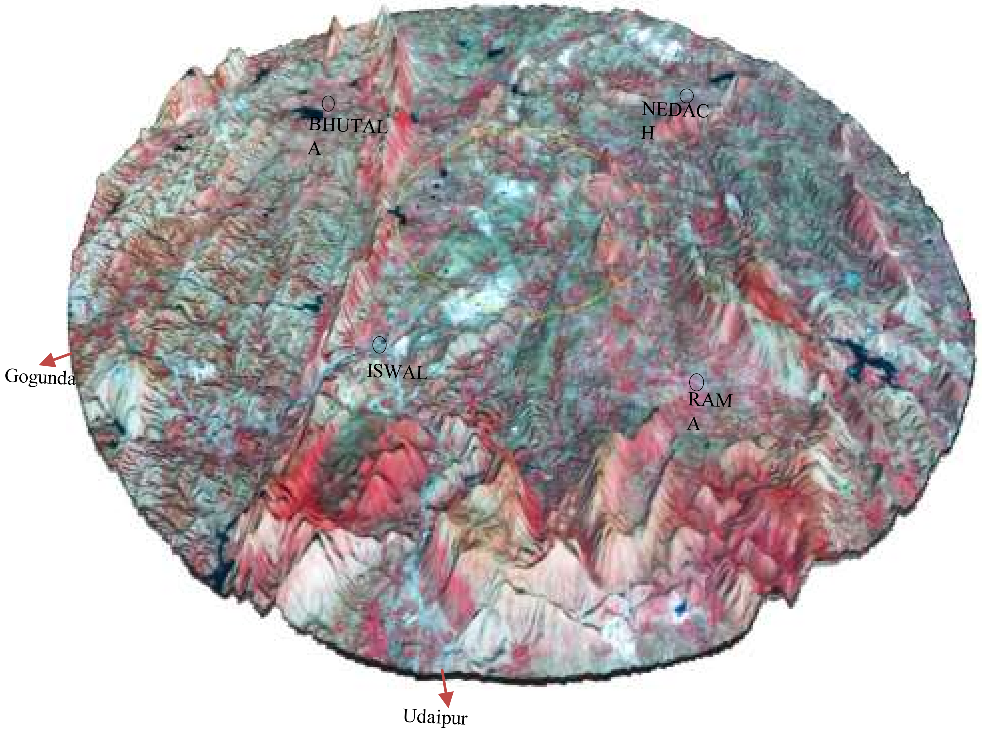


Welcome

APPLICATION OF REMOTE SENSING & GIS IN MECL

by

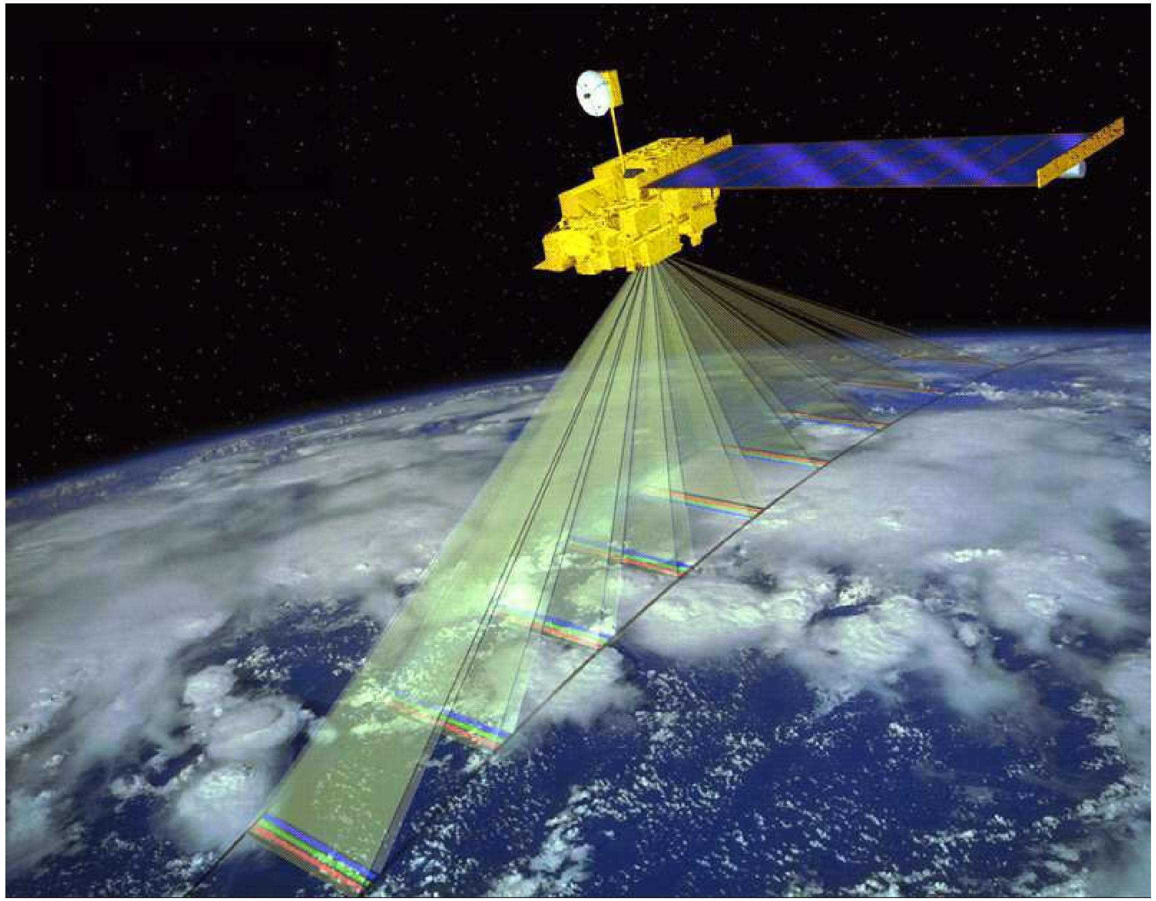
Dr. S. KAMALAKARAM (Dy. General Manager, Exploration)

Remote Sensing:

Remote sensing is the science of acquiring, processing, and interpreting images and related data, acquired from aircraft and satellites, that record the interaction between matter and electromagnetic energy (Sabins, 1997).

Or

Remote sensing is the collection of information about an object without being in direct physical contact with the object.



