SATELLITE IMAGE FOR 4 Ha OF FOREST LAND IDENTIFIED TOWARDS COMPENSATORY AFFORESTATION AGAINST THE PROPOSED DIVERSION OF 1.732 Ha OF FOREST LAND IN ROAD WIDENING FOR TALAIPALI COAL MINING PROJECT PREPARED BY CCOST (CHHATTISGARH SPACE APPLICATIONS CENTRE CHHATTISGARH COUNCIL OF SCIENCE AND TECHNOLOGY AGAINST THE PO 5500033645-108-1071 Date : 15.07.2019.
2. THE REPORT ON DGPS SURVEY USING HIGH RESOLUTION SATELLITE IMAGE FOR 18 Ha OF FOREST LAND IDENTIFIED TOWARDS COMPENSATORY AFFORESTATION AGAINST THE PROPOSED DIVERSION OF 8.795 Ha OF LEFTOUT FOREST LAND IN MGR FOR TALAIPALI COAL MINING PROJECT PREPARED BY CCOST (CHHATTISGARH SPACE APPLICATIONS CENTRE CHHATTISGARH COUNCIL OF SCIENCE AND TECHNOLOGY AGAINST THE PO 5500033645-108-1071 Date : 15.07.2019.

This is for your kind information please.

(M.K.Beg)

DGM(Mining)
27.08.19
27/8/19

Read
23/8/19.

REPORT ON

DGPS SURVEY USING HIGH RESOLUTION SATELLITE IMAGE FOR 4 Ha OF FOREST LAND IDENTIFIED TOWARDS COMPENSATORY AFFORESTATION AGAINST THE PROPOSED DIVERSION OF 1.732 Ha OF FOREST LAND IN ROAD WIDENING FOR TALAIPALI COAL MINING PROJECT

Submitted to

NTPC LIMITED
LAILUNGA ROAD, TEHSIL-GHARGHODA, DISTRICT-RAIGARH
PIN CODE-496111, CHHATTISGARH

Submitted by

छत्तीसगढ़ अंतरिक्ष उपयोग केन्द्र

CHHATTISGARH SPACE APPLICATIONS CENTRE
CHHATTISGARH COUNCIL OF SCIENCE AND TECHNOLOGY
VIGYAN BHAVAN, VIDHAN SABHA ROAD, DALDAL SEONI,
PIN-492014, RAIPUR C.G.

छत्तीसगढ़ अंतरिक्ष उपयोग केन्द्र

Chhattisgarh Space Application Centre
Chhattisgarh Council of Science and Technology

PROJECT EXECUTION TEAM

1. **M.K. Beg, Scientist "E1"**
2. **Amit Prakash Multaniya, Project Scientist**
3. **Hemant Dansena, Research Associate I**
4. **Kamal Kishor Sahu, Senior Research Fellow**

Official Notification (for DGPS Survey)
No. F7-14/2013/12
Government of Chhattisgarh

DGPS SURVEY CARRIED OUT

FOR

TALAIPALI COAL MINING PROJECT
DISTRICT-RAIGARH, PIN CODE-496111
CHHATTISGARH

रमेश खेर / RAMESH KHER
मुख्य महाप्रबंधक / Chief General Manager
एनटीपीसी लि./NTPC Limited
तलईपाली, बनाई और भालुमुडा कोल माईनिंग प्रोजेक्ट
Talaipalli, Banai & Bhaluguda Coal Mining Projects
लैलुंगा रोड, घरघोड़ा, जिला - रायगढ़ (छ.ग.) 496111
Lailunga Road Ghargoda, Distt. - Raigarh (C.G.) 496111

कार्यालय,
विज्ञान भवन,
छत्तीसगढ़ विज्ञान एवं प्रौद्योगिकी परिषद,
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रायपुर (छ.ग.) पिन - 492014

