POWERGRID CORPORATION OF INDIA LIMITED

DGPS Survey of 76.918 Ha land proposed for Compensatory Afforestation (CA) in lieu of proposed forest diversion of 26.5789 Ha in Korba forest division & 33.7057 Ha in Dharamjaygarh forest division for 765KV D/C Jharsuguda to Korba Transmission Line

DGPS SURVEY AND GIS MAPPING DONE BY:

Geotrax International Services
Raipur, Chhattisgarh.

एम. एच. सिद्दीकी/M. H. SIDDIQUI
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Geotrax International Services Hyderabad

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1. Introduction and Background

1.1 Background

POWERGRID CORPORATION OF INDIA LIMITED (A Govt. of India enterprises), the central transmission utility (CTU) of the country has been entrusted upon the construction of various EHV transmission lines and associated state-of-the art substations towards establishment and operation of regional and national power grid to transfer of bulk power within & across the regions with reliability.

As a part of the above 765KV D/C Jharsuguda-Dharamjaygarh-korba transmission line-2 (WR Portion) Circuit 3&4 is being constructed under "common system associated with East Coast Energy Pvt. Ltd. & NCC power projects LTOA Generation project in Srikakulam area (Part-B)". The line is passing through three forest divisions of Chhattisgarh state – Raigarh, Korba & Dharamjaygarh.

SL NO	FOREST DIVISION	PROPOSED FOREST DIVERSION AREA (in Ha)
1	**Korba**	**26.5789**
2	**Dharamjaygarh**	**33.7057**
3	Raigarh	93.1635

1.2 Compensatory Afforestation (CA)

Compensatory afforestation in lieu of diversion of forest land involves identification of non-forest land or degraded forest land and raising plantation.

According to condition imposed by MOEF in their In-principle approval dated 22.10.2013, that compensatory afforestation over the non-forest land equal to the forest land being diverted or degraded forest land double the land proposed for diversion, shall be raised and maintained by the State Forest Department at the cost of user agency.

1.3 Location of land for CA

Therefore, Bajaj Electricals Limited & PGCIL has identified forest land of approx... 76.918 Ha of degraded forest land in Champa forest division of Chhattisgarh. The joint site inspection of the site has been carried by the concerned Range Officer of the Forest department & the survey team. It is

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certified by the Forest Department that the applied area has been found suitable for Compensatory Afforestation (CA).

The Compartment wise details of the area is given as under:

SL NO	FOREST DIVISION	RANGE	LAND TYPE	COMPARTMENT NO	PROPOSED AREA (in Ha)
1	Champa	Balauda	Reserved Forest	62	40.409
2	Champa	Balauda	Reserved Forest	80	36.509
Total Area (Ha)					**76.918**

As per directives of Ministry of Environment & Forests dated 8th July 2011; all applications seeking diversion of forest land for non-forest purpose under Forest Conservation Act, 1980 must be accompanied with Geo-referenced shape file (both soft copy and hard copy maps) of the forest land proposed for diversion prepared using Differential GPS (DGPS).

As per directives of Ministry of Environment & Forests (MoEF) dated 8th July 2011; all applications for Forest Diversion, under Forest Conservation Act, 1980 must be accompanied with Geo-referenced shape file, showing the boundary of the proposed area (both soft copy and hard copy maps), prepared using Differential GPS (DGPS) and the same should be uploaded to MoEF website along with the online application.

To meet this requirement of MoEF, Bajaj Electricals Limited on behalf of PowerGrid Corporation of India Limited, entrusted the DGPS survey work to M/s Geotrax International Services, Raipur, which is an empanelled agency of Directorate of Geology and Mines, Chhattisgarh (Ref. Circular No. F-7-14/2013/12, dated. 10.11.2014).

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2. Scope of Work

1. Establishment of one base station for DGPS Survey and temporary benchmarks.
2. Fixation of corridor boundary point by DGPS (Boundary point fixed at every corner and turning point.
3. Data processing and Interpretation
    a. Geo-referencing of SOI Toposheet (1:50000), Forest Stock map (1:15000, if available) and satellite imagery
    b. Creation of proposed CA land boundary vector map using the DGPS Surveyed data
    c. Superimposition of CA land polygon layer on Georeferenced forest maps, SOI Toposheet and Satellite imagery.
    d. Computation of Forest area proposed for diversion/CA. It includes Reserved/Protected Forest/Revenue Forest.
    e. Preparation of Geo-referenced forest map at 1:15000 scale, and SOI Toposheet at 1:50000 scale.
    f. Preparation of DGPS survey report along with soft copy of – maps in shapefile format and kml file
4. Printing of report and Geo-referenced maps (7sets) and Technical compliance.

3. Deliverables

The deliverables envisaged for the assignment are described below

1. Post processed DGPS observations data as well as raw data in RINEX format.
2. DGPS Reports - Base line & network adjustment report for the primary and temporary benchmarks.
3. Geo-referenced SOI map & forest block maps (for PF/RF areas, if any) based on DGPS observations.
4. Geo-reference shape file (Soft copy) of showing CA land Forest Patche/s
5. Area statement as per DGPS Survey showing proposed area for compensatory afforestation
6. DGPS Survey and mapping report

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4. Brief description of the Technical approach

4.1 Input Data

Bajaj Electricals Limited & PowerGrid Corporation of India Limited along with Korba Forest department has identified the sites for CA in Korba and Jangir-Champa forest divisions. The maps (SOI Toposheet & Forest Map) required for geo-referencing were provided to M/s Geotrax International Services.

4.2 Planning DGPS Survey

Based on the input data (maps, land schedule details) and information provided given by CSPTCL, the DGPS base station - Primary and Secondary Control Points (PCP and SCP) in the project area are planned. One PCP with 72 hours observation that is established by Geotrax, on the roof top of the Ganga Bhavan Guest House in NTPC Township, Korba is used as a base station for the project. Secondary control point (SCP) is planned in Gugdgaon village in Baluda Range of Jangir-Champa forest division.

