DGPS / Total Station Survey Report

Survey Report of 46.781 Ha. Forest land effected under Janjgir-Champa Forest Division, for Construction and Widening of 4-Lane with paved shoulders configuration of Bilaspur- Urga Section of NH-130 A in the State of Chhattisgarh. (0+000 to 70+200)

Forest Proposal No - FP/CG/ROAD/34338/2018

Forest Area Proposed for Diversion – 46.781 Ha

Janjgir-Champa Forest Division

Submitted By

PIU, Bilaspur,

National Highway Authority of India

भारतीय राष्ट्रीय राजमार्ग प्राधिकरण
National Highways Authority Of India
(Ministry Of Road Transport & Highways Government Of India)

PROJECT DIRECTOR
NHAI, PIU, Bilaspur (C.G.)

INTRODUCTION TO DGPS

WHAT IS DGPS AND WHY USE IT?

Differential Global Positioning System (**DGPS**) is an enhancement to Global Positioning System that provides improved location accuracy, from the 15-meter nominal GPS accuracy to about 10 cm in case of the best implementations.

DGPS refers to using a combination of receivers and satellites to reduce/eliminate common receiver based and satellite based errors, reduce orbit errors, reduce ionospheric and tropospheric errors, reduce effects of SA eliminate satellite and receiver clock errors. It also improves accuracy significantly 100's of metres to metres to centimetres to millimetres

1. DGPS uses one or several (network) fixed ground based reference stations (in known locations).

2. The base station compares its own known location, to that computed from a GPS receiver.

3. Any difference is then broadcast as a correction to the user. Correction signals can be broadcast either from ground stations, or via additional satellites. These services are privately owned and usually require a user subscription.

Examples:

- Satellite Based Augmentation System (SBAS),
- Wide Area Augmentation System (WAAS),
- Local Area Augmentation System (LAAS),
- European Geostationary Navigation Overlay Service (EGNOS),
- Omni STAR
- Coast guard beacon service.

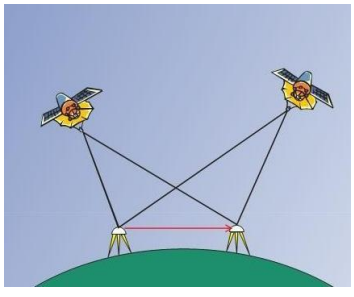
Why do we Need Differential GPS?

By using DGPS we can improve our positional accuracy from around 1.5m with standard GPS to around 40cm with DGPS, without the need for post processing.
In the case of the road survey van (top right), users can measure the amount of road wear and judge whether the road should be resurfaced just by driving over it. Just one day's driving can replace a month's manual work using traditional methods.

There are many other applications like this. The labour saving is immense but at the same time, previously impossible tasks are made possible such as the prediction of earthquakes before they occur.

DGPS Summary

- Term refers to simple C/A code differential
- Available on GPS receivers from low cost to high cost
- Produces accuracies from sub-metre to metres
- Many real-time DGPS correction providers - Coast guard, EGNOS, Omni STAR
- Used for many different applications including marine navigation, precision farming and vehicle testing applications.



What is RTK?

Real Time Kinematic is an advanced form of DGPS which uses the satellites carrier wave to compare 2 observations from different receivers within the system, to fine tune the satellite and receiver clock errors, thus improving positional accuracy.

Real Time Kinematic (RTK)

The GPS signal is made up of 3 distinct components:

- Carrier wave • GPS Code
- Navigation message

Typical GPS receivers will use the GPS navigation message to calculate its position. RTK uses the carrier wave of the GPS signal, which is 19.02cm long. By counting the number of cycles (and phase of the carrier), the travel time and distance can be measured more accurately.

RTK Summary

- Similar technique as DGPS that uses the carrier phase to provide more accurate positioning
- Cost is higher compared to DGPS receivers • Produces accuracies from 20 cm to sub-centimetres
- RTK corrections provided via a local base station or by a private correction provider - Omni STAR, Leica, Trimble
- Produces accuracies from 20 cm to sub-centimetres
- RTK corrections provided via a local base station or by a private correction provider - Omni STAR, Leica, Trimble

Used for many different applications including machine control (construction, container ports, farming), vehicle testing applications, surveying (land, marine, hydrographic, aerial)

RINEX FILE

The first proposal for the ***Receiver Independent Exchange Format RINEX*** was developed by the Astronomical Institute of the University of Berne for the easy exchange of the Global. Positioning System (GPS) data to be collected during the first large European GPS campaign EUREF 89, which involved more than 60 GPS receivers of 4 different manufacturers. The governing aspect during the development was the following fact: Most geodetic processing software for GPS data use a well-defined set of observables:

- The carrier-phase measurement at one or both carriers (actually being a measurement on the beat frequency between the received carrier of the satellite signal and a receiver generated reference frequency).
- The pseudo range (code) measurement, equivalent to the difference of the time of reception (expressed in the time frame of the receiver) and the time of transmission (expressed in the time frame of the satellite) of a distinct satellite signal.
-

- The observation time being the reading of the receiver clock at the instant of validity of the carrier-phase and/or the code measurements. Usually the software assumes that the observation time is valid for both the phase and the code measurements, and for all satellites observed. Consequently, all these programs do not need most of the information that is usually stored by the receivers: They need phase, code, and time in the above-mentioned definitions, and some station related information like station name, antenna height, etc. Up till now two major format versions have been developed and published:
- The original RINEX Version 1 presented at and accepted by the 5th International Geodetic Symposium on Satellite Positioning in Las Cruces, 1989. [Gurtner et al. 1989], [Evans 1989]
- RINEX Version 2 presented at and accepted by the Second International Symposium of Precise Positioning with the Global Positioning system in Ottawa, 1990, mainly adding the possibility to include tracking data from different satellite systems (GLONASS, SBAS). [Gurtner and Mader 1990a, 1990b], [Gurtner 1994]. Several subversions of RINEX Version 2 have been defined:
- Version 2.10: Among other minor changes allowing for sampling rates other than integer seconds and including raw signal strengths as new observables. [Gurtner 2002] • Version 2.11: Includes the definition of a two-character observation code for L2C pseudoranges and some modifications in the GEO NAV MESS files [Gurtner and Estey 2005]
- Version 2.20: Unofficial version used for the exchange of tracking data from spaceborne receivers within the IGS LEO pilot project [Gurtner and Estey 2002]. As spin-offs of this idea of a receiver-independent GPS
- Version 2.11: Includes the definition of a two-character observation code for L2C pseudo ranges and some modifications in the GEO NAV MESS files [Gurtner and Estey 2005]
- Version 2.20: Unofficial version used for the exchange of tracking data from spaceborne receivers within the IGS LEO pilot project [Gurtner and Estey 2002]. As spin-offs of this idea of a receiver-independent GPS exchange format other RINEX-like exchange file formats have been defined, mainly used by the International GNSS Service IGS:
- Exchange format for **satellite and receiver clock offsets** determined by processing data of a GNSS tracking network [Ray and Gurtner 1999]
- Exchange format for the complete **broadcast data of spacebased augmentation systems** SBAS. [Suard et al. 2004]
- IONEX: Exchange format for **ionosphere models** determined by processing data of a GNSS tracking network [Schaer et al. 1998] • ANTEX: Exchange format for **phase centre variations** of geodetic GNSS antennae [Rothacher and Schmid 2005]. The upcoming European Navigation Satellite System Galileo and the enhanced GPS with new frequencies and observation types, especially the possibility to track frequencies on different channels, ask for a more flexible and more detailed definition of the observation codes. To improve the handling of the data files in case of “mixed” files, i.e. files containing tracking data of more than one satellite system, each one with different observation types, the record structure of the data record has been modified significantly and, following several requests, the limitation to 80 characters length

has been removed. As the changes are quite significant, they lead to a new RINEX Version 3. The new version also includes the unofficial Version 2.20 definitions for space-borne receivers. The major change asking for a version 3.01 was the requirement to generate consistent phase observations across different tracking modes or channels, i.e. to apply ¼-cycle shifts prior to RINEX file generation, if necessary, to facilitate the processing of such data.

- IONEX: Exchange format for **ionosphere models** determined by processing data of a GNSS tracking network [Schaer et al. 1998] •

ANTEX: Exchange format for **phase centre variations** of geodetic GNSS antennae [Rothacher and Schmid 2005].

The upcoming European Navigation Satellite System Galileo and the enhanced GPS with new frequencies and observation types, especially the possibility to track frequencies on different channels, ask for a more flexible and more detailed definition of the observation codes. To improve the handling of the data files in case of "mixed" files, i.e. files containing tracking data of more than one satellite system, each one with different observation types, the record structure of the data record has been modified significantly and, following several requests, the limitation to 80 characters length has been removed. As the changes are quite significant, they lead to a new RINEX Version 3. The new version also includes the unofficial Version 2.20 definitions for space-borne receivers. The major change asking for a version 3.01 was the requirement to generate consistent phase observations across different tracking modes or channels, i.e. to apply ¼-cycle shifts prior to RINEX file generation, if necessary, to facilitate the processing of such data.

The RINEX version 3.00 format consists of three ASCII file types:

1. Observation data File
2. Navigation message File
3. Meteorological data File

Each file type consists of a header section and a data section. The header section contains global information for the entire file and is placed at the beginning of the file. The header section contains header labels in columns 61-80 for each line contained in the header section. These labels are mandatory and must appear exactly as given in these descriptions and examples. The format has been optimized for minimum space requirements independent from the number of different observation types of a specific receiver or satellite system by indicating in the header the types of observations to be stored for this receiver and the satellite systems having been observed. In computer systems allowing variable record lengths the observation records may be kept as short as possible. Trailing blanks can be removed from the records. There is no maximum record length limitation for the observation records.