NTPC LIMITED
LAILUNGA ROAD, TEHSIL-GHARGHODA, DISTRICT-RAIGARH
PIN CODE-496111, CHHATTISGARH

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1. INTRODUCTION

NTPC Limited awarded the task to Chhattisgarh Council of Science & Technology (CCOST) for carrying out DGPS survey of the CA (Compensatory Afforestation) Land against the proposed diversion of 1.732 ha of forest land for road widening at Talaipalli Coal Mining Project Vide Work Order No. 5500033645-108-1071 Dated : 15.07.2019. DGPS survey to be carried out in Orange Area (Orange area part Baigbhari,Pusalda) , double the area proposed for diversion towards compensatory Afforestation purpose, (CA Land) identified by Department of Forest, Govt. of Chhattisgarh. The entire work shall comply with the requirement of Chhattisgarh Forest Department and as per the guide lines laid down in Forest Conservation Act 1980. The requirement of Digital Maps by DGPS survey showing geo-referenced boundary in shape file of the CA Land proposed for Afforestation are to be authenticated by concerned agency.

Ministry of Environment and Forests, Govt. of India vide their circular No.F.No.-11-9/98-FC, dated 08-07-2011 have stipulated that to ensure accurate delineation of forest area proposed to be diverted for non-forestry purposes under Section-2 of Forest Conservation Act, 1980 the diversion proposal under Forest Conservation Act shall be accompanied by DGPS/ETS surveyed reports of the forest land proposed for diversion and the area proposed for the Compensatory Afforestation as per guidelines laid down in the circular issued by ministry of forest and environment, Government of India from time to time. While submitting proposal for diversion of forest land for non forest purpose, the user agency has to submit the Georeferenced boundary, using DGPS in shape file containing maps along with hard copy authenticated by Divisional Forest Officer (DFO) concerned. The conventional methods of survey to delineate and demarcate the forest land with reference to the earlier Cadastral/Forest Compartment/compartment base map are time consuming. Further, the conventional surveys are "Unprojected" Surveys, hence linking them to geospatial domain is a challenging task. The modern survey technique using Differential Global positioning system (DGPS) with georeferenced high resolution satellite image bring efficacy in survey in shorter time span compared to old method of survey and record preparation.

Earth observation satellites can today monitor almost every corner of our planet; the collection of information over each location, even in difficult terrain, has been intensively carried out in recent years using satellite data. In the recent years, since high resolution satellites have become operational, the information that can be collected from space borne images has dramatically increased, since the improved geometrical resolution has enabled the detection of natural and man-made features that were simply impossible to distinguish in the past with medium resolution satellite data. Therefore, it is now possible to produce accurate representations of a specific location of the earth just sitting in front of a computer.

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can be marked those satellites that can collect information with a geometrical resolution equal or better than 2.5 meters. The emerging new satellite technologies enabling earth observation at a high spatial resolution of 2.5 m resolution, together with powerful and high-speed computing and processing capabilities have brought revolutionary changes in the field of GIS-based Forest Compartment land information system. The high-resolution satellite imagery is showing its usefulness for Cadastral/Forest Compartment surveys due to which traditional cadastre and land registration systems have been undergoing major changes worldwide.

High-resolution space-borne remote sensing image data show a high level of detail and provide many opportunities to be used as base for Forest Compartment map generation. The combination of GIS and GPS activities play a crucial role in developing the survey of the forest boundary points and making Forest Compartment maps. Area, length other measures in the GIS numerical database are considerably easy to compute and correlate with already available data with line department.

2. OBJECTIVES

- DGPS survey for4 Ha CA land identified by the Forest department out of the 25.00 ha Orange area in Puaslda village. Total CA land area identified after survey is 22.00 hectare only instead of 25 Ha.
- Deriving coordinates of each observations point using DGPS in the world geodetic system 1984 (WGS-84) Datum.
- Integration of Geo-referenced Vectorized compartment map and to check the accuracy.
- Merging of Cartosat 1 with LISS-IV (1:4000) and also to superimpose Geo-referenced boundary map on high resolution satellite image (merged product).
- GIS data base creation and analysis.
- Processing of DGPS Observation For Final Coordinates And Generation of Geo-Referenced Shape File Of The Ca Land Boundary
- Submission of Report/Maps/KML and Shape files.