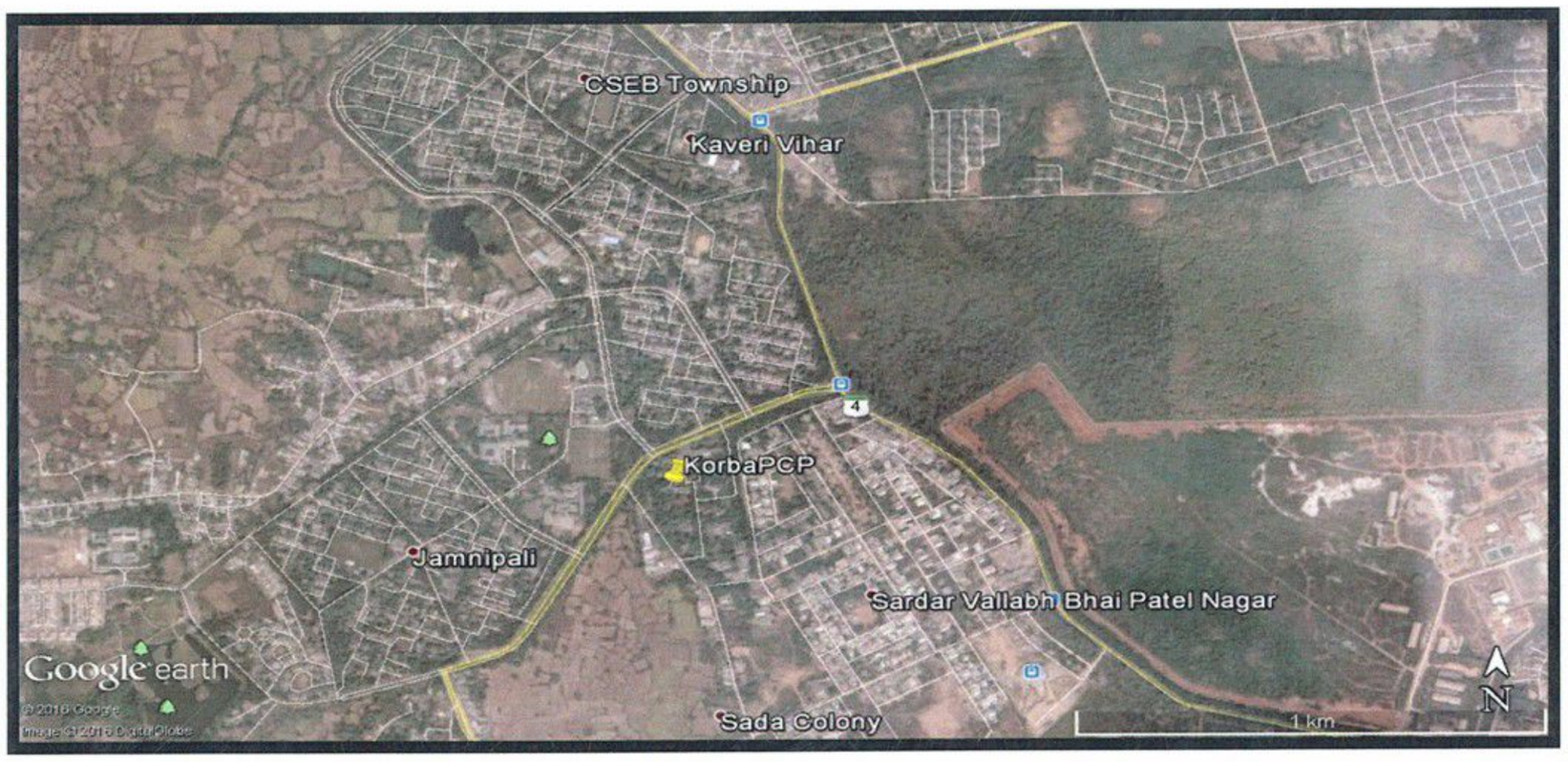

Fig-1: Satellite Image showing the location of the Primary Control Point

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4.3 Establishment of Primary Control Point

The Primary Control Point (PCP) with 72 hours of DGPS Observation was established as the DGPS base station. The PCP was established in the roof top of the NTPC Ganga Guest House (Shiv Park) in Korba. As per Survey of India (SOI) Guideline, the PCP is to be fixed through continuous observation for 72 hours duration. The observed data was processed with reference to the data of International GNSS Service (IGS) stations as per SOI guideline (IGS processed report is enclosed as Annexure-1). The coordinate of the PCP is as follows:

Latitude: N23°24'56.56025", Longitude: E82°39'42.25144"

Ellipsoidal Height: 255.971 m.

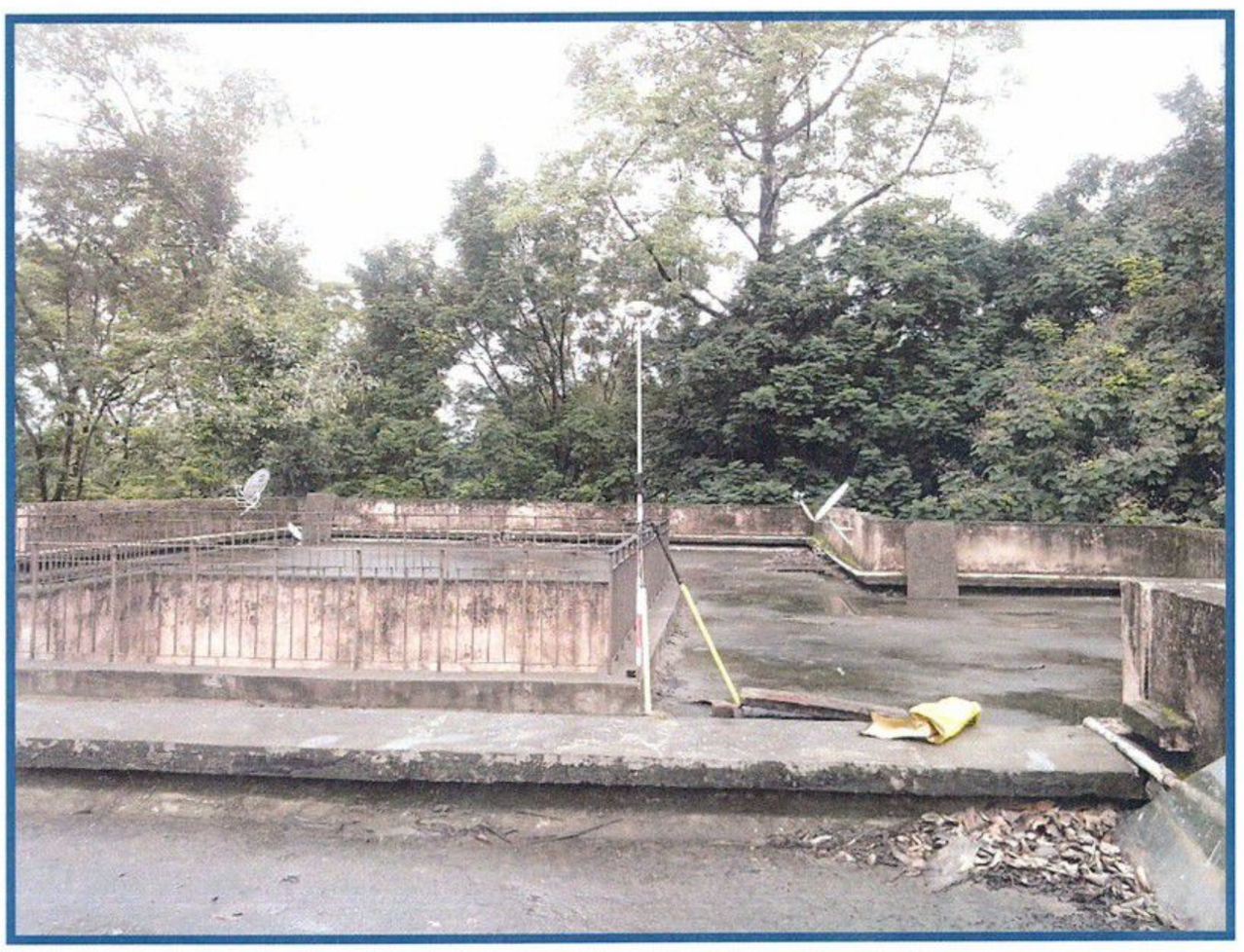

Fig-2: Images showing NTPC Township, Ganga Bhawan Guest House Primary Control Point (PCP)

4.4 Establishment of Secondary Control Point (SCP)

One Secondary Control Point is established in Baluda range of Jangir-Champa forest division. The DGPS observation of 3-4 hours duration is carried out on the Secondary control points – Gudgaon SCP, Jangir-Champa and is established with reference to Korba Primary Control Point.

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Point ID	Latitude (d:m:s)	Longitude (d:m:s)	Ellipsoidal Height (m)	Location
Korba PCP	22°24'56.56025"N	82°39'42.25144"E	255.971	Ganga Bhawan Guest House, NTPC Township
Gudgaon SCP	22°14'21.99543"N	82°35'49.35365"E	221.388	Gudgaon Primary School

4.5 DGPS Survey

DGPS survey was carried out using a pair of DGPS instrument. One DGPS Instrument was used as Base Station. The first base station for the survey was established at the Secondary control Point in Balrampur. The base is shifted using the Real Time Kinematic Survey method. The distance between the Base Station and rover was always less than 5km.

The other DGPS instrument was working as Rover. The survey was conducted in Real Time Kinematic (RTK) mode. The Survey team carried out DGPS Survey of boundary points by walking along the proposed CA land boundary. DGPS readings were collected at every 50m distance along boundary and at every turn or bend. For Geo-referencing forest maps around 5 GCPs were collected.

During the survey the start and end of forest patch was identified in the field with the help of staff from the forest department. The forest department staff also provided information regarding the forest range, compartment number etc.

The static data is Post Processed using Trimble Business Centre software.

4.6 Creation of CA Land patch boundary

The surveyed points captured through DGPS were plotted in the GIS Software and the Polygon and Polyline layers are created using the DGPS Surveyed points. Different layers such as the CA Patch polygon, Compartment boundary etc is prepared. The vector layers prepared are then super-imposed on the Geo-referenced Forest map and SOI toposheet.