Each Observation file and each Meteorological Data file basically contain the data from one site and one session. Starting with Version 2 RINEX also allows including observation data from more than one site subsequently occupied by a roving receiver in rapid static or kinematic applications. Although Version 2 and higher allow to insert header records into the data section it is not recommended to concatenate data of more than one receiver (or antenna) into the same

file, even if the data do not overlap in time. If data from more than one receiver have to be exchanged, it would not be economical to include the identical satellite navigation messages collected by the different receivers several times. Therefore the navigation message file from one receiver may be exchanged or a composite navigation message file created containing non-redundant information from several receivers in order to make the most complete file. The format of the data records of the RINEX Version 1 navigation message file was identical to the former NGS exchange format. RINEX version 3 navigation message files may contain navigation messages of more than one satellite system (GPS, GLONASS, Galileo, Quasi Zenith Satellite System (QZSS), BeiDou System (BDS) and SBAS).

The actual format descriptions as well as examples are given in the Appendix Tables at the end of the document.

BASIC DEFINITIONS

Time:

The time of the measurement is the receiver time of the received signals. It is identical for the phase and range measurements and is identical for all satellites observed at that epoch. For single-system data files it is by default expressed in the time system of the respective satellite system. Otherwise the actual time can (for mixed files must) be indicated in the Start Time header record.

Pseudo-Range:

The pseudo-range (PR) is the distance from the receiver antenna to the satellite antenna including receiver and satellite clock offsets–satellite clock offset + other biases) so that the pseudo-range reflects the actual behaviour of the receiver and satellite clocks. The pseudo-range is stored in units of meters.

Phase:

The phase is the carrier-phase measured in whole cycles. The half cycles measured by squaring type receivers must be converted to whole cycles and flagged by the respective observation code.

The phase changes in the same sense as the range (negative doppler). The phase observations between epochs must be connected by including the integer number of cycles. The observables are not corrected for external effects like atmospheric refraction, satellite clock offsets, etc. If necessary phase observations are corrected for phase shifts needed to guarantee consistency between phases of the same frequency and satellite system based on different signal channels.

If the receiver or the converter software adjusts the measurements using the real-time-derived receiver clock offsets dT(r), the consistency of the 3

1 Time (corr) = Time(r) - dT(r)

2 PR (corr) = PR (r) - dT(r)*c 3 phase (corr) = phase (r) - dT(r)*freq

Doppler:

The sign of the doppler shift as additional observable is defined as usual: Positive for approaching satellites.

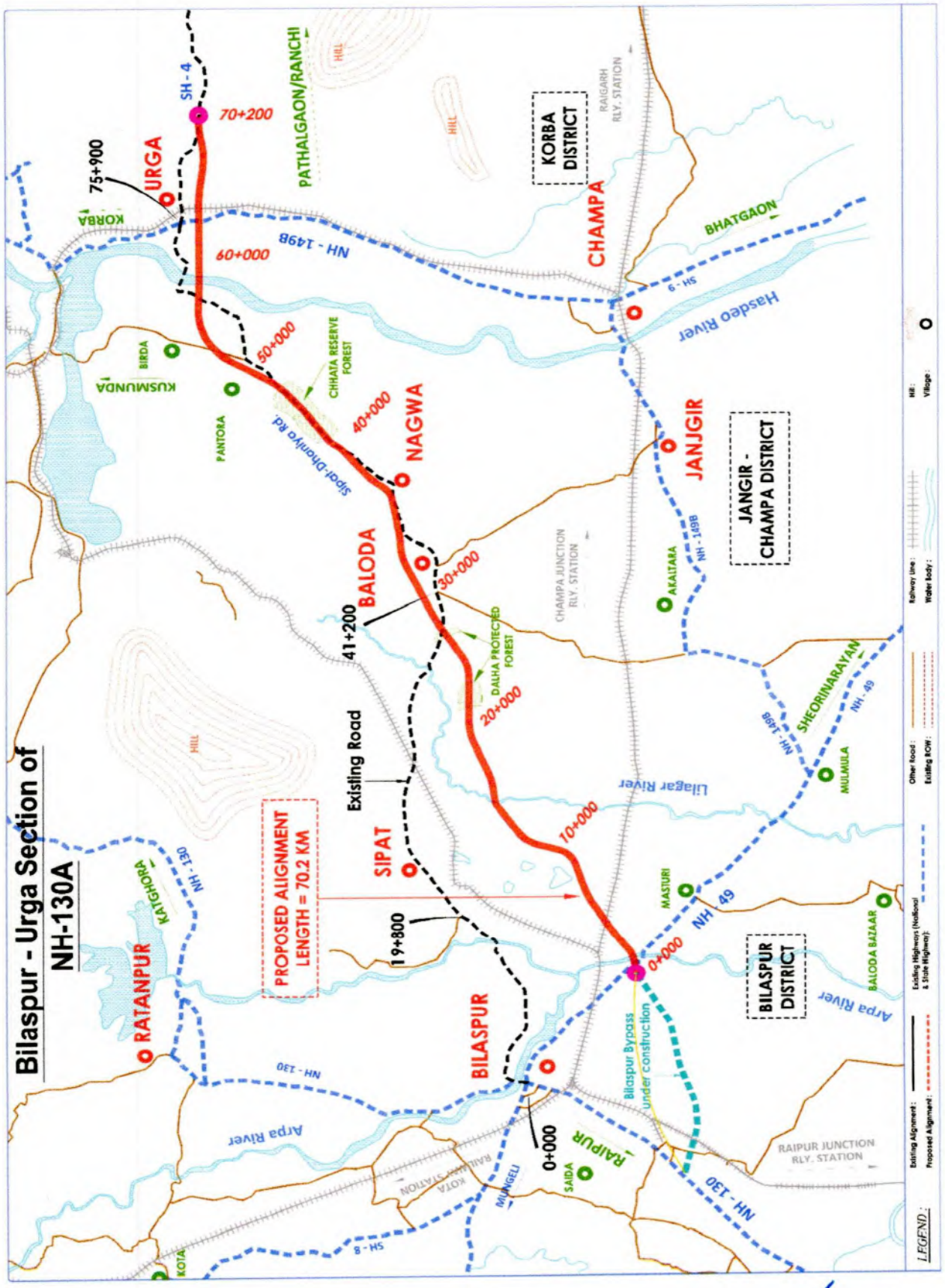
Satellite numbers:

Starting with RINEX Version 2 the former two-digit satellite numbers **nn**are preceded by a one-character system identifier **s**. The same satellite system identifiers are also used in all header records when appropriate.

THE EXCHANGE OF RINEX FILES:

The original RINEX file naming convention was implemented in the MSDOS era when file names were restricted to 8.3 characters. Modern operating systems typically support 255 character file names. The goal of the new file naming convention is to be more: descriptive, flexible and extensible than the RINEX 2.11 file naming convention. All elements are fixed length and are separated by an underscore "_" except for the: file type and compression fields that uses a period "." separator. Fields must be padded with zeros to fill the field width. The file compression field is optional. In order to further reduce the size of observation files Yuki Hatanaka developed a compression scheme that takes advantage of the structure of the RINEX observation data by forming higher order differences in time between observations of the same type and satellite. This compressed file is also an ASCII file that is subsequently compressed again using the above mentioned standard compression programs.

Location Plan



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PROJECT DIRECTOR
NHAI, PIU, Bilaspur (C.G.)

Proposal for Diversion of 46.781 Ha. Forest land under Janjgir-Champa Division, for Construction and Widening of 4- Lane with paved shoulders configuration of Bilaspur- Urga Section of NH-130 A in the State of Chhattisgarh. (0+000 to 70+200)

S.no.	Tehsil	Village/Forest Name	Area
1.	Akaltara	Amlipali	2.296
2.	Akaltara	Son	3.822
3.	Akaltara	Piparda	6.355
4.	Akaltara	Chandaniya	0.164
5.	Baloda	Bachhoud	2.34
6.	Baloda	Baloda	1.048
7.	Baloda	Chhatta	28.421
8.	Baloda	Agarkhar	0.828
9.	Baloda	Baloda Reserve Forest	1.507
Total			**46.781**

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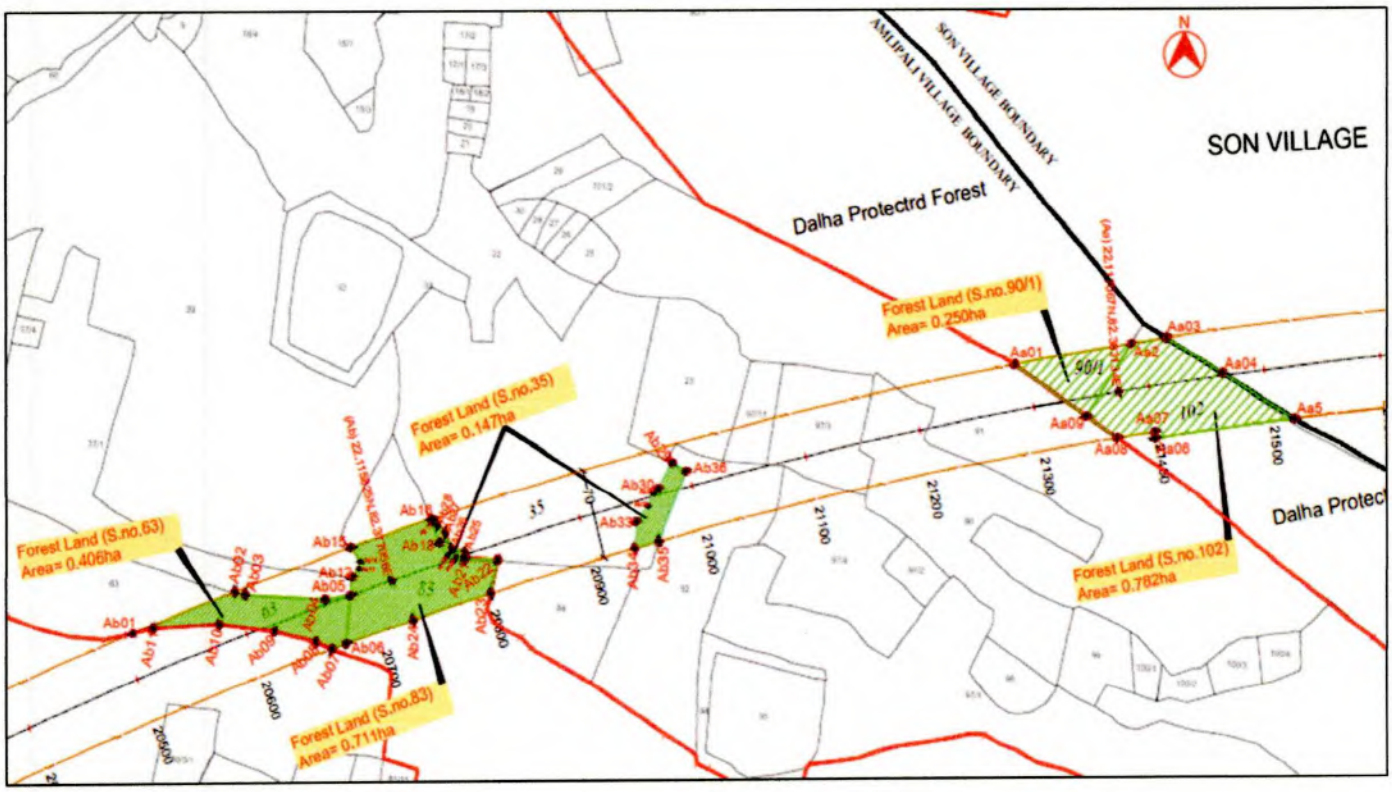
GPS Survey points for Diversion