3. LOCATION OF THE AREA

DGPS survey carried out in Pusalda village located in Gharghoda Block of Raigarh district, Chhattisgarh. The total CA land area for afforestation is 4 Ha against the proposed diversion of 1.732 ha of forest land for road widening at of Talaipalli Coal Mining Project, NTPC Limited. The area is falling in Survey of India Toposheet No.65N/07. Approximate coordinates of the polygon bounding the two corners is given below:-

- Lower left corner - 22° 18' 30.815" N, 83° 18' 28.719" E
- Upper right corner - 22° 18' 43.511" N, 83° 18' 42.417" E

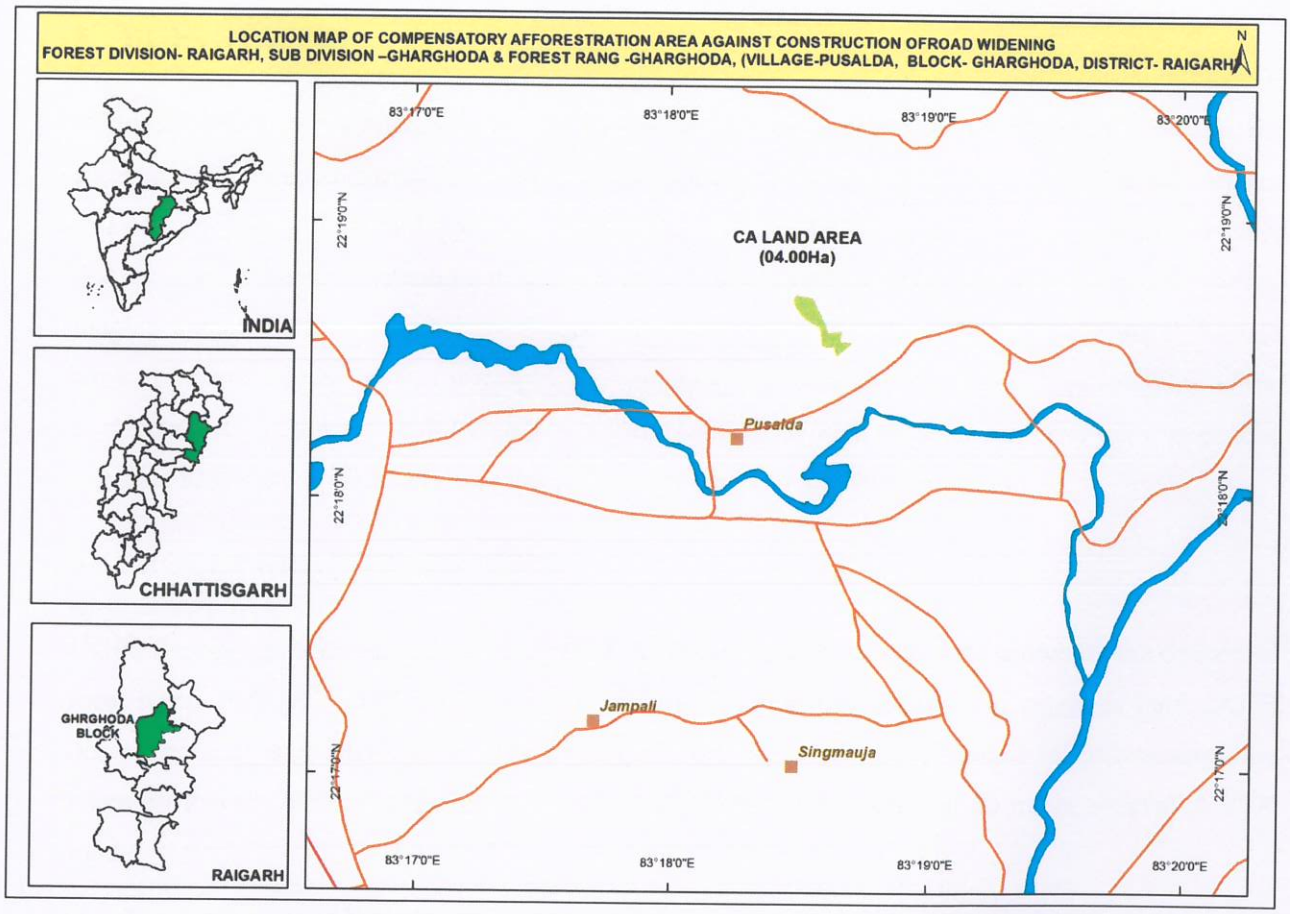

Fig: 1 Location map of the area

4. DATA SETS USED

a) The Satellite Imagery:

High resolution Cartosat-1 data with panchromatic images of 2.5 m resolution and multispectral images of Resourcesat-2 (LISS-IV) with 5.8 m resolution was acquired in SISDP project from National Remote Sensing Centre, Hyderabad used for study areas.

b) DGPS Data:

Lieca DGPS with CS/GS12 Raw Data Logging License for Viva CS field controller, which enables logging of GNSS raw data with a GS12 receiver and GS12 GNSS Smart Antenna, Geodetic 120 channel GNSS receiver was used for GCPs collection.

5. DGPS SYSTEM

DGPS system consist a reference receiver located on a known position and one or more receivers, the antenna, differential correction processing system and data link equipment. Both the reference receiver and user receiver collect and store data for later processing. DGPS system is based on the principle that receiver in the same vicinity will simultaneously experience common error on a particular satellite ranging signal. In the user receiver, measurements are taken from the reference receiver to remove common errors. Based on this principle, the user receiver must use the same set of satellites as the reference station then the DGPS equation is formulated to remove the common error get cancel. The common errors are signal path delay through atmosphere and satellite clock.