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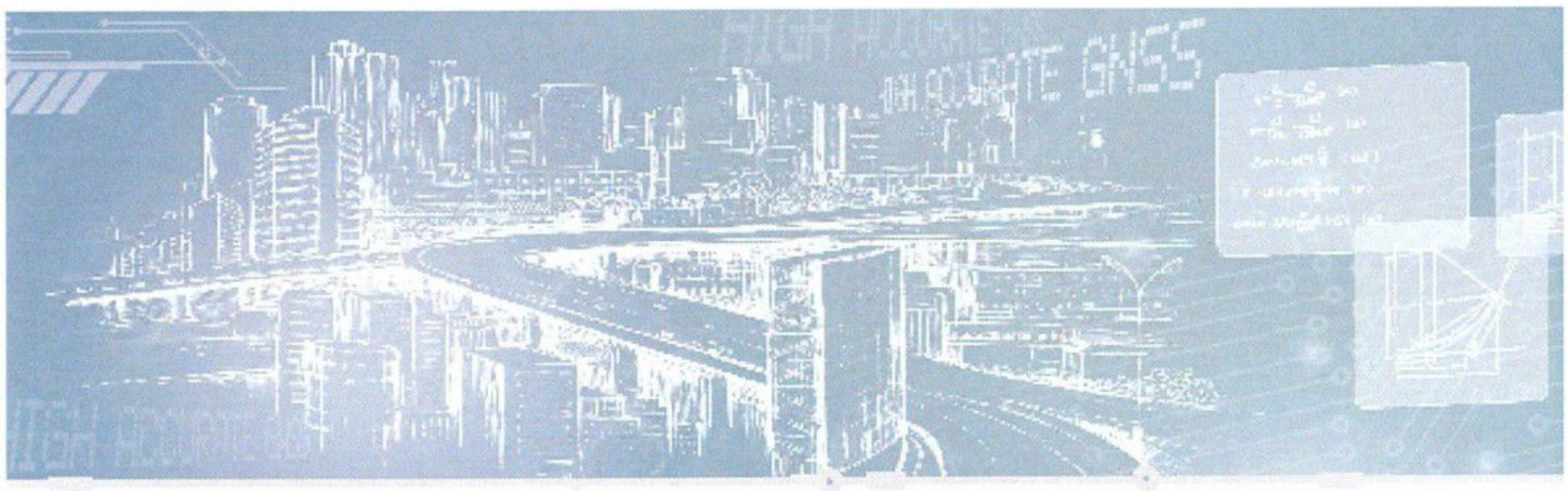
4.7 Specification of DGPS Equipment

Geotrax deployed the most advance and hi-precision devices to carry out the DGPS survey. The DGPS performance specifications are given below. The corresponding fact sheets are placed below for ready reference.

ComNav **T300 GNSS Receiver**



Features

- *Ultra small*
- *Super light*
- *Many user-friendly conveniences built in*
- *GPS L1/L2/L5, BeiDou B1/B2/B3, GLONASS L1/L2*
- *Low power consumption*
- *Support long baseline E-RTK[1]*

RTK robust enough for challenging environments, in a device that is light and easy to carry

With decades of experience in the surveying GNSS receiver, the T300 is a product which combines lots of market proved advantages together. It can track all the working GNSS constellations. By using ComNav's unique QUAN™ algorithm technology, it can function in RTK mode with all the GNSS constellations or by using any single GNSS constellation such as GLONASS or BeiDou. The strong anti-interference ability of the receiver makes it possible to work in any environment.

Design driven to improve user experience

Our R&D people are always thinking about how to improve the physical experience of users and workflow in the field. With this in mind, the T300 integrates a cutting edge GNSS board, Bluetooth®, UHF (Rx&Tx) into a compact board. Smart design makes the T300 the lightest and smallest (volume) receiver in the world.

Hot swap battery design

Extending the field working time is also a passion for our R&D people. They do lots of tests and analysis to reduce the power consumption, and make the whole system work more efficiently. In parallel, they've designed in the capability to hot swap the battery source. When the warning sounds and LED flashes, put your second battery in place. Then recharge the first while you keep working.

Consumer grade batteries... always available

Losing power in the field is significantly inconvenient for users, as the batteries for GNSS receivers are often unusual types and not readily available. Once again our R&D people developed a solution so that the T300 runs on normal consumer batteries.

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Technical Specifications T300

Signal Tracking

- 256 channels with simultaneously tracked satellite signals
  - GPS: L1 C/A, L1 C, L2 P, L5
  - BeiDou: B1, B2, B3
  - GLONASS: L1, L2
  - SBAS: WAAS, EGNOS, MSAS, GAGAN

Performance Specifications

- Cold start: <50 s
- Warm start: <30 s
- Hot start: <15 s
- Initialization time: <10 s
- Singal re-acquisition: <2 s
- Initialization reliability: >99.9%

Positioning Specifications

- Post Processing Static
  -Horizontal: 2.5 mm + 0.5 ppm RMS
  -Vertical: 5 mm + 0.5 ppm RMS
- Real Time Kinematic
  -Horizontal: 8 mm + 1 ppm RMS
  -Vertical: 15 mm + 1 ppm RMS
- E-RTK[1] (baseline<100 km)
  -Horizontal: 0.2 m + 1 ppm RMS
  -Vertical: 0.4 m + 1 ppm RMS
- Code differential GNSS positioning
  -Horizontal: 0.25 m+ 1 ppm RMS
  -Vertical: 0.5 m + 1 ppm RMS
- SBAS: Typically <1 m 3D RMS
- Standalone: <1.5 m 3D RMS

Communications and Memory

- 1 Serial port (7 pin Lemo),
  Baud rates up to 921,600 bps.
- Radio modem: Tx/Rx with full frequency range from 410-470 MHz [2]
  -Transmit power: 0.5-2W adjustable
  - Range: 1-4 km
- Position data output rates: 1 Hz, 2 Hz, 5 Hz, 10 Hz
- 5 LEDs (indicating Power, Satellite Tracking, Bluetooth® and Differential Data)
- Bluetooth® : V 2.X protocol, work compatible with Windows 7, Windows mobile and Android

Data Format

- Correction data I/O:
  - RTCM 2.x, 3.x, CMR (GPS only), CMR+ (GPS only).
- Position data output:
  - ASCII: NMEA-0183 GSV, RMC, HDT, VHD, GGA, GSA, ZDA, VTG, GST, PJK, PTNL
  - ComNav Binary update to 20 Hz

Physical

- Size(W×H): 15.8 cm × 7.5 cm
- Weight: 0.95 kg (include 2 batteries)

Environmental

- Operating temperature: -40 °C to + 65 °C (40 °F to 149 °F)
- Storage temperature: -40 °C to + 85 °C (40 °F to 185 °F)
- Humidity: 100% condensation
- Waterproof and dust proof: IP67 protected from temporary immersion to depth of 1 meter, floats
- Shock: survives a 2 meter drop on to concrete

Electrical

- Input Voltage: 5-27 VDC
- Power consumption: 2.85 W (3 constellations)[3]
- Li-ion battery capacity: 2 × 1800 mAh, up to 8 hours typically
- Memory: 256 MB internal with up to 16 GB pluggable memory card

Software

- ComNav field data collection software CGSurvey
- Carlson's SurvCE field data collection software (optional)
- MicroSurvey's FieldGenius field data collection software (optional)

1 E-RTK, BeiDou B3 signal used in RTK calculate engine; concern the current situation, this mode can be used in APAC.

2 410-470 MHz, 3 frequency range, 410-430, 430-460, 460-470, need to clarify when place the order.

3 Power consumption will increase if using internal radio modem transmitter.

Specifications subject to change without notice.

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5. Results

The total CA Land area proposed for compensatory afforestation is 76.918 Ha. The details of the proposed CA area is shown below. DGPS Survey co-ordinates of the CA Land patches are in Annexure-1, and the geo-referenced maps is in Annexure -2. The area statement is given in the following below tables:

AREA STATEMENT

SCHEDULE OF FOREST LAND PROPOSED FOR DHARAMJAYGARH FOREST DIVISION- PROTECTED FOREST/ORANGE AREA/RESERVED FOREST					
Sl. No.	**Division**	**Range**	**Compartment Type**	**Compartment No**	**Proposed CA Area (in Ha)**
1	Champa	Baluda	Reserved Forest	62	40.409
2	Champa	Balauda	Reserved Forest	80	36.509
Total Area (Ha)					**76.918**

6. Background of Organization

6.1 Company Profile: Geotrax

Geotrax International Services (www.geotrax.in) is a Professional Land Mapping and Services provider across India established in the year 1999. During the last 14+ years, we had an opportunity to execute a variety of surveying jobs all over India and in the Middle East to various customer specifications for RIS, LIS, and Municipal GIS oriented jobs. Cadastral Surveys using ETS/DGPS and Provision of Ground control conforming to stringent accuracy standards using high end instruments as RTK/GPRS DGPS is our specialty. We also have a UAV (Drone) and Ground Penetrating Radar (on Roaster).