PROCESS OF REMOTE SENSING

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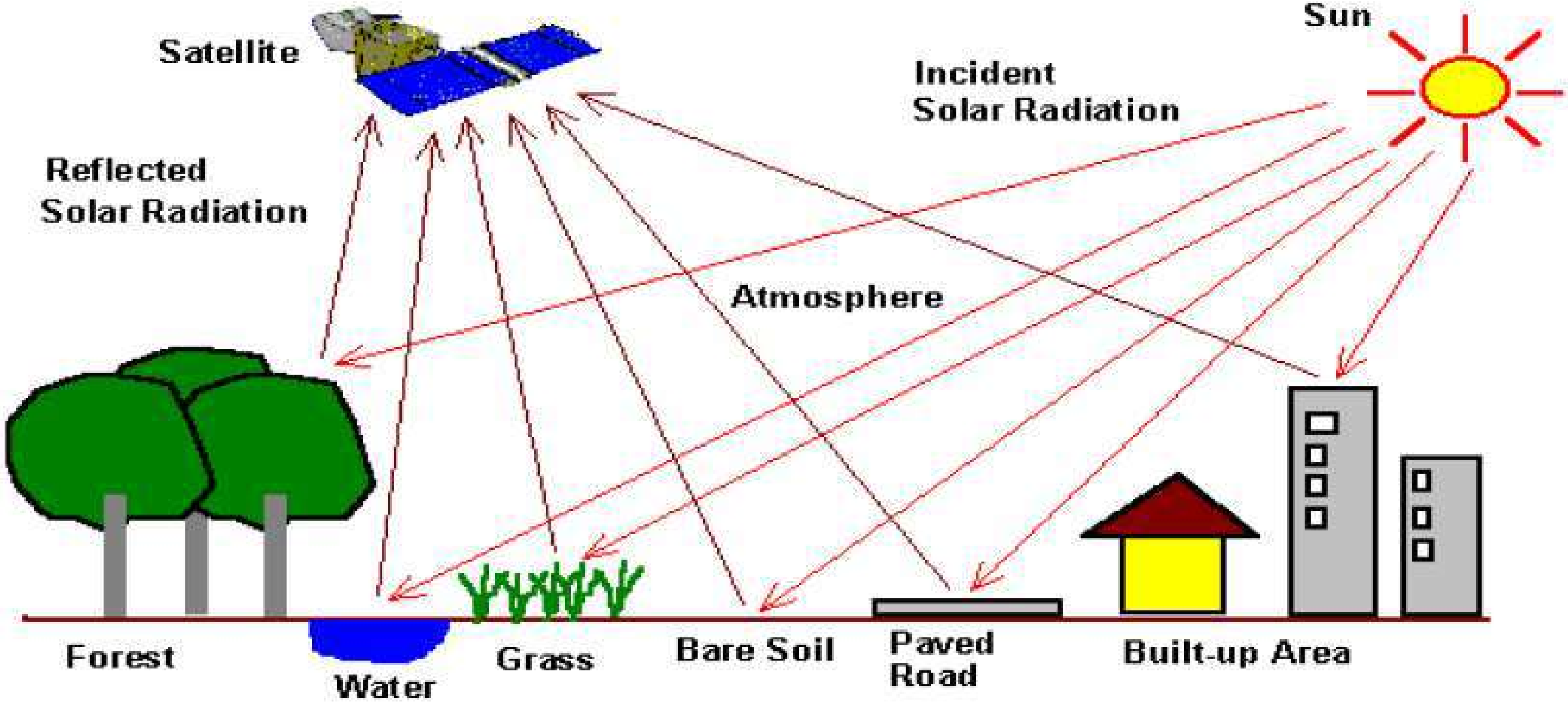

Schematic Diagram showing Process of Remote Sensing

ELEMENTS INVOLVED IN REMOTE SENSING

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1.**Energy Source** or Illumination (A)

2.Radiation and the **Atmosphere** (B)