6. PROCEDURE FOR SURVEY

DGPS Survey has been carried out along the CA land boundaries which were shown by the concerned local forest staff and NTPC officers and as per confirmation to locations and extent of land, DGPS observations at each observation points along the periphery of land allocated for afforestation are taken by Rover with minimum observation period of about 01 minutes at 50 meter interval in RTK mode.

6.1. Establishment of Base Station:

Base station was fixed near the site for observation in RTK mode of survey as there was no SOI reference points was available in that area.

6.2. Digitization and geo-referencing of Compartment maps

CA Land Boundary vector in the form of shape file has been prepared by generating the coordinates of the observation points in geographic latitude & longitude as well as UTM projection with WGS 84 datum. Demarcated boundary geo-referenced with the help of coordinates and superimposed on Cartosat-1 image. (Merged product)

6.3. GIS Analysis

The surveyed boundary shape file from DGPS survey, geo-referenced CA Land, geo-referenced compartment maps/revenue map is superimposed on the satellite image using ArcGIS software (10.0) Area calculated and statistics of area was generated.

7. INPUT DATA

- Digital data Cartosat 1 PAN and LISS IV was acquired through National Remote Sensing Centre, Hyderabad under SIS-DP project of ISRO.
- Leica GS12 Base and Rover Dual Frequency RTK / Post Processing Differential Global Positioning System with configuration as under.
- Compartment map of the area provided by NTPC Limited.
- Survey of India Toposheet No 64N/07 (1:50000).