Janjgir-Champa Forest division, District Janjgir-Champa

1. Village – Amlipali, Tehsil – Akaltara, Area – 2.296 Ha.



GPS Coordinates: Degree, Minute & Second (Area-2.296 Ha.)

Point No.	Latitude (N)			Longitude (E)			Total Area (Ha.)
	Degree	Minute	Second	Degree	Minute	Second	
Ab01	22	6	55.74	82	22	29.62	
Ab02	22	6	56.75	82	22	32.70	
Ab03	22	6	56.68	82	22	33.00	
Ab04	22	6	56.53	82	22	35.40	
Ab05	22	6	56.61	82	22	36.16	
Ab06	22	6	55.38	82	22	36.02	
Ab07	22	6	55.25	82	22	35.59	
Ab08	22	6	55.44	82	22	35.11	2.296
Ab09	22	6	55.72	82	22	33.88	
Ab10	22	6	55.94	82	22	32.21	
Ab11	22	6	55.86	82	22	30.23	
Ab12	22	6	57.08	82	22	36.22	
Ab13	22	6	57.29	82	22	36.42	

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Point No.	Latitude (N)			Longitude (E)			Total Area (Ha.)
	Degree	Minute	Second	Degree	Minute	Second	
Ab14	22	6	57.47	82	22	36.47	
Ab15	22	6	57.81	82	22	36.18	
Ab16	22	6	58.49	82	22	38.60	
Ab17	22	6	58.40	82	22	38.64	
Ab18	22	6	57.91	82	22	38.85	
Ab19	22	6	57.57	82	22	39.07	
Ab20	22	6	57.51	82	22	39.34	
Ab21	22	6	57.49	82	22	39.60	
Ab22	22	6	57.45	82	22	40.59	
Ab23	22	6	56.60	82	22	40.37	
Ab24	22	6	55.96	82	22	38.04	
Ab06	22	6	55.38	82	22	36.02	
Ab05	22	6	56.61	82	22	36.16	
Ab17	22	6	58.40	82	22	38.64	
Ab18	22	6	57.91	82	22	38.85	
Ab19	22	6	57.57	82	22	39.07	
Ab20	22	6	57.51	82	22	39.34	
Ab21	22	6	57.49	82	22	39.60	
Ab25	22	6	57.66	82	22	39.60	
Ab26	22	6	57.74	82	22	39.20	
Ab27	22	6	58.13	82	22	39.02	
Ab28	22	6	58.34	82	22	38.78	
Ab29	22	6	59.84	82	22	45.84	
Ab30	22	6	59.18	82	22	45.43	
Ab31	22	6	59.05	82	22	45.27	
Ab32	22	6	58.73	82	22	45.11	
Ab33	22	6	58.33	82	22	44.75	
Ab34	22	6	57.67	82	22	44.70	
Ab35	22	6	57.84	82	22	45.44	
Ab36	22	6	59.60	82	22	46.27	
Aa1	22	7	2.16	82	22	56.15	
Aa2	22	7	2.64	82	22	59.66	
Aa3	22	7	2.76	82	23	0.72	
Aa4	22	7	1.87	82	23	2.38	
Aa5	22	7	0.71	82	23	4.54	
Aa6	22	7	0.26	82	23	0.36	
Aa7	22	7	0.43	82	23	0.34	
Aa8	22	7	0.28	82	22	59.21	
Aa9	22	7	0.85	82	22	58.28	

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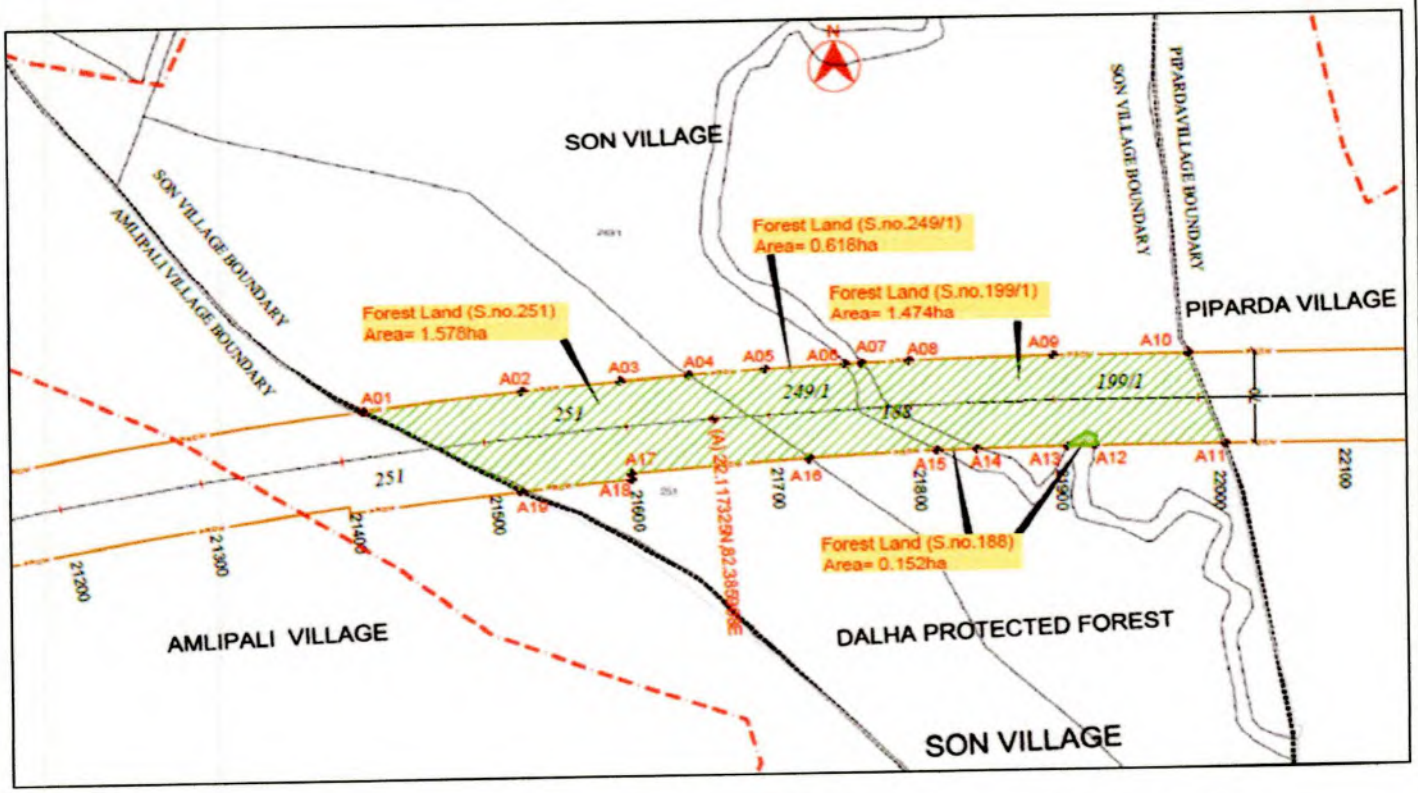
2. Village – Son, Tehsil – Akaltara, Area – 3.822 Ha.



GPS Coordinates: Degree, Minute & Second (Area-3.822 Ha.)