Geotrax is headed by Mr. V.V.S Bandhakavi (Ex-Survey of India employee) who has more than 40+ years' experience in the field of surveying in India and abroad.

Some of our major clients include:

- Odisha Space Application Centre (ORSAC)

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- Steel Authority of India (SAIL)
- National Thermal Power Corporation (NTPC)
- Survey Settlement and Land Records Department (Govt. Of Gujarat)
- Survey Settlement and Land Records Department (Govt. Of Madhya Pradesh)
- Irrigation Dept. (Govt. of Jammu and Kashmir)
- National Remote Sensing Agency (Hyderabad)
- Meinhardt India Private Limited (Delhi),
- Nagarjuna Construction Company (NCC, Hyderabad)
- Consulting Engineering Services (CES, New Delhi)
- Lee Associates of South Asia (LASA, Delhi)
- Power development Corporation (Govt. of Jammu and Kashmir)

Geotrax expertise covers:

- DGPS Surveys for Mining lease boundary, and Forest Diversion
- Consultancy services for Mining Plan & EIA
- Boundary and cadastral surveys using DGPS and Total station;
- Topographic surveys.
- Ground control surveys for photogrammetric projects, including Airborne GPS.
- Only one of the two companies in India who are empanelled by NRSA for DGPS survey for ground control point collection
- Route and alignment surveys combining conventional and photogrammetric methods.
- Construction and cross-section surveys (from road design to precision layout and quality control).

Being a client focused organization, Geotrax's combination of survey equipment, personnel, and computer resources allow for the tailoring of the project approach to match the orders of accuracy and precision requirements for each project. Geotrax's equipment resources include 250 DGPS, 33 hand-held GPS units, theodolites, electronic digital and automatic levels, 19 Electronic Total Stations, and data collectors.

On the mapping side, our CAD and GIS professionals assist the survey projects by creating accurate maps. We have dedicated CAD experts who have extensive experience with different CAD software.

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7. Annexures

7.1 Annexure–1: PCP Observation Processing Report

AUSPOS GPS Processing Report

September 5, 2015

This document is a report of the GPS data processing undertaken by the AUSPOS Online GPS Processing Service (version: AUSPOS 2.2) . The AUSPOS Online GPS Processing Service uses International GNSS Service (IGS) products (final, rapid, ultra-rapid depending on availability) to compute precise coordinates in ITRF anywhere on Earth and GDA94 within Australia. The Service is designed to process only dual frequency GPS phase data.

An overview of the GPS processing strategy is included in this report.

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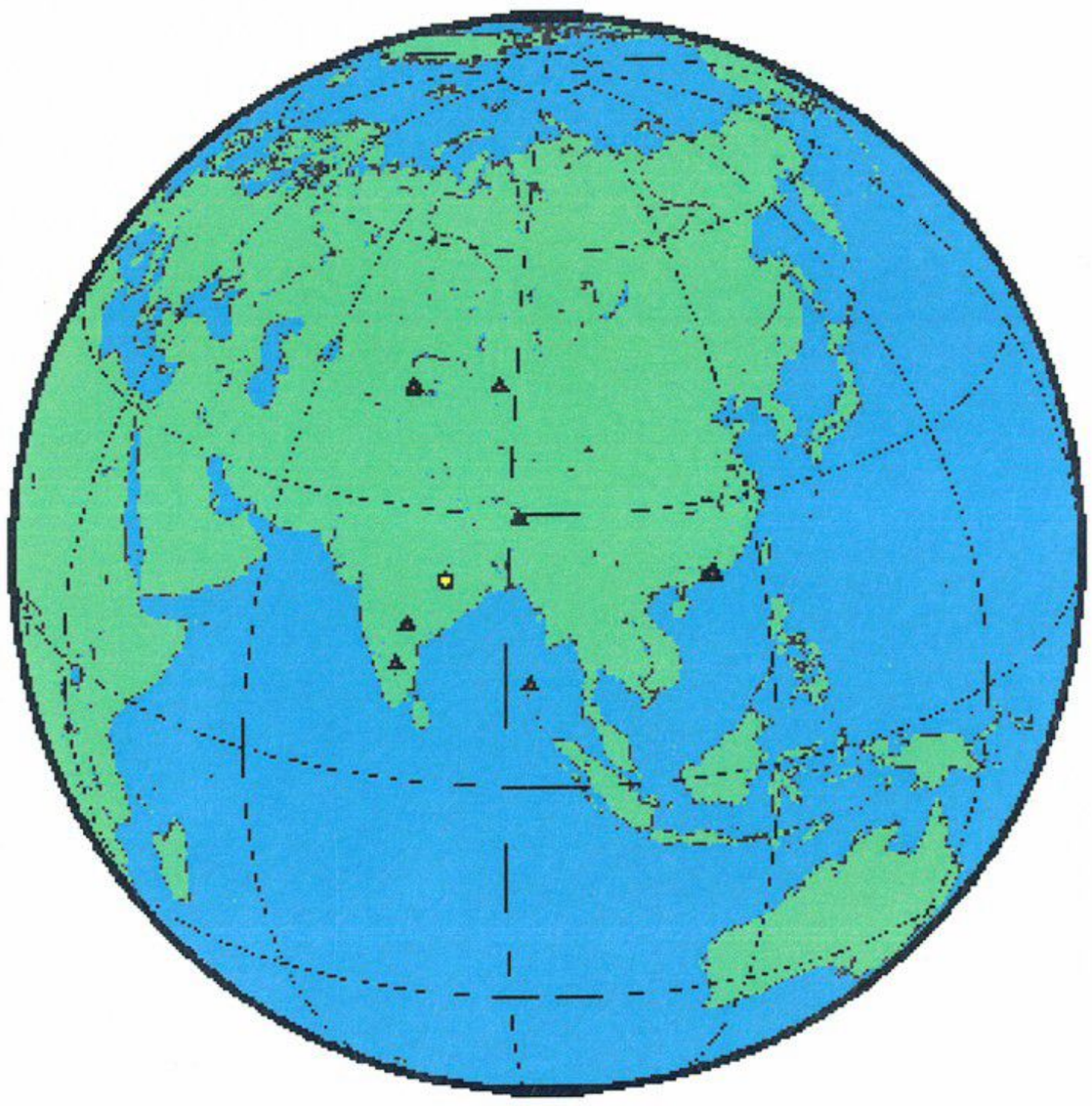
Australian Government
Geoscience Australia

1 User Data

All antenna heights refer to the vertical distance from the Ground Mark to the Antenna Reference Point (ARP).

Station (s)	Submitted File	Antenna Type	Antenna Height (m)	Start Time	End Time
0310	03102853244a.150	CNTT300 NONE	1.835	2015/09/01 16:58:00	2015/09/04 17:19:00

2 Processing Summary



Date	User Stations	Reference Stations	Orbit Type
2015/09/01 16:58:00	0310	CHUM FOMD HKNP HKOH HKSC HKSL HYDE IISC LHAZ PBRI POL2 URUM	IGS rapid

Remark: An IGS Rapid Orbit product has been used in this computation, IGS Rapid orbits are usually of very high quality. However, to ensure you achieve the highest quality coordinates please resubmit approximately 2 weeks after the observation session end to ensure the use of the IGS Final Orbit product.