8. EQUIPMENT SPECIFICATIONS

S. No.	DGPS EQUIPMENT SPECIFICATIONS
1.	**DESCRIPTION BASE AND ROVER**
	GS12 GNSS Smart Antenna, Geodetic 120 channel GNSS receiver, includes GPS L1 + L2, 1 Hz position rate, (e.g. Glonass, Gallileo, GPS L5, Network RTK, Raw data logging ...)
	GS12 GLONASS License for the Viva CS10 field controller, which enables use of GLONASS with a GS12 receiver.
	GS12 Raw Data Logging License for Viva CS10 field controller, which enables logging of GNSS raw data with a GS12 receiver.
	GS12 5Hz License for Viva CS10 field controller, which enables to compute 5 Hz positions with a GS12 receiver.
	GS12 RTK Reference Station License key for Viva CS10 field controller, which enables the GS12 to be used as an RTK base station.
	CS10 Field Controller. Ruggedized WinCE field controller with full VGA touch display, 1GB NAND Flash Memory, 512MB SDRAM, CF/SD card slot and 2MP camera. Includes Bluetooth, virtual numeric keypad, and stylus.
2.	**RTK Base and Rover Radio** HPR2, Satellite-EASY Pro 35W high power radio, 403-473 Mhz RX/TX radio. 5 Meter Mast for Base, Gainflex antenna, CGR10, 403-470 Mhz RXO radio for controllers. ProCom Unity Gain Antenna, GLS13 telescopic aluminum pole
3.	**Field Software** SmartWorx Viva Software (with CS LT license)
4.	**Data Processing Software** Leica Geo Office GNSS-PP Bundle (Node locked). Includes LandXMLImport/Export, COGO calculations, L1/L2 GNSS processing, GLONASS, RINEXImport and Datum & Map., LGO Design & Adjustment 3D
5.	**Measurement Performance & Accuracy**
	Accuracy (rms) Code differential with DGPS / RTCM2
	DGPS / RTCM
	Accuracy (rms) with Real-Time (RTK)[2]
	Standard of compliance

S. No.	DGPS EQUIPMENT SPECIFICATIONS	
	Rapid static (phase) Static mode agree initialization	
	Kinematic (phase) Moving mode after initialization	
	Accuracy (rms) with Post Processing[2]	
	Static (phase) with long observations	
	Static and rapid static (phase)	Typically, 25 cm (rms)
	Kinematic (phase)	
	On the Fly (OTF) Initialization	Compliance with ISO17123-8
	RTK technology	Horizontal: 5 mm + 0.5 ppm (rms) Vertical: 10 mm + 0.5 ppm (rms)
	Reliability of OTF initialization	Horizontal: 10 mm + 1 ppm (rms) Vertical: 20 mm + 1 ppm (rms)
	Time of initialization	
	ORF range	Horizontal: 3 mm + 0.1 ppm (rms) Vertical: 3.5 mm + 0.4 ppm (rms)
	Network RTK	Horizontal: 5 mm + 0.5 ppm (rms) / Vertical: 10 mm + 0.5 ppm (rms)
	Network technology	Horizontal: 10 mm + 1 ppm (rms) / Vertical: 20 mm + 1 ppm (rms)
	Supported RTK network solutions	Leica SmartCheck+ technology
	Supported RTK network standards	Better than 99.99%[2]

9. DGPS COORDINATES OF ORANGE AREA (BAIGBHARI PUSALDA), BLOCK-GHARGHODA, DISTRICT- RAIGARH

Table 1: Survey Coordinates of CA land boundary point (4 Ha)