Point No.	Latitude (N)			Longitude (E)			Total Area (Ha.)
	Degree	Minute	Second	Degree	Minute	Second	
A01	22	7	2.76	82	23	0.72	
A02	22	7	3.16	82	23	4.60	
A03	22	7	3.36	82	23	7.00	
A04	22	7	3.47	82	23	8.66	
A05	22	7	3.58	82	23	10.54	
A06	22	7	3.66	82	23	12.50	
A07	22	7	3.68	82	23	12.90	
A08	22	7	3.71	82	23	14.06	
A09	22	7	3.77	82	23	17.58	
A10	22	7	3.75	82	23	20.87	3.822
A11	22	7	1.47	82	23	21.74	
A12	22	7	1.49	82	23	18.55	
A13	22	7	1.49	82	23	17.89	
A14	22	7	1.47	82	23	15.68	
A15	22	7	1.45	82	23	14.71	
A16	22	7	1.35	82	23	11.57	
A17	22	7	1.09	82	23	7.22	
A18	22	7	0.93	82	23	7.23	
A19	22	7	0.71	82	23	4.54	

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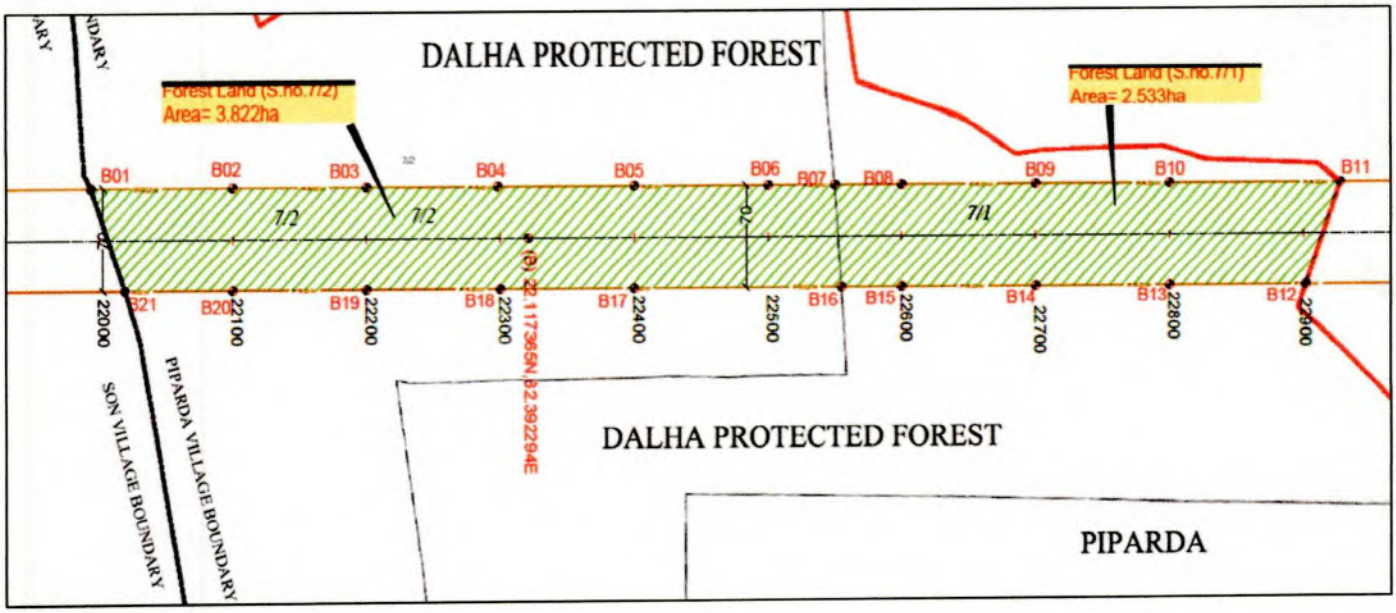
3. Village – Piparda, Tehsil – Akaltara, Area – 6.355 Ha.



GPS Coordinates: Degree, Minute & Second (Area-6.355 Ha.)

Point No.	Latitude (N)			Longitude (E)			Total Area (Ha.)
	Degree	Minute	Second	Degree	Minute	Second	
B01	22	7	3.75	82	23	20.87	
B02	22	7	3.72	82	23	24.57	
B03	22	7	3.69	82	23	28.06	
B04	22	7	3.66	82	23	31.48	
B05	22	7	3.63	82	23	35.04	
B06	22	7	3.60	82	23	38.53	
B07	22	7	3.58	82	23	40.28	
B08	22	7	3.57	82	23	42.02	
B09	22	7	3.54	82	23	45.51	
B10	22	7	3.50	82	23	49.00	6.355
B11	22	7	3.47	82	23	53.45	
B12	22	7	1.20	82	23	52.53	
B13	22	7	1.23	82	23	48.97	
B14	22	7	1.26	82	23	45.49	
B15	22	7	1.29	82	23	42.00	
B16	22	7	1.30	82	23	40.43	
B17	22	7	1.35	82	23	35.02	
B18	22	7	1.38	82	23	31.53	
B19	22	7	1.41	82	23	28.04	
B20	22	7	1.44	82	23	24.55	
B21	22	7	1.47	82	23	21.74	

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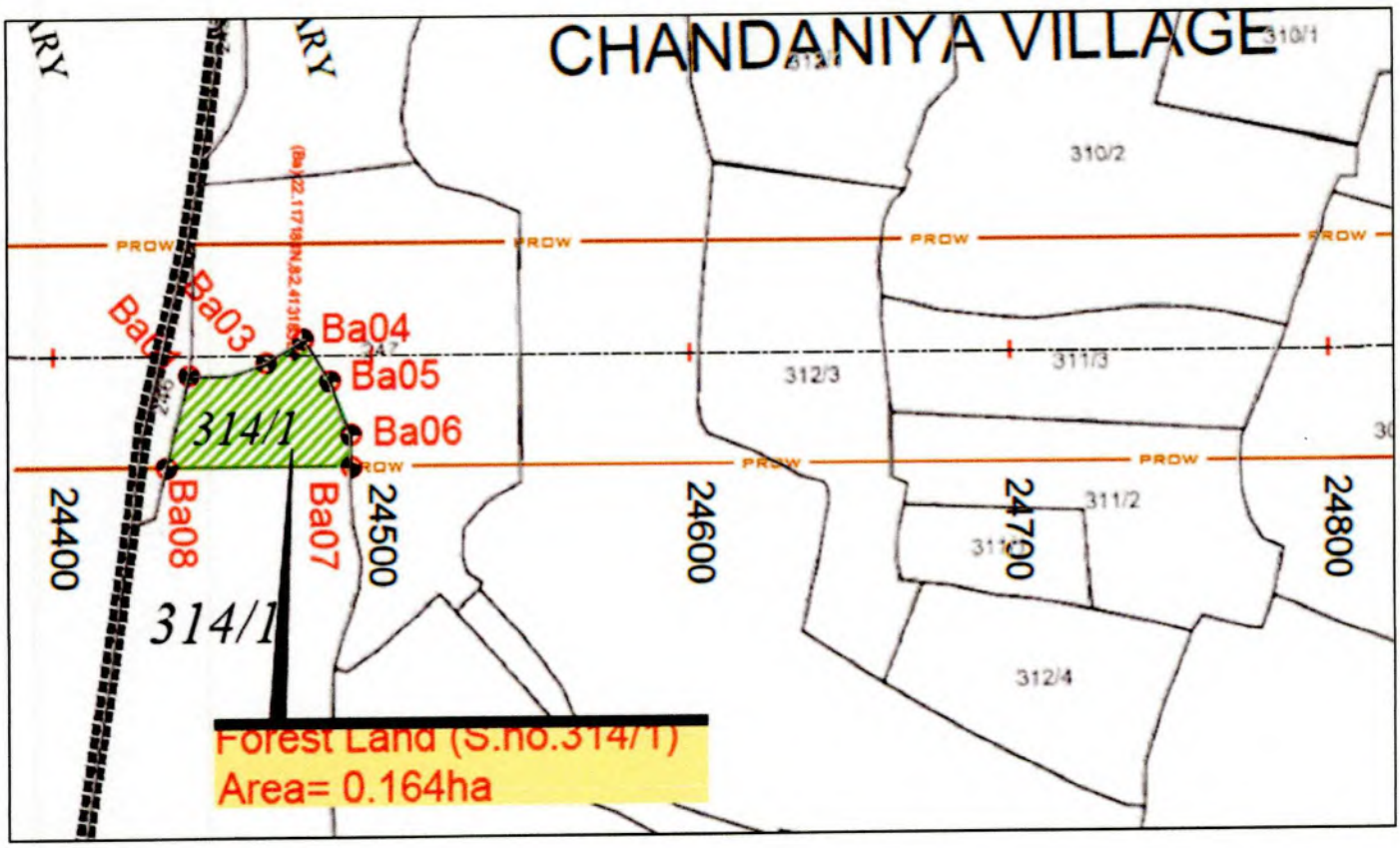
PROJECT DIRECTOR
MPAT, PIU, Bilaspur (C.G.)

4. Village – Chandaniya, Tehsil – Akaltara, Area – 0.164 Ha.



GPS Coordinates: Degree, Minute & Second (Area-0.164 Ha.)

Point No.	Latitude (N)			Longitude (E)			Total Area (Ha.)
	Degree	Minute	(Ha.)	Degree	Minute	Second	
Ba01	22	7	1.66	82	24	46.30	0.164
Ba02	22	7	1.65	82	24	46.78	
Ba03	22	7	1.78	82	24	47.15	
Ba04	22	7	2.01	82	24	47.56	
Ba05	22	7	1.58	82	24	47.84	
Ba06	22	7	1.03	82	24	48.06	
Ba07	22	7	0.71	82	24	48.06	
Ba08	22	7	0.73	82	24	46.04	