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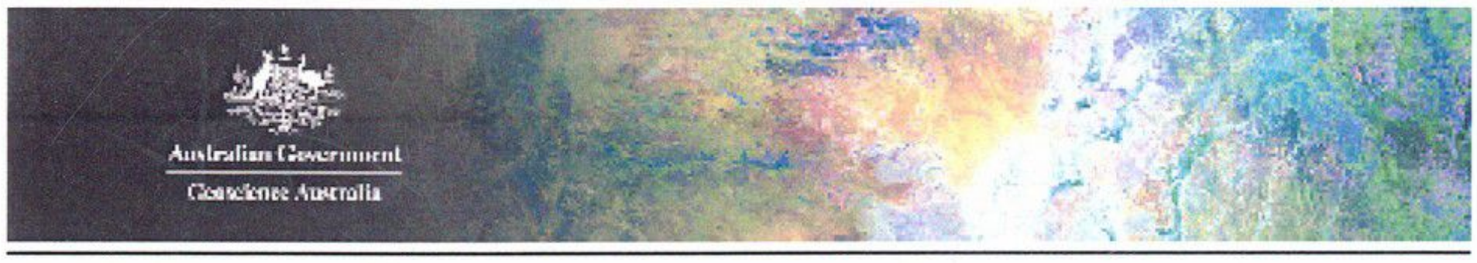

3 Computed Coordinates, ITRF2008

All computed coordinates are based on the IGS realisation of the ITRF2008 reference frame. All the given ITRF2008 coordinates refer to a mean epoch of the site observation data. All coordinates refer to the Ground Mark.

3.1 Cartesian, ITRF2008

Station	X (m)	Y (m)	Z (m)	ITRF2008 @
0310	753502.779	5851003.824	2417128.610	01/09/2015
CHUM	1228950.508	4508079.981	4327868.535	01/09/2015
FOMD	-2359952.427	5416530.098	2394688.444	01/09/2015
HKNP	-2392360.773	5400226.077	2400094.284	01/09/2015
HKOH	-2423817.411	5386056.906	2399883.192	01/09/2015
HKSC	-2414267.426	5386768.794	2407459.848	01/09/2015
HKSL	-2393382.928	5393860.985	2412592.230	01/09/2015
HYDE	1208444.133	5966805.988	1897077.240	01/09/2015
IISC	1337935.993	6070317.091	1427877.150	01/09/2015
LHAZ	-106941.934	5549269.787	3139215.148	01/09/2015
PBRI	-295635.865	6240848.753	1278178.464	01/09/2015
POL2	1239971.079	4530790.135	4302578.856	01/09/2015
URUM	193030.295	4606851.297	4393311.527	01/09/2015

3.2 Geodetic, GRS80 Ellipsoid, ITRF2008

Geoid-ellipsoidal separations, in this section, are computed using a spherical harmonic synthesis of the global EGM2008 geoid. More information on the EGM2008 geoid can be found at http://earth-info.nga.mil/GandG/wgs84/gravitymod/egm2008/

Station	Latitude (DMS)	Longitude (DMS)	Ellipsoidal Height(m)	Derived Above Geoid Height(m)
0310	22 24 56.56025	82 39 42.25144	255.971	317.021
CHUM	42 59 54.60506	74 45 03.96764	716.348	759.338
FOMD	22 11 50.69355	113 32 32.97328	56.634	61.319
HKNP	22 14 56.63158	113 53 37.96894	350.652	353.998
HKOH	22 14 51.66789	114 13 42.80678	166.369	168.246
HKSC	22 19 19.81360	114 08 28.29557	20.198	22.654
HKSL	22 22 19.21147	113 55 40.75206	95.260	98.803
HYDE	17 25 02.14157	78 33 03.14377	441.688	518.493
IISC	13 01 16.20960	77 34 13.36808	843.666	929.587
LHAZ	29 39 26.40057	91 06 14.50981	3624.596	3659.287
PBRI	11 38 16.00905	92 42 43.69165	-22.503	38.431
POL2	42 40 47.17388	74 41 39.36690	1714.208	1754.274
URUM	43 48 28.61936	87 36 02.41272	858.878	922.257

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3.3 Positional Uncertainty (95% C.L.) - Geodetic, ITRF2008

Station	Longitude(East) (m)	Latitude(North) (m)	Ellipsoidal Height(Up) (m)
0310	0.006	0.005	0.013
CHUM	0.006	0.005	0.009
FOMD	0.007	0.005	0.009
HKNP	0.007	0.005	0.008
HKOH	0.007	0.005	0.009
HKSC	0.007	0.005	0.009
HKSL	0.007	0.005	0.008
HYDE	0.006	0.005	0.009
IISC	0.006	0.005	0.010
LHAZ	0.006	0.004	0.010
PBRI	0.006	0.005	0.010
POL2	0.006	0.005	0.009
URUM	0.006	0.005	0.008

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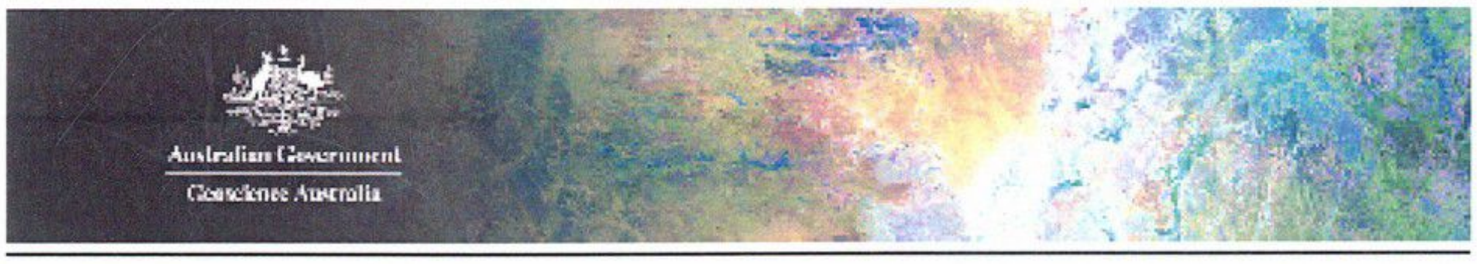

4 Ambiguity Resolution - Per Baseline

Baseline	Ambiguities Resolved	Baseline Length (km)
HKOH - HKSL	92.0 %	33.892
HKOH - HKSC	94.2 %	12.211
CHUM - POL2	96.7 %	35.732
0310 - HYDE	49.4 %	700.596
HYDE - PBRI	54.1 %	1649.361
CHUM - URUM	95.9 %	1042.674
HKNP - URUM	85.6 %	3359.554
HKNP - HKSL	91.7 %	14.063
HKNP - PBRI	38.6 %	2522.221
FOMO - HKNP	93.2 %	36.679
HYDE - LHAZ	78.4 %	1856.740
HYDE - IISC	83.9 %	497.626
AVERAGE	79.5%	980.112

Please note for a regional solution, such as used by AUSPOS, an average ambiguity resolution of 50% or better for the network indicates a reliable solution.

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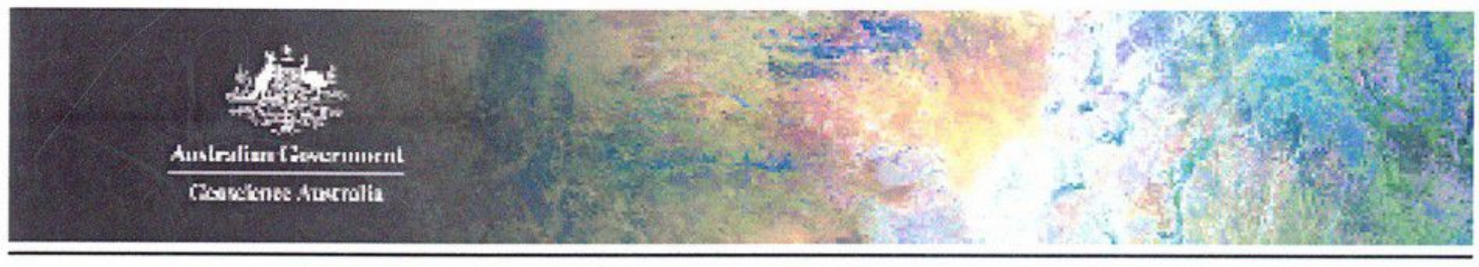

5 Computation Standards

5.1 Computation System

Software	Bernese GNSS Software Version 5.2.
GNSS system(s)	GPS only.