SURVEY ID	GEOGRAPHICAL COORDINATES		UTM COORDINATES	
	LATITUDE	LONGITUDE	NORTHING	EASTING
F1	22° 18' 43.69920" N	83° 18' 29.23658" E	2469195.87800	737767.41480
F2	22° 18' 43.66274" N	83° 18' 29.37568" E	2469194.81736	737771.41380
F3	22° 18' 43.53819" N	83° 18' 30.28040" E	2469191.38181	737797.37075
F4	22° 18' 43.36897" N	83° 18' 31.50958" E	2469186.71413	737832.63693
F5	22° 18' 43.20391" N	83° 18' 32.86619" E	2469182.23052	737871.54885
F6	22° 18' 43.18903" N	83° 18' 32.96803" E	2469181.81742	737874.47111
F7	22° 18' 43.16963" N	83° 18' 33.04133" E	2469181.25280	737876.57860
F8	22° 18' 42.51462" N	83° 18' 33.40051" E	2469161.25876	737887.16906
F9	22° 18' 41.59938" N	83° 18' 33.90240" E	2469133.32092	737901.96720
F10	22° 18' 41.08244" N	83° 18' 34.18586" E	2469117.54160	737910.32520
F11	22° 18' 39.12729" N	83° 18' 35.15013" E	2469057.81365	737938.84960
F12	22° 18' 37.15880" N	83° 18' 36.12097" E	2468997.67840	737967.56850
F13	22° 18' 36.32508" N	83° 18' 36.42483" E	2468972.16196	737976.65951
F14	22° 18' 35.45728" N	83° 18' 36.74110" E	2468945.60261	737986.12208
F15	22° 18' 35.67161" N	83° 18' 38.55248" E	2468952.99066	738037.87448
F16	22° 18' 35.76986" N	83° 18' 39.30412" E	2468956.34280	738059.34490
F17	22° 18' 35.84439" N	83° 18' 39.68583" E	2468958.80320	738070.23680
F18	22° 18' 35.76252" N	83° 18' 39.88425" E	2468956.37151	738075.95529
F19	22° 18' 35.20443" N	83° 18' 39.71793" E	2468939.12888	738071.45723
F20	22° 18' 33.69100" N	83° 18' 39.26690" E	2468892.37004	738059.25932
F21	22° 18' 33.52453" N	83° 18' 41.00440" E	2468888.01059	738109.07628
F22	22° 18' 33.34118" N	83° 18' 42.91799" E	2468883.20931	738163.94225
F100	22° 18' 30.75921" N	83° 18' 38.72370" E	2468801.93466	738045.09092
F101	22° 18' 31.64494" N	83° 18' 38.46692" E	2468829.07173	738037.32264
F102	22° 18' 32.37599" N	83° 18' 38.25497" E	2468851.46993	738030.91091
F103	22° 18' 32.69728" N	83° 18' 38.07433" E	2468861.27521	738025.58831
F104	22° 18' 32.60180" N	83° 18' 37.25193" E	2468857.97700	738002.09080
F105	22° 18' 32.62359" N	83° 18' 36.83214" E	2468858.46345	737990.06340
F106	22° 18' 32.59228" N	83° 18' 36.26804" E	2468857.25284	737973.92991
F107	22° 18' 32.80038" N	83° 18' 35.46389" E	2468863.30264	737950.81188
F108	22° 18' 34.17107" N	83° 18' 35.26458" E	2468905.38465	737944.46049
F109	22° 18' 35.63271" N	83° 18' 35.14223" E	2468950.29892	737940.26968
F110	22° 18' 36.18385" N	83° 18' 35.09895" E	2468967.23580	737938.77100
F111	22° 18' 36.41154" N	83° 18' 35.03531" E	2468974.21262	737936.84198
F112	22° 18' 36.74069" N	83° 18' 34.92276" E	2468984.28983	737933.46507
F113	22° 18' 37.75804" N	83° 18' 33.22791" E	2469014.84596	737884.46852
F114	22° 18' 38.40103" N	83° 18' 32.10757" E	2469034.13685	737852.09467