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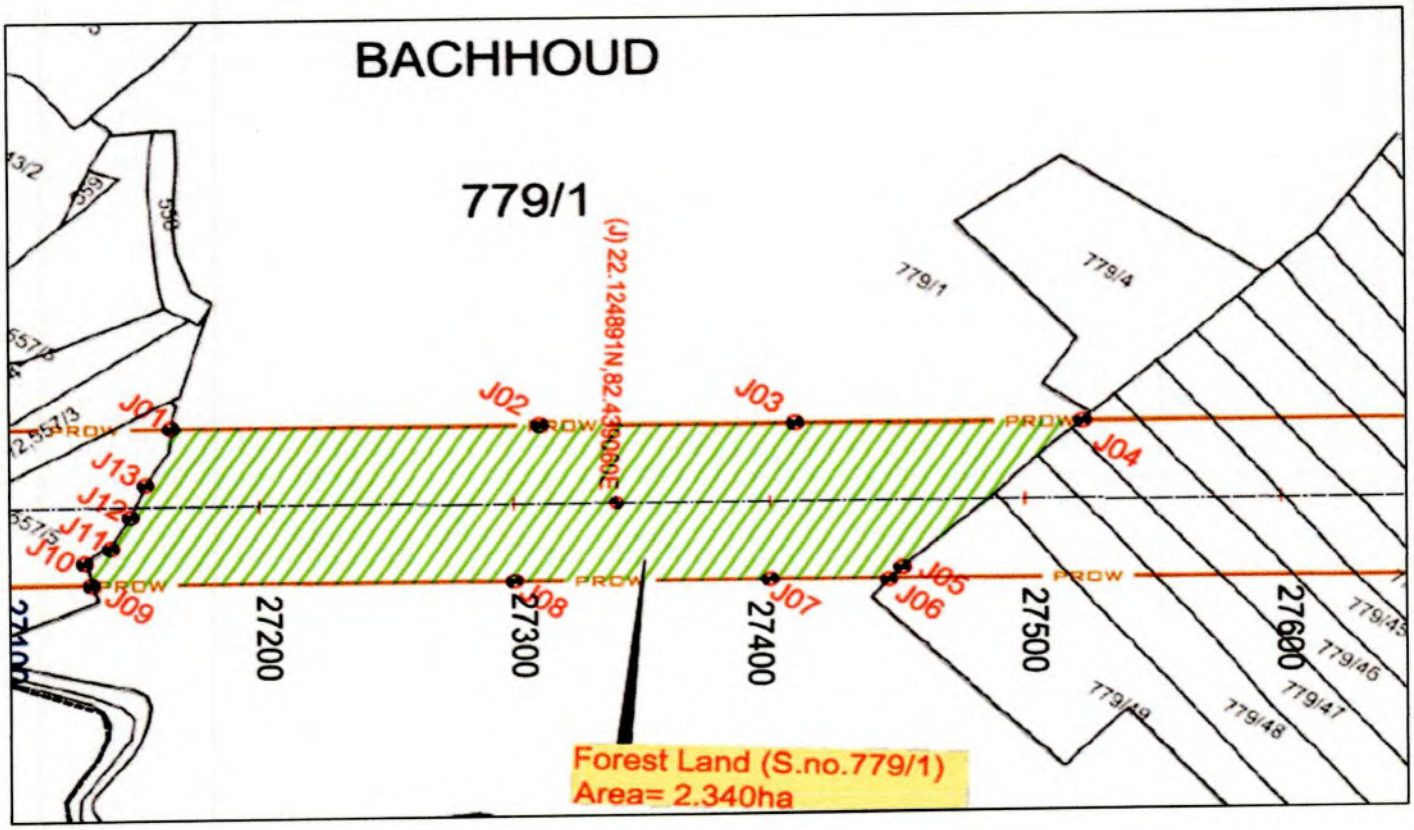
5. Village –Bachhoud, Tehsil – Baloda, Area – 2.34 Ha.



GPS Coordinates: Degree, Minute & Second (Area-2.34 Ha.)

Point No.	Latitude (N)			Longitude (E)			Area in (Ha)
	Degree	Minute	Second	Degree	Minute	Second	
J01	22	7	27.61	82	26	14.80	2.34
J02	22	7	30.07	82	26	19.09	
J03	22	7	31.77	82	26	22.06	
J04	22	7	33.68	82	26	25.40	
J05	22	7	30.68	82	26	24.49	
J06	22	7	30.43	82	26	24.44	
J07	22	7	29.66	82	26	23.04	
J08	22	7	27.96	82	26	20.07	
J09	22	7	25.14	82	26	15.14	
J10	22	7	25.37	82	26	14.88	
J11	22	7	25.72	82	26	15.07	
J12	22	7	26.24	82	26	15.05	
J13	22	7	26.73	82	26	14.96	

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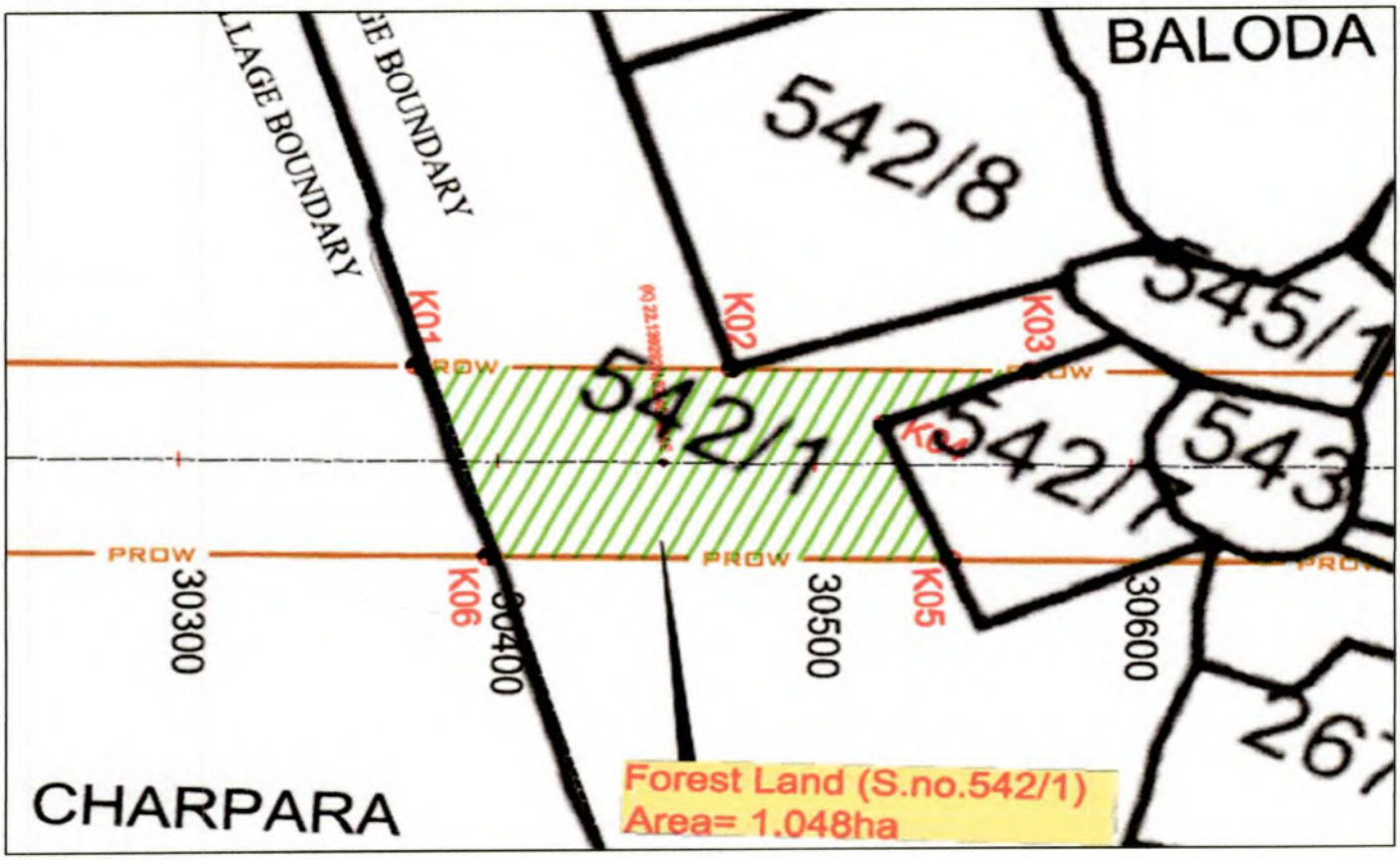
6. Village –Baloda, Tehsil – Baloda, Area – 1.048 Ha.



GPS Coordinates: Degree, Minute & Second (Area-1.048 Ha.)

Point No.	Latitude (N)			Longitude (E)			Total Area (Ha)
	Degree	Minute	Second	Degree	Minute	Second	
K01	22	8	21.40	82	27	50.74	1.048
K02	22	8	22.77	82	27	53.87	
K03	22	8	24.08	82	27	56.84	
K04	22	8	22.85	82	27	55.69	
K05	22	8	21.69	82	27	57.13	
K06	22	8	19.67	82	27	52.53	