5.2 Data Preprocessing and Measurement Modelling

Data preprocessing	Phase preprocessing is undertaken in a baseline by baseline mode using triple-differences. In most cases, cycle slips are fixed by the simultaneous analysis of different linear combinations of L1 and L2. If a cycle slip cannot be fixed reliably, bad data points are removed or new ambiguities are set up A data screening step on the basis of weighted postfit residuals is also performed, and outliers are removed.
Basic observable	Carrier phase with an elevation angle cutoff of 7° and a sampling rate of 3 minutes. However, data cleaning is performed a sampling rate of 30 seconds. Elevation dependent weighting is applied according to $1/\sin(e)^2$ where e is the satellite elevation.
Modelled observable	Double differences of the ionosphere-free linear combination.
Ground antenna phase centre calibrations	IGS08 absolute phase-centre variation model is applied.
Tropospheric Model	A priori model is the GMF mapped with the DRY-GMF.
Tropospheric Estimation	Zenith delay corrections are estimated relying on the WET-GMF mapping function in intervals of 2 hour. N-S and E-W horizontal delay parameters are solved for every 24 hours.
Tropospheric Mapping Function	GMF
Ionosphere	First-order effect eliminated by forming the ionosphere-free linear combination of L1 and L2. Second and third effect applied.
Tidal displacements	Solid earth tidal displacements are derived from the complete model from the IERS Conventions 2010, but ocean tide loading is not applied.
Atmospheric loading	Applied
Satellite centre of mass correction	IGS08 phase-centre variation model applied
Satellite phase centre calibration	IGS08 phase-centre variation model applied
Satellite trajectories	Best available IGS products.
Earth Orientation	Best available IGS products.

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5.3 Estimation Process

Adjustment	Weighted least-squares algorithm.
Station coordinates	Coordinate constraints are applied at the Reference sites with standard deviation of 1mm and 2mm for horizontal and vertical components respectively.
Troposphere	Zenith delay parameters and pairs of horizontal delay gradient parameters are estimated for each station in intervals of 2 hours and 24 hours.
Ionospheric correction	An ionospheric map derived from the contributing reference stations is used to aid ambiguity resolution.
Ambiguity	Ambiguities are resolved in a baseline-by-baseline mode using the Code-Based strategy for 180-6000km baselines, the Phase-Based L5/L3 strategy for 18-200km baselines, the Quasi-Ionosphere-Free (QIF) strategy for 18-2000km baselines and the Direct L1/L2 strategy for 0-20km baselines.

5.4 Reference Frame and Coordinate Uncertainty

Terrestrial reference frame	IGS08 station coordinates and velocities mapped to the mean epoch of observation.
Australian datum	GDA94 coordinates determined via Helmert transformation from ITRF using the Dawson and Woods (2010) parameters.
Derived AHD	For stations within Australia, AUSGeoid09 is used to compute AHD. AUSGeoid09 is the Australia-wide gravimetric quasigeoid model that has been a posteriori fitted to the Australian Height Datum.
Above-geoid heights	Earth Gravitational Model EGM2008 released by the National Geospatial-Intelligence Agency (NGA) EGM Development Team is used to compute above-geoid heights. This gravitational model is complete to spherical harmonic degree and order 2159, and contains additional coefficients extending to degree 2190 and order 2159.
Coordinate uncertainty	Coordinate uncertainty is expressed in terms of the 95% confidence level for both GDA94 and ITRF2008. Uncertainties are scaled using an empirically derived model which is a function of data span, quality and geographical location.

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7.2 Annexure–2: DGPS Surveyed co-ordinates of CA land boundary in Jangir-Champa division

DGPS Points for CA Land of Compartment No RF 80

SL NO	PILLAR ID	EASTING "m"	NORTHING "m"	LATITUDE "N"	LONGITUDE "E"
1	P 1	663768.851	2460424.231	22°14'29.60852"	82°35'20.92650"
2	P 2	663843.945	2460447.157	22°14'30.32824"	82°35'23.55741"
3	P 3	664139.684	2460432.849	22°14'29.76197"	82°35'33.88012"
4	P 4	664200.328	2460416.412	22°14'29.20681"	82°35'35.99193"
5	P 5	664445.578	2460388.899	22°14'28.22834"	82°35'44.54656"
6	P 6	664446.980	2460316.030	22°14'25.85883"	82°35'44.56870"
7	P 7	664494.007	2460067.650	22°14'17.76767"	82°35'46.11949"
8	P 8	664525.554	2460004.406	22°14'15.70074"	82°35'47.19787"
9	P 9	664344.057	2459963.037	22°14'14.41799"	82°35'40.84451"
10	P 10	664270.769	2459956.813	22°14'14.24075"	82°35'38.28286"
11	P 11	664213.759	2459946.912	22°14'13.93839"	82°35'36.28836"
12	P 12	664136.339	2459947.520	22°14'13.98463"	82°35'33.58496"
13	P 13	663995.702	2459905.773	22°14'12.67548"	82°35'28.65838"
14	P 14	664011.885	2459806.473	22°14'09.44162"	82°35'29.18705"
15	P 15	663941.141	2459807.902	22°14'09.51226"	82°35'26.71711"
16	P 16	663816.853	2459787.711	22°14'08.89829"	82°35'22.36941"
17	P 17	663752.499	2460100.109	22°14'19.07660"	82°35'20.23663"
18	P 18	663766.844	2460152.863	22°14'20.78678"	82°35'20.75692"

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Geotrax International Services Hyderabad

DGPS Points for CA Land of Compartment No RF 62

SL NO	PILLAR ID	EASTING "m"	NORTHING "m"	LATITUDE "N"	LONGITUDE "E"
1	P 1	657003.052	2459296.977	22°13'55.22149"	82°31'24.24642"
2	P 2	657026.506	2459380.160	22°13'57.91827"	82°31'25.09468"
3	P 3	656996.810	2459450.907	22°14'00.22809"	82°31'24.08254"
4	P 4	657024.591	2459493.994	22°14'01.61985"	82°31'25.06784"
5	P 5	657046.141	2459485.204	22°14'01.32701"	82°31'25.81729"
6	P 6	657066.283	2459524.003	22°14'02.58185"	82°31'26.53435"
7	P 7	657142.828	2459491.492	22°14'01.49981"	82°31'29.19601"
8	P 8	657200.040	2459592.498	22°14'04.76495"	82°31'31.22948"
9	P 9	657163.135	2459612.966	22°14'05.44251"	82°31'29.94788"
10	P 10	657172.641	2459654.492	22°14'06.78947"	82°31'30.29448"
11	P 11	657150.207	2459667.073	22°14'07.20586"	82°31'29.51545"
12	P 12	657186.410	2459731.114	22°14'09.27611"	82°31'30.80227"
13	P 13	657260.219	2459692.811	22°14'08.00661"	82°31'33.36636"
14	P 14	657286.810	2459735.604	22°14'09.38917"	82°31'34.31006"
15	P 15	657218.655	2459773.854	22°14'10.65508"	82°31'31.94337"
16	P 16	657333.644	2459943.085	22°14'16.11943"	82°31'36.01867"
17	P 17	657397.551	2459902.711	22°14'14.78584"	82°31'38.23626"
18	P 18	657461.609	2459996.284	22°14'17.80704"	82°31'40.50633"
19	P 19	657582.134	2459894.894	22°14'14.47109"	82°31'44.67963"
20	P 20	657930.168	2459569.454	22°14'03.77602"	82°31'56.71884"
21	P 21	658025.258	2459494.519	22°14'01.30844"	82°32'00.01304"
22	P 22	658093.206	2459468.607	22°14'00.44362"	82°32'02.37670"
23	P 23	658052.252	2459356.262	22°13'56.80457"	82°32'00.90681"
24	P 24	657952.349	2459361.561	22°13'57.00973"	82°31'57.41993"
25	P 25	657737.841	2459343.806	22°13'56.50302"	82°31'49.92274"
26	P 26	657569.591	2459333.350	22°13'56.21836"	82°31'44.04353"
27	P 27	657361.647	2459372.244	22°13'57.55112"	82°31'36.79554"
28	P 28	657196.120	2459343.758	22°13'56.67924"	82°31'31.00508"