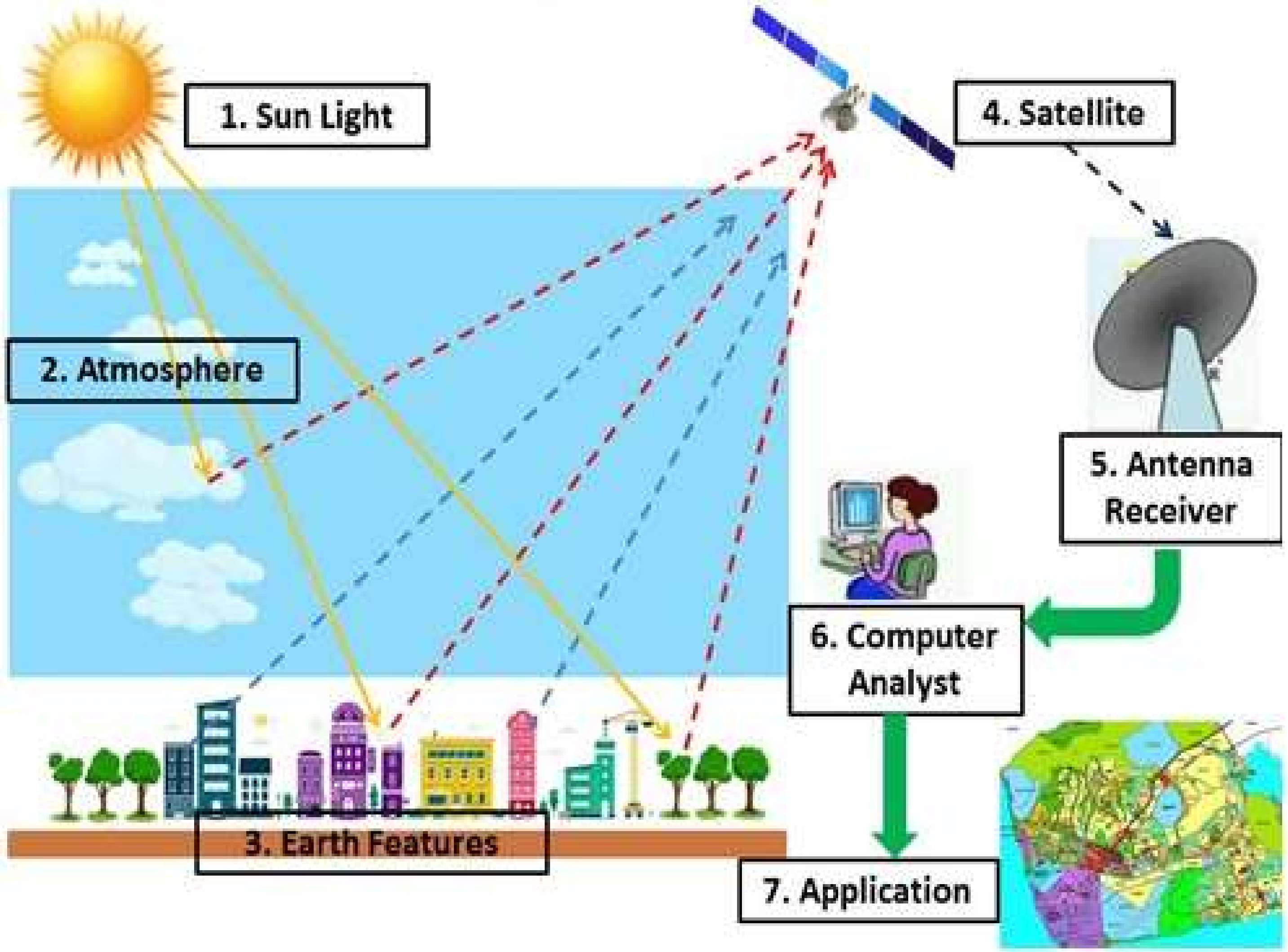
3.**Interaction with the Target (C)**

*4.**Recording of Energy by the Sensor*** (D)

5.Transmission, Reception, and Processing (E)

6.Interpretation and Analysis (F)

7. **Application (G)**



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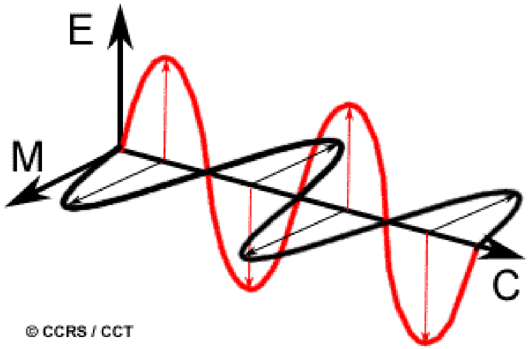
- Electromagnetic (EM) radiation is a form of energy, transported through space in the form of periodic disturbances of **electric and magnetic fields**.
- An electromagnetic wave is characterized by a **frequency** and a **wavelength**.
- These two quantities are related to the speed of light by the equation:

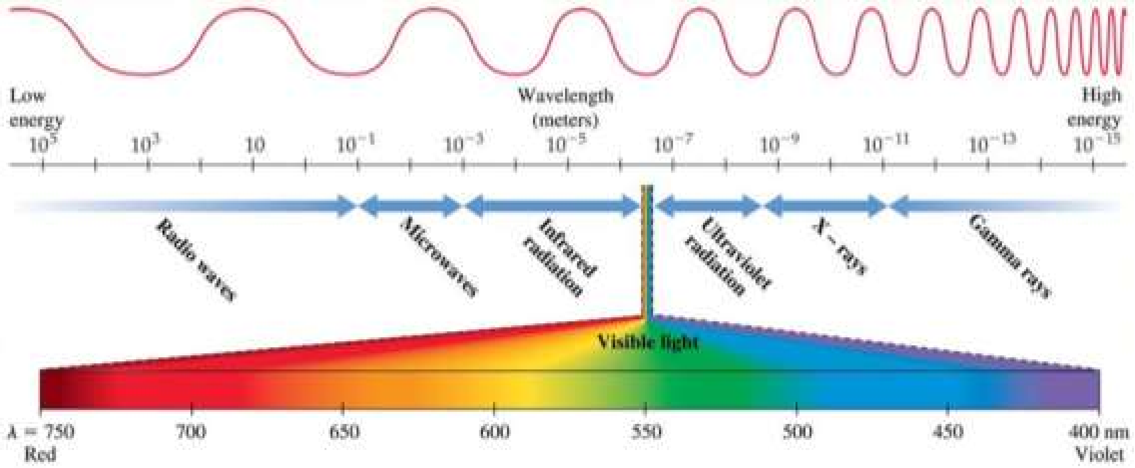
speed of light = frequency x wavelength



E=Electrical field, M=magnetic field, C=speed of light

Electromagnetic (EM) Spectrum

- The electromagnetic (EM) spectrum is the range of all types of EM radiation.
- The **EM spectrum** ranges from the shorter wavelengths (including gamma and x rays) to the longer wavelengths (including microwaves and broadcast radio waves).
- There are several regions of the electromagnetic spectrum which are useful for remote sensing



ELECTROMAGNETIC (EM) SPECTRUM FOR REMOTE SENSING

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VISIBLE Range:

- **The light which our eyes - our "remote sensors" -can detect is part of the visible spectrum.**
- This narrow band of electromagnetic radiation extends from about 400 nm (violet) to about 700 nm (red).
- The **longest visible wavelength is red and the shortest is violet.**
- **This is the only portion of the spectrum we can associate with the concept of colours.**

INFRARED Region:

- **Ranges from** 0.7 to 300 μm wavelength. This region is further divided into the following bands:

  Near Infrared (NIR): 0.7 to 1.5 μm.
  Short Wavelength Infrared (SWIR): 1.5 to 3 μm

  Mid Wavelength Infrared (MWIR): 3 to 8 μm
  Long Wavelength Infrared (LWIR): 8 to 15 μm.

  Far Infrared (FIR): longer than 15 μm.

MICROWAVE Region:

- **1 mm to 1 m wavelength.** The microwaves are further divided into different frequency (wavelength) bands: **(1 GHz = 109 Hz)**
- **Used in microwave ovens.**
- *Waves transfer energy to the water in the food causing them to vibrate which in turn transfers energy in the form of heat to the food.*
- **Used by cell phones and pagers.**

RADAR (Radio Detection and Ranging)

- Used to find the speed of an object by sending out radio waves and measuring the time it takes them to return.

There are meaningful distinctions between remote sensing 'platforms', 'sensors' and 'images'

- **Platform**

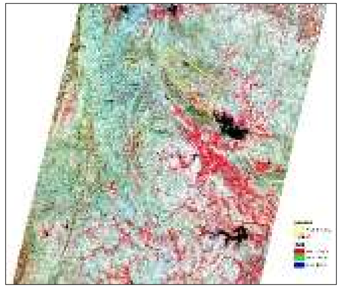
  The craft on which a sensing device is mounted.

- **Sensor**

  The sensing device or instrument itself. The measurements of EM energy are made by sensors that are attached to a static or moving platform.