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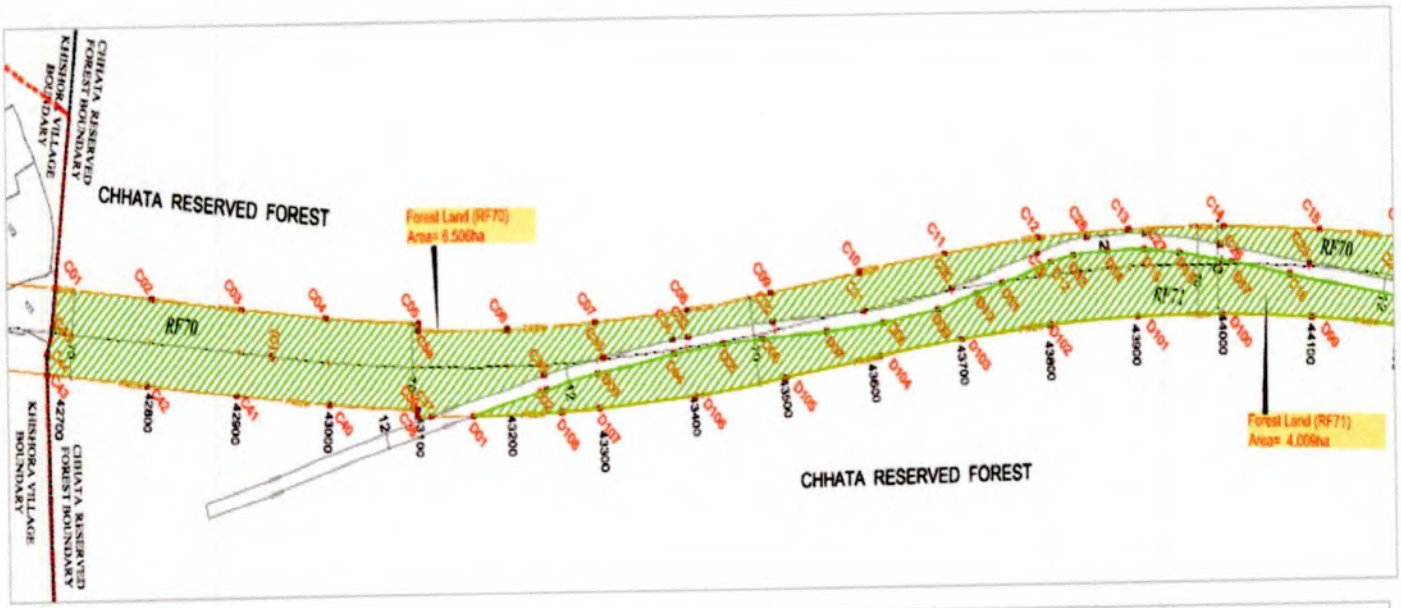
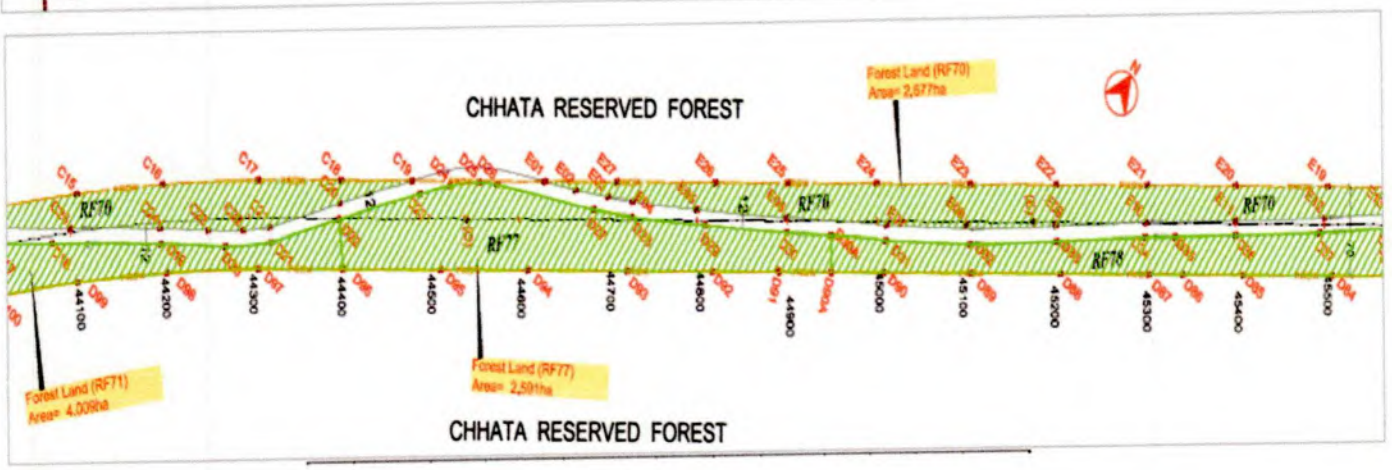
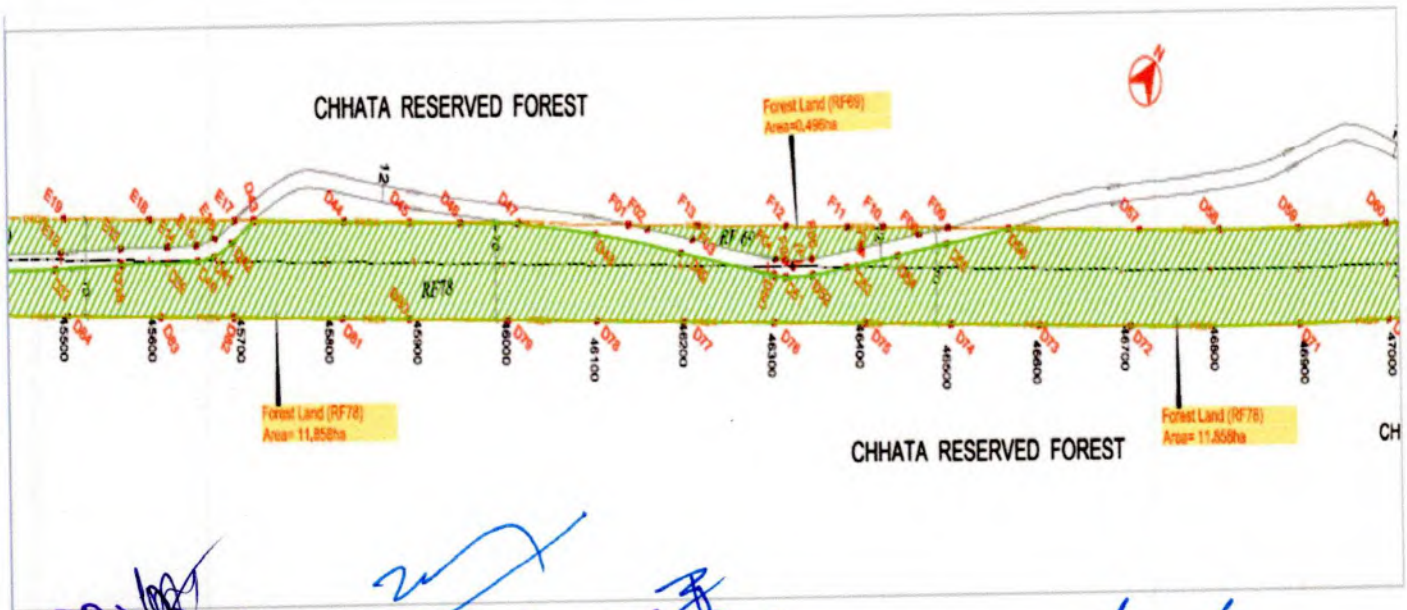
7. Village –Chhatta, Tehsil – Baloda, Area – 28.421 Ha.







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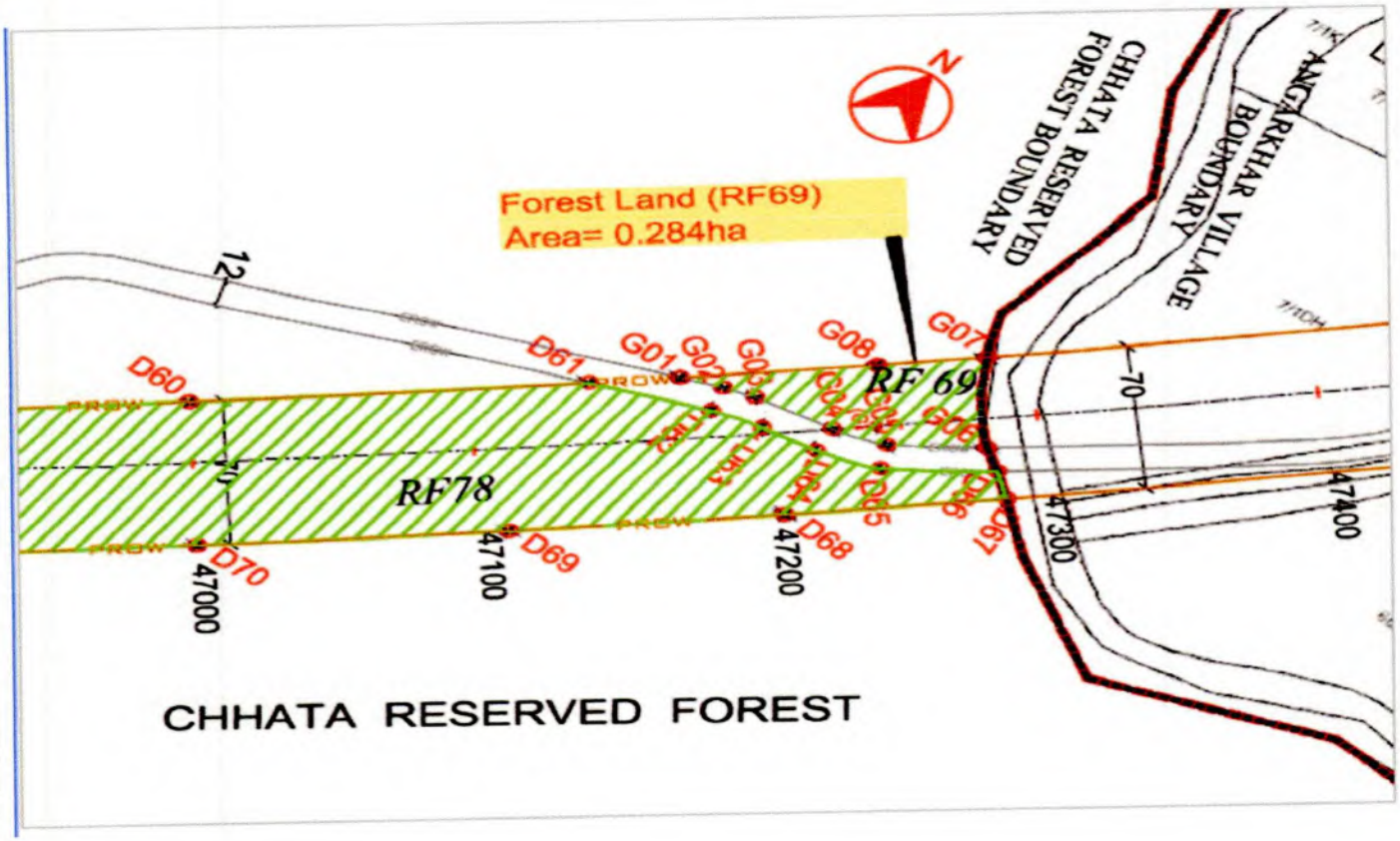

GPS Coordinates: Degree, Minute & Second (Area-28.421 Ha.)