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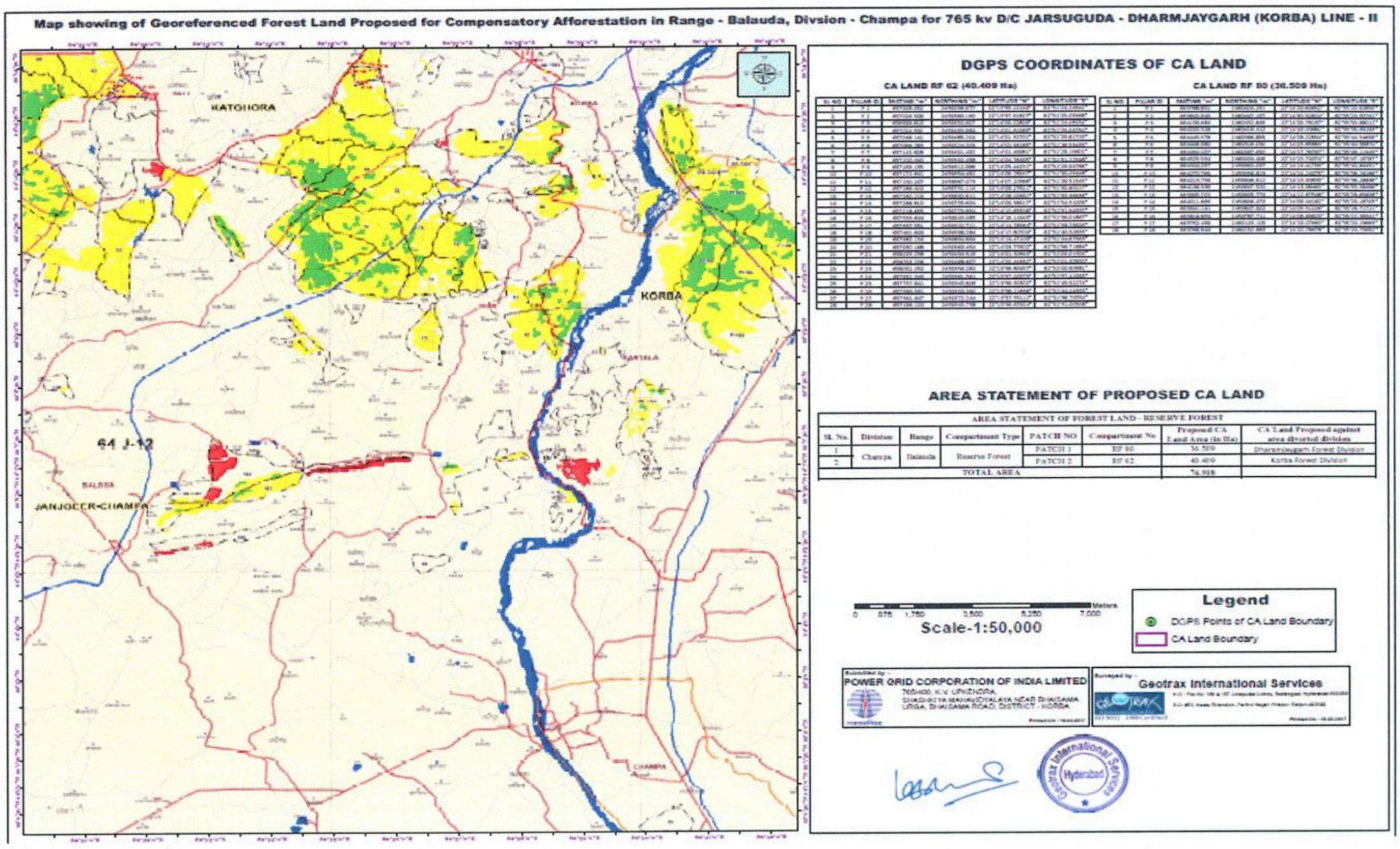
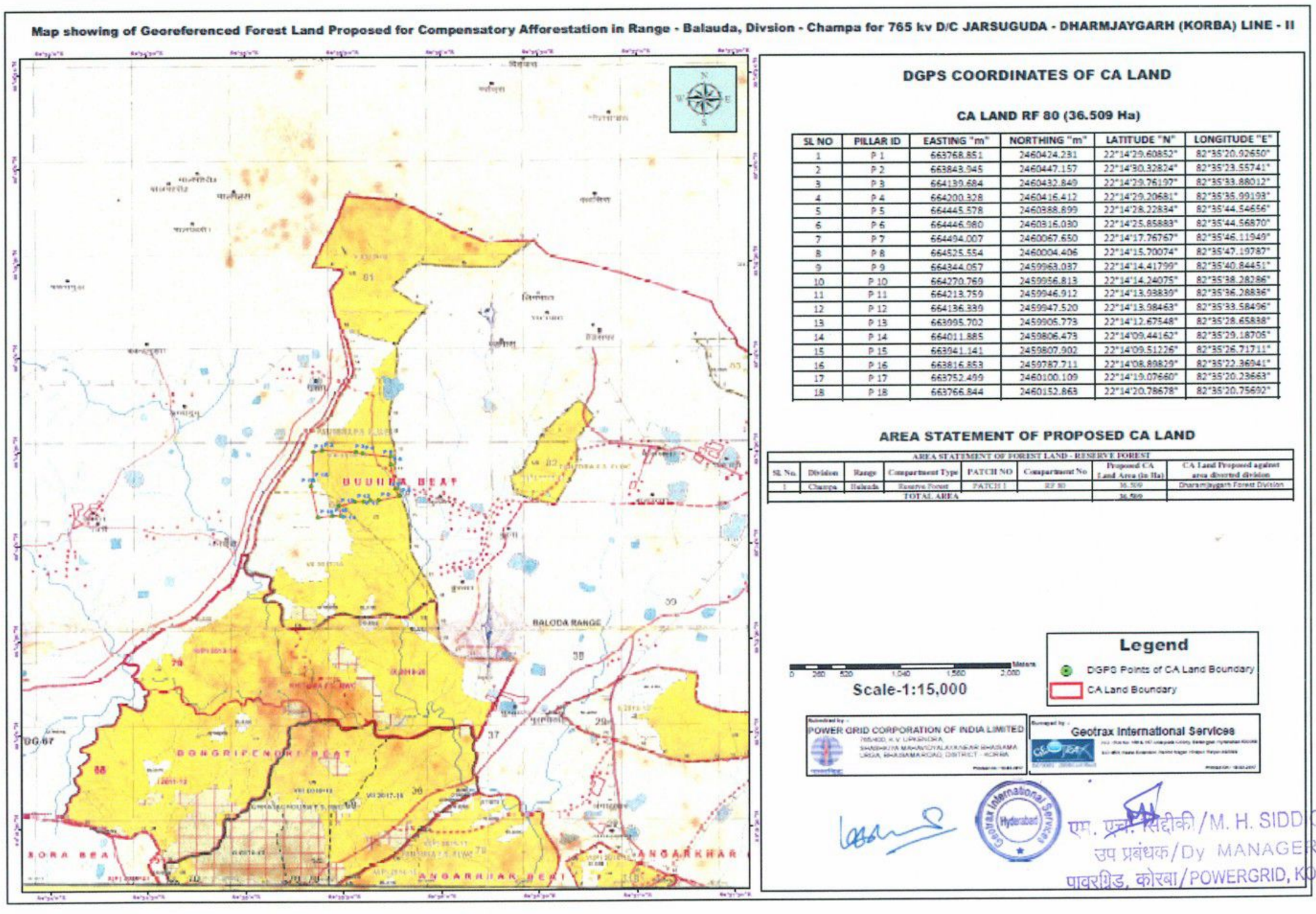
7.3 Annexure–4: DGPS Surveyed Map of Proposed CA Land (Forest Map 1:15000 scale)