- **Image**

  The image data acquired by the sensing device



REMOTE SENSING PLATFORMS

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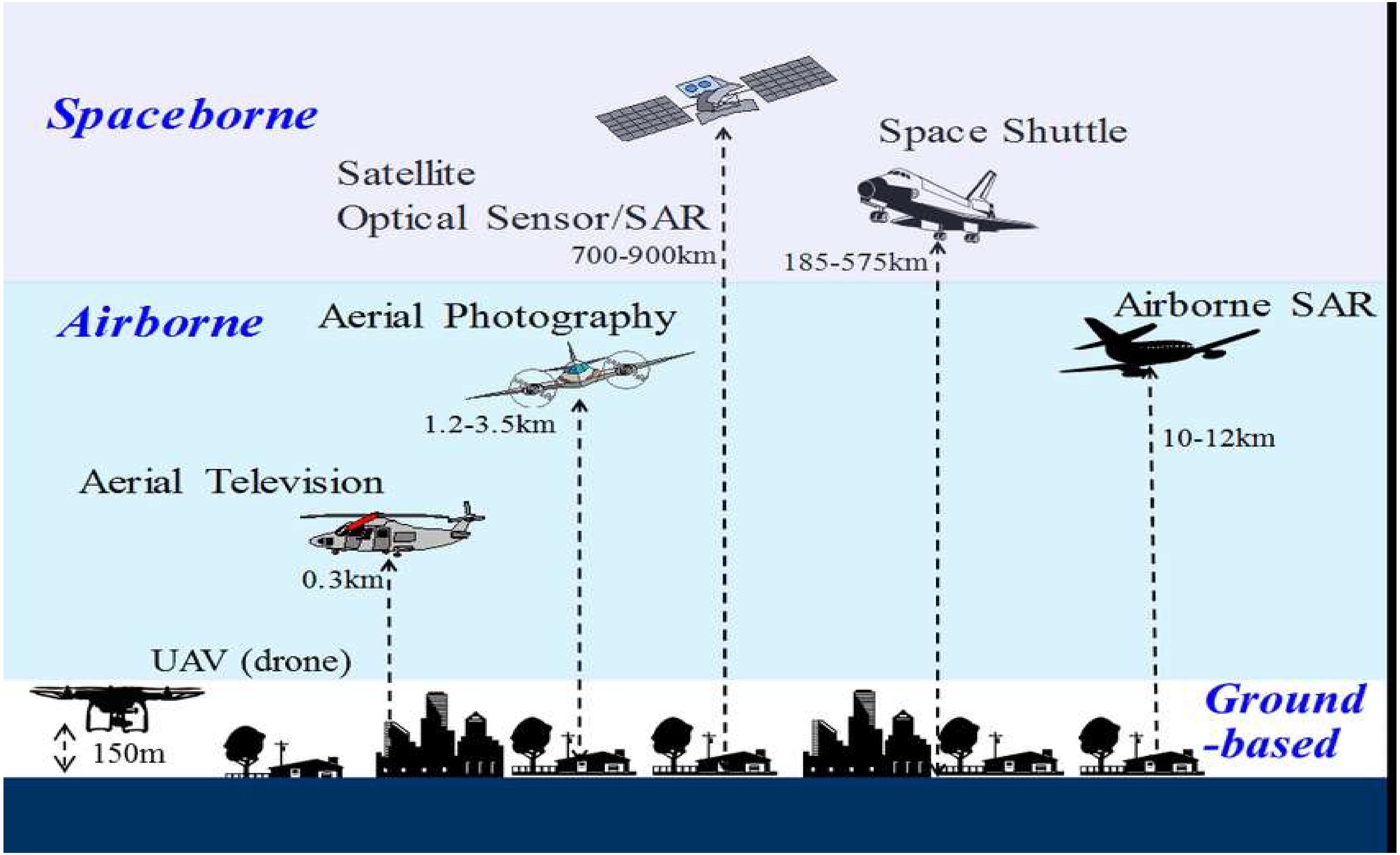


RESOLUTION IN REMOTE SENSING

The resolution of an image refers to the potential detail provided by the imagery:

1. Spatial
2. Spectral
3. Temporal
4. Radiometric