Chhatta Reserved Forest RF70 (Area – 6.506 ha.)

Point No.	Latitude (N)			Longitude (E)			Total Area (Ha.)
	Degree	Minute	Second	Degree	Minute	Second	
C01	22	11	6.19	82	34	7.88	
C02	22	11	8.46	82	34	10.74	
C03	22	11	10.58	82	34	13.39	
C04	22	11	12.58	82	34	15.88	
C05	22	11	14.87	82	34	18.52	
C05a	22	11	14.75	82	34	18.65	
C06	22	11	17.05	82	34	21.05	
C07	22	11	19.44	82	34	23.35	
C08	22	11	22.05	82	34	25.63	
C09	22	11	24.50	82	34	27.57	
C10	22	11	27.18	82	34	29.62	6.506
C11	22	11	29.71	82	34	31.57	
C12	22	11	32.40	82	34	33.84	
C13	22	11	34.88	82	34	36.14	
C14	22	11	37.39	82	34	38.69	
C15	22	11	39.80	82	34	41.39	
C16	22	11	41.86	82	34	43.92	

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Point No.	Latitude (N)			Longitude (E)			Total Area (Ha.)
	Degree	Minute	Second	Degree	Minute	Second	
C17	22	11	44.02	82	34	46.83	
C18	22	11	45.82	82	34	49.43	
C19	22	11	47.35	82	34	51.65	
C20	22	11	45.30	82	34	49.75	
C21	22	11	43.29	82	34	47.97	
C22	22	11	42.65	82	34	47.20	
C23	22	11	41.90	82	34	46.11	
C24	22	11	40.89	82	34	44.58	
C25	22	11	38.94	82	34	41.77	
C26	22	11	36.97	82	34	38.95	
C27	22	11	35.22	82	34	36.68	
C28	22	11	33.66	82	34	35.15	
C29	22	11	32.11	82	34	34.09	
C30	22	11	29.26	82	34	32.44	
C31	22	11	26.56	82	34	30.48	
C32	22	11	24.02	82	34	28.20	
C33	22	11	21.58	82	34	26.16	
C34	22	11	21.12	82	34	25.79	
C35	22	11	19.01	82	34	24.26	
C36	22	11	17.13	82	34	22.99	
C37	22	11	13.48	82	34	20.75	
C38	22	11	13.12	82	34	20.35	
C39	22	11	13.24	82	34	20.23	
C40	22	11	11.06	82	34	17.73	
C41	22	11	8.85	82	34	14.98	
C42	22	11	6.73	82	34	12.33	
C43	22	11	4.37	82	34	9.36	
C44	22	11	4.70	82	34	8.99	
C45	22	11	5.37	82	34	8.60	

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Chhatta Reserved Forest RF71 (Area – 4.009 ha.)

Point No.	Latitude (N)			Longitude (E)			Total Area (Ha.)
	Degree	Minute	Second	Degree	Minute	Second	
D01	22	11	14.56	82	34	21.89	
D02	22	11	16.94	82	34	23.35	
D03	22	11	18.56	82	34	24.45	
D04	22	11	20.90	82	34	26.13	
D05	22	11	22.36	82	34	27.29	
D06	22	11	23.46	82	34	28.24	
D07	22	11	25.25	82	34	29.87	
D08	22	11	26.86	82	34	31.27	
D09	22	11	28.52	82	34	32.49	
D10	22	11	29.82	82	34	33.25	
D11	22	11	30.67	82	34	33.74	
D12	22	11	32.29	82	34	34.66	
D13	22	11	32.99	82	34	35.13	
D14	22	11	33.96	82	34	35.98	
D15	22	11	34.94	82	34	36.96	
D16	22	11	35.78	82	34	37.99	4.009
D17	22	11	36.95	82	34	39.61	
D18	22	11	38.23	82	34	41.44	
D19	22	11	40.60	82	34	44.86	
D20	22	11	41.94	82	34	46.91	
D21	22	11	43.02	82	34	48.27	
D22	22	11	44.96	82	34	50.00	
D96	22	11	44.03	82	34	50.94	
D97	22	11	42.21	82	34	48.30	
D98	22	11	40.13	82	34	45.51	
D99	22	11	38.00	82	34	42.90	
D100	22	11	35.74	82	34	40.38	
D101	22	11	33.53	82	34	38.12	
D102	22	11	31.12	82	34	35.87	
D103	22	11	28.59	82	34	33.72	
D104	22	11	26.15	82	34	31.82	
D105	22	11	23.34	82	34	29.68	
D106	22	11	20.68	82	34	27.58	
D107	22	11	17.96	82	34	25.21	
D108	22	11	16.93	82	34	24.24	

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Chhatta Reserved Forest RF77 (Area – 2.591 ha.)

Point No.	Latitude (N)			Longitude (E)			Total Area (Ha.)
	Degree	Minute	Second	Degree	Minute	Second	
D22	22	11	44.96	82	34	50.00	2.591
D23	22	11	47.24	82	34	52.11	
D24	22	11	48.08	82	34	52.91	
D25	22	11	48.77	82	34	53.76	
D26	22	11	49.12	82	34	54.38	
D27	22	11	50.70	82	34	57.79	
D28	22	11	51.36	82	34	59.08	
D29	22	11	52.78	82	35	01.53	
D30	22	11	54.41	82	35	04.20	
D30A	22	11	55.32	82	35	05.65	
D90A	22	11	54.57	82	35	06.24	
D91	22	11	53.43	82	35	04.59	
D92	22	11	52.01	82	35	02.52	
D93	22	11	50.16	82	34	59.84	
D94	22	11	48.02	82	34	56.73	
D95	22	11	46.14	82	34	54.01	

Chhatta Reserved Forest RF78 (Area – 11.858 ha.)

Point No.	Latitude (N)			Longitude (E)			Total Area (Ha.)
	Degree	Minute	Second	Degree	Minute	Second	
D30A	22	11	55.32	82	35	5.65	11.858
D30	22	11	54.41	82	35	4.20	
D31	22	11	56.40	82	35	7.42	
D32	22	11	58.16	82	35	10.11	
D33	22	12	0.08	82	35	12.75	
D34	22	12	2.10	82	35	15.47	
D35	22	12	2.76	82	35	16.39	
D36	22	12	4.09	82	35	18.25	
D37	22	12	5.96	82	35	20.82	
D38	22	12	7.50	82	35	22.83	
D39	22	12	8.55	82	35	24.28	
D40	22	12	9.24	82	35	25.19	
D41	22	12	9.70	82	35	25.64	
D42	22	12	10.35	82	35	25.99	
D43	22	12	11.26	82	35	26.34	
D44	22	12	13.24	82	35	29.21	
D45	22	12	14.67	82	35	31.30	
D46	22	12	15.78	82	35	32.90	
D47	22	12	17.04	82	35	34.74	

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Point No.	Latitude (N)			Longitude (E)			Total Area (Ha.)
	Degree	Minute	Second	Degree	Minute	Second	
D48	22	12	18.54	82	35	37.33	
D49	22	12	20.06	82	35	40.33	
D50	22	12	21.70	82	35	43.63	
D51	22	12	21.92	82	35	44.02	
D52	22	12	22.54	82	35	44.83	
D53	22	12	23.45	82	35	45.82	
D54	22	12	24.79	82	35	47.24	
D55	22	12	26.09	82	35	48.59	
D56	22	12	27.77	82	35	50.31	
D57	22	12	30.64	82	35	54.47	
D58	22	12	32.39	82	35	56.97	
D59	22	12	34.18	82	35	59.44	
D60	22	12	36.20	82	36	2.15	
D61	22	12	39.15	82	36	5.95	
D62	22	12	39.63	82	36	7.46	
D63	22	12	39.76	82	36	8.15	
D64	22	12	39.83	82	36	8.92	
D65	22	12	40.03	82	36	9.76	
D66	22	12	40.79	82	36	10.96	
D67	22	12	40.51	82	36	11.33	
D68	22	12	38.81	82	36	9.26	
D69	22	12	36.73	82	36	6.67	
D70	22	12	34.43	82	36	3.70	
D71	22	12	32.39	82	36	0.95	
D72	22	12	28.62	82	35	55.64	
D73	22	12	26.61	82	35	52.73	
D74	22	12	24.68	82	35	49.92	
D75	22	12	22.82	82	35	47.22	
D76	22	12	20.81	82	35	44.31	
D77	22	12	18.84	82	35	41.46	
D78	22	12	16.94	82	35	38.70	
D79	22	12	15.00	82	35	35.88	
D80	22	12	12.83	82	35	32.73	
D81	22	12	11.38	82	35	30.62	
D82	22	12	8.99	82	35	27.16	
D83	22	12	7.40	82	35	24.84	
D84	22	12	5.37	82	35	21.90	
D85	22	12	3.46	82	35	19.13	
D86	22	12	2.15	82	35	17.24	
D87	22	12	1.43	82	35	16.19	
D88	22	11	59.51	82	35	13.41	
D89	22	11	57.58	82	35	10.60	
D90	22	11	55.69	82	35	7.86	
D90A	22	11	54.67	82	35	6.24	

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Chhatta Reserved Forest RF70 (Area – 2.677 ha.)