**Not to scale*



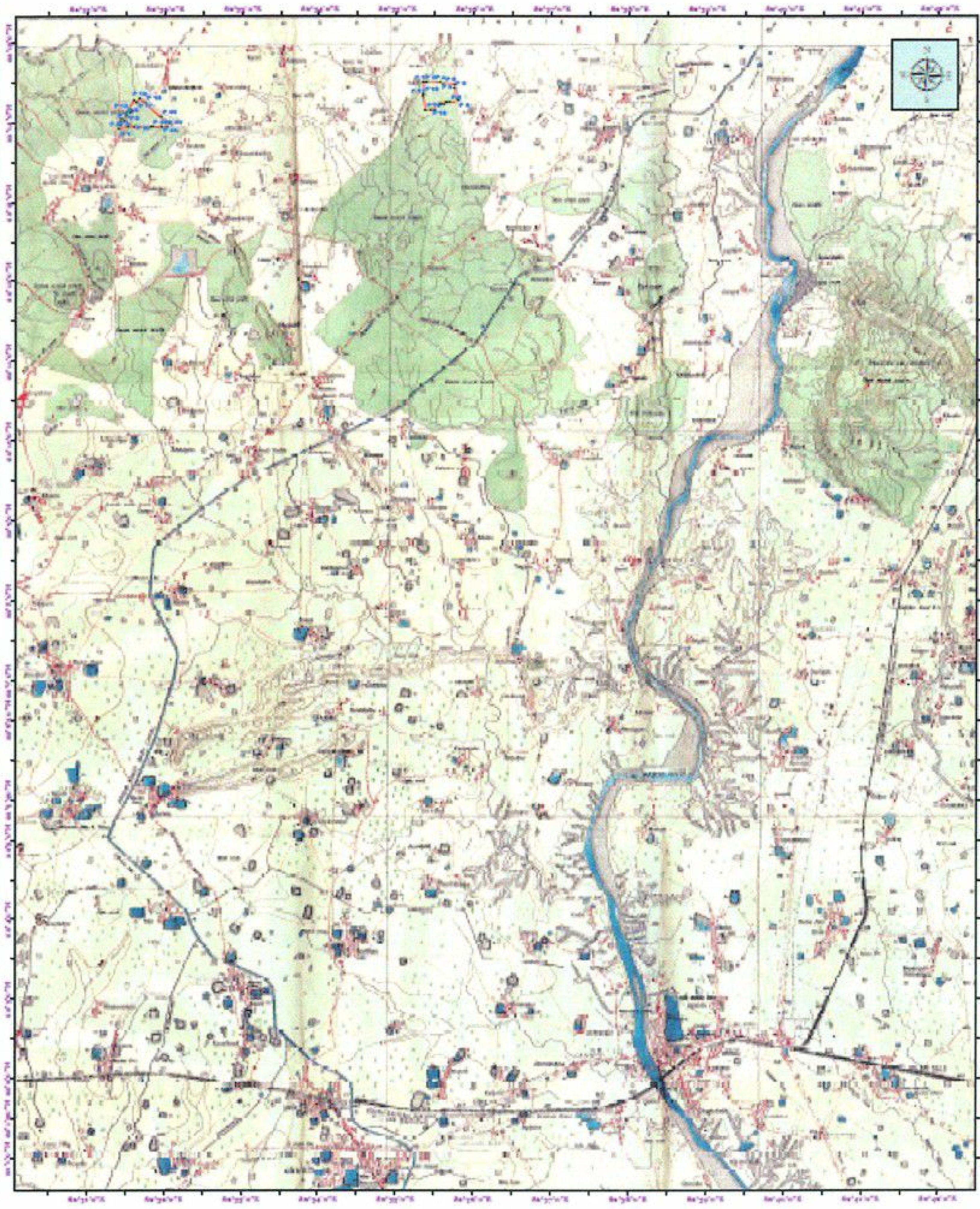
**Not to scale*



7.4 Annexure–5: DGPS Surveyed Map of Proposed CA Land (SOI Toposheet 1:50000)

**Not to scale*

Map showing of Land Proposed for Compensatory Afforestation in Range - Balauda, Divsion - Champa for 765 kv D/C JARSUGUDA - DHARMJAYGARH (KORBA) LINE - II



DGPS COORDINATES OF CA LAND

CA LAND RF 62 (40.409 Ha)

SL NO	PILLAR ID	EASTING "m"	NORTHING "m"	LATITUDE "N"	LONGITUDE "E"
1	P 1	[illegible]	[illegible]	[illegible]	[illegible]
2	P 2	[illegible]	[illegible]	[illegible]	[illegible]
3	P 3	[illegible]	[illegible]	[illegible]	[illegible]
4	P 4	[illegible]	[illegible]	[illegible]	[illegible]
5	P 5	[illegible]	[illegible]	[illegible]	[illegible]
6	P 6	[illegible]	[illegible]	[illegible]	[illegible]
7	P 7	[illegible]	[illegible]	[illegible]	[illegible]
8	P 8	[illegible]	[illegible]	[illegible]	[illegible]
9	P 9	[illegible]	[illegible]	[illegible]	[illegible]
10	P 10	[illegible]	[illegible]	[illegible]	[illegible]
11	P 11	[illegible]	[illegible]	[illegible]	[illegible]
12	P 12	[illegible]	[illegible]	[illegible]	[illegible]
13	P 13	[illegible]	[illegible]	[illegible]	[illegible]
14	P 14	[illegible]	[illegible]	[illegible]	[illegible]
15	P 15	[illegible]	[illegible]	[illegible]	[illegible]
16	P 16	[illegible]	[illegible]	[illegible]	[illegible]
17	P 17	[illegible]	[illegible]	[illegible]	[illegible]
18	P 18	[illegible]	[illegible]	[illegible]	[illegible]
19	P 19	[illegible]	[illegible]	[illegible]	[illegible]
20	P 20	[illegible]	[illegible]	[illegible]	[illegible]
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22	P 22	[illegible]	[illegible]	[illegible]	[illegible]
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24	P 24	[illegible]	[illegible]	[illegible]	[illegible]
25	P 25	[illegible]	[illegible]	[illegible]	[illegible]
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27	P 27	[illegible]	[illegible]	[illegible]	[illegible]
28	P 28	[illegible]	[illegible]	[illegible]	[illegible]

CA LAND RF 80 (36.509 Ha)

SL NO	PILLAR ID	EASTING "m"	NORTHING "m"	LATITUDE "N"	LONGITUDE "E"
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2	P 2	[illegible]	[illegible]	[illegible]	[illegible]
3	P 3	[illegible]	[illegible]	[illegible]	[illegible]
4	P 4	[illegible]	[illegible]	[illegible]	[illegible]
5	P 5	[illegible]	[illegible]	[illegible]	[illegible]
6	P 6	[illegible]	[illegible]	[illegible]	[illegible]
7	P 7	[illegible]	[illegible]	[illegible]	[illegible]
8	P 8	[illegible]	[illegible]	[illegible]	[illegible]
9	P 9	[illegible]	[illegible]	[illegible]	[illegible]
10	P 10	[illegible]	[illegible]	[illegible]	[illegible]
11	P 11	[illegible]	[illegible]	[illegible]	[illegible]
12	P 12	[illegible]	[illegible]	[illegible]	[illegible]
13	P 13	[illegible]	[illegible]	[illegible]	[illegible]
14	P 14	[illegible]	[illegible]	[illegible]	[illegible]
15	P 15	[illegible]	[illegible]	[illegible]	[illegible]
16	P 16	[illegible]	[illegible]	[illegible]	[illegible]
17	P 17	[illegible]	[illegible]	[illegible]	[illegible]
18	P 18	[illegible]	[illegible]	[illegible]	[illegible]

AREA STATEMENT OF PROPOSED CA LAND

AREA STATEMENT OF FOREST LAND - RESERVE FOREST							
Sl. No.	Division	Range	Compartment Type	PATCH NO	Compartment No	Proposed CA Land Area (in Ha)	CA Land Proposed against area diverted division
1	Champa	Balauda	Reserve Forest	PATCH 1	RF 80	36.509	Dharamjaygarh Forest Division
2				PATCH 2	RF 62	40.409	Korba Forest Division
TOTAL AREA						76.918	

0 875 1,750 3,500 5,250 7,000 Meters

Scale-1:50,000

Legend

DGPS Points of CA Land Boundary

CA Land Boundary

Submitted by :-
POWER GRID CORPORATION OF INDIA LIMITED
765/400, K.V. UPKENDRA,
SHASHKIYA MAHAVIDYALAYA NEAR BHAISAMA
URGA, BHAISAMA ROAD, DISTRICT - KORBA

Surveyed by :-
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