SURVEY ID	GEOGRAPHICAL COORDINATES		UTM COORDINATES	
	LATITUDE	LONGITUDE	NORTHING	EASTING
F115	22° 18' 39.11806" N	83° 18' 30.98431" E	2469055.70400	737819.60220
F116	22° 18' 39.35983" N	83° 18' 30.84489" E	2469063.08121	737815.49725
F117	22° 18' 39.68794" N	83° 18' 30.56649" E	2469073.05335	737807.37318
F118	22° 18' 40.36514" N	83° 18' 29.95935" E	2469093.62177	737789.67432
F119	22° 18' 41.38357" N	83° 18' 29.25658" E	2469124.64596	737769.07732
F120	22° 18' 41.64395" N	83° 18' 29.07390" E	2469132.57665	737763.72544
F121	22° 18' 41.83596" N	83° 18' 29.02693" E	2469138.46341	737762.29037
F122	22° 18' 42.21913" N	83° 18' 28.93423" E	2469150.21080	737759.45650
F123	22° 18' 42.52494" N	83° 18' 28.94352" E	2469159.62344	737759.57825
F124	22° 18' 42.83579" N	83° 18' 28.91657" E	2469169.17491	737758.66049
F125	22° 18' 43.10101" N	83° 18' 28.98563" E	2469177.36477	737760.51276
F126	22° 18' 43.33205" N	83° 18' 29.04580" E	2469184.49896	737762.12628
F127	22° 18' 43.53825" N	83° 18' 29.15295" E	2469190.88980	737765.09648
BASE STATION	22° 18' 43.45219" N	83° 18' 29.27025" E	2469188.29338	737768.49480

10. GIS ANALYSIS AND CONCLUSION

Land for compensatory afforestation Orange area, located in Pusalda village was provided by Forest department to NTPC limited. The area computed from the DGPS geo-referenced map was compared with the forest compartment orange area map proposed to be diverted for afforestation. The area as per forest record allocated to NTPC Limited for compensatory afforestation is 4 Ha out of 25.00 Hectare towards the diversion of 1.732 Ha forest land for widening of road.

Forest details are given in Table 2:

Table 2: Summary of Land Statistics to Be Diverted Taken Up for Compensatory Afforestation

SUMMARY OF LAND STATISTICS OF FOREST AREA TO BE TAKEN UP FOR COMPENSATORY AFFORESTATION			
S NO	TYPE OF LAND	Land ID	CA AREA AS PER DGPS SURVEY
1	ORANGE AREA	BAIGHBAHRI PUSALDA	4.00
TOTAL AREA (Ha.)			4.00

रमेश खेर / RAMESH KHER
मुख्य महाप्रबंधक / Chief General Manager
एनटीपीसी लि.लिमिटेड / NTPC Limited
तलाईपाली, बनाई और भालुमुडा कोल माइनिंग प्रोजेक्ट्स
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हेलुंगा रोड, घरघोदा, जिला - रायगढ़ (छ.ग.) 496111
Helunga Road Gharghoda, Distt. - Raigarh (C.G) 496111

वन मण्डलाधिकारी
रायगढ़, वनमण्डल

कार्यालय,
विज्ञान भवन,
छत्तीसगढ़ विज्ञान एवं प्रौद्योगिकी परिषद,
विधान सभा रोड, दलदल सिवनी,
रायपुर (छ.ग.) पिन - 492014

11. DELIVERABLES

- Index map of 4 Ha Compensatory Afforestation area (CA Land)against the diversion of 1.732 ha of forest land for road widening at Talaipalli Coal Mining Project. **ANNEXURE-I**

- DGPS Survey Boundary of 4 Ha CA Land superimposed on Toposheet against the diversion of 1.732 ha of forest land for road widening at Talaipalli Coal Mining Project(1:50000) **ANNEXURE-II**

- 4 Ha Compensatory Afforestation area (CA Land) Superimposed on High resolution satellite image against the diversion of 1.732 ha of forest land for road widening at Talaipalli Coal Mining Project (1:4000) **ANNEXURE-III**

- DGPS Survey Boundary & Coordinates of Compensatory Afforestation area against the diversion of 1.732 ha of forest land for road widening at Talaipalli Coal Mining Project (1:4000) **ANNEXURE-IV**

***** Glimpses of Field *****

छत्तीसगढ़ अंतरिक्ष उपयोग केन्द्र

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