Point No.	Latitude (N)			Longitude (E)			Total Area (Ha.)
	Degree	Minute	Second	Degree	Minute	Second	
E01	22	11	50.21	82	34	55.79	
E02	22	11	50.70	82	34	56.91	
E03	22	11	51.27	82	34	58.03	
E04	22	11	51.70	82	34	58.87	
E05	22	11	52.94	82	35	1.02	
E06	22	11	54.71	82	35	3.93	
E07	22	11	56.73	82	35	7.20	
E08	22	11	58.38	82	35	9.74	
E09	22	12	0.38	82	35	12.50	
E10	22	12	2.41	82	35	15.22	
E11	22	12	4.39	82	35	17.99	
E12	22	12	6.40	82	35	20.74	
E13	22	12	7.80	82	35	22.57	2.677
E14	22	12	8.86	82	35	24.02	
E15	22	12	9.53	82	35	24.91	
E16	22	12	10.05	82	35	25.38	
E17	22	12	10.84	82	35	25.73	
E18	22	12	8.98	82	35	23.04	
E19	22	12	7.10	82	35	20.31	
E20	22	12	5.11	82	35	17.42	
E21	22	12	3.22	82	35	14.67	
E22	22	12	1.24	82	35	11.81	
E23	22	11	59.40	82	35	9.13	
E24	22	11	57.38	82	35	6.20	
E25	22	11	55.44	82	35	3.39	
E26	22	11	53.89	82	35	1.15	
E27	22	11	51.77	82	34	58.06	

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Chhatta Reserved Forest RF69 (Area – 0.496 ha.)

Point No.	Latitude (N)			Longitude (E)			Total Area (Ha.)
	Degree	Minute	Second	Degree	Minute	Second	
F01	22	12	19.46	82	35	38.25	0.496
F02	22	12	19.80	82	35	38.90	
F03	22	12	20.58	82	35	40.50	
F04	22	12	22.03	82	35	43.42	
F05	22	12	22.24	82	35	43.78	
F06	22	12	22.83	82	35	44.55	
F07	22	12	24.13	82	35	45.95	
F08	22	12	25.69	82	35	47.57	
F09	22	12	26.44	82	35	48.37	
F10	22	12	25.03	82	35	46.33	
F11	22	12	24.26	82	35	45.21	
F12	22	12	22.91	82	35	43.24	
F13	22	12	20.97	82	35	40.44	

Chhatta Reserved Forest RF69 (Area – 0.284 ha.)

Point No.	Latitude (N)			Longitude (E)			Total Area (Ha.)
	Degree	Minute	Second	Degree	Minute	Second	
G01	22	12	39.84	82	36	6.81	0.284
G02	22	12	40.00	82	36	7.34	
G03	22	12	40.10	82	36	7.76	
G04	22	12	40.22	82	36	8.86	
G05	22	12	40.38	82	36	9.57	
G06	22	12	41.03	82	36	10.60	
G07	22	12	42.19	82	36	9.68	
G08	22	12	41.34	82	36	8.66	

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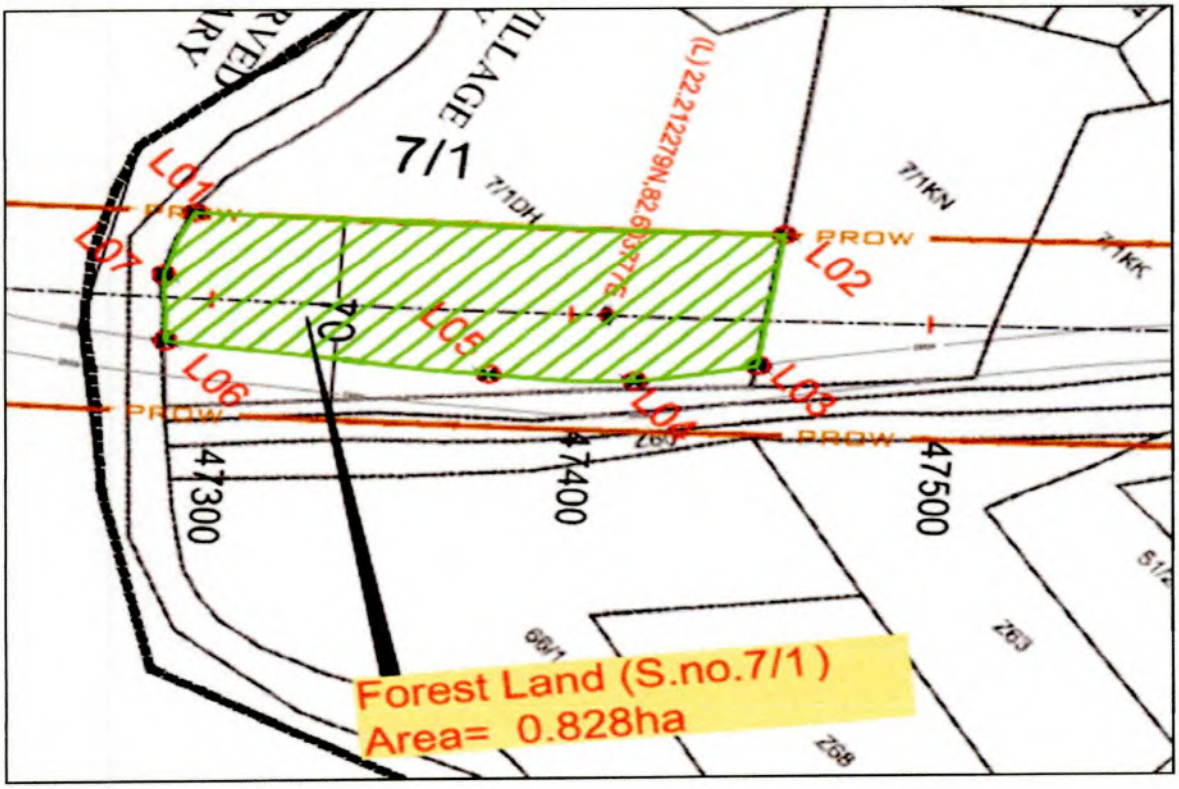
8. Village – Agarkhar, Tehsil – Baloda, Area – 0.828 Ha.



GPS Coordinates: Degree, Minute & Second (Area-0.828 Ha.)

Point No.	Latitude (N)			Longitude (E)			Total Area (Ha.)
	Degree	Minute	Second	Degree	Minute	Second	
L01	22	12	42.37	82	36	9.89	0.828
L02	22	12	45.99	82	36	14.10	
L03	22	12	44.79	82	36	15.06	
L04	22	12	43.87	82	36	14.35	
L05	22	12	42.98	82	36	13.30	
L06	22	12	41.17	82	36	10.80	
L07	22	12	41.67	82	36	10.22	

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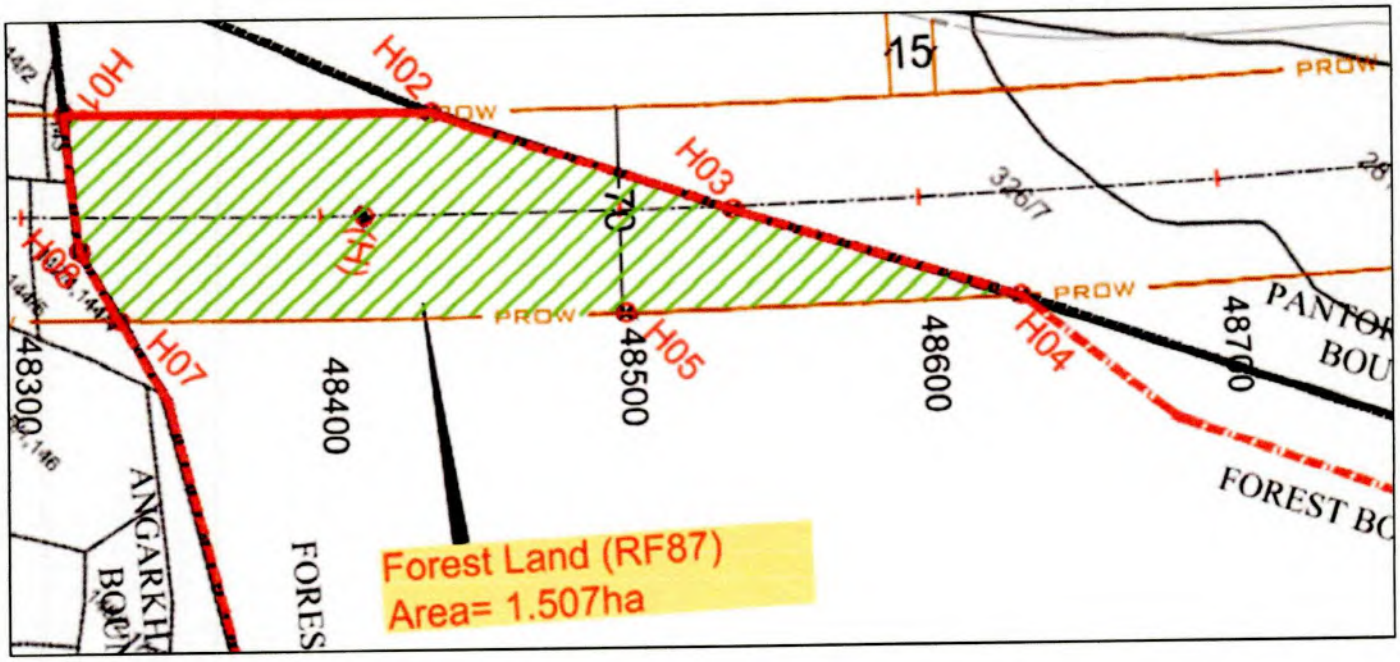
PROJECT DIRECTOR
NHAI, PIU, Bilaspur (C.G.)

9. Reserve Forest, Tehsil – Baloda, Area – 1.507 Ha.



GPS Coordinates: Degree, Minute & Second (Area-1.507 Ha.)

Point No.	Latitude (N)			Longitude (E)			Total Area (Ha.)
	Degree	Minute	Second	Degree	Minute	Second	
H01	22	13	5.31	82	36	35.55	1.507
H02	22	13	8.17	82	36	38.54	
H03	22	13	9.74	82	36	41.85	
H04	22	13	11.31	82	36	44.94	
H05	22	13	8.12	82	36	41.85	
H06	22	13	5.81	82	36	39.51	
H07	22	13	4.14	82	36	37.76	
H08	22	13	4.38	82	36	36.84	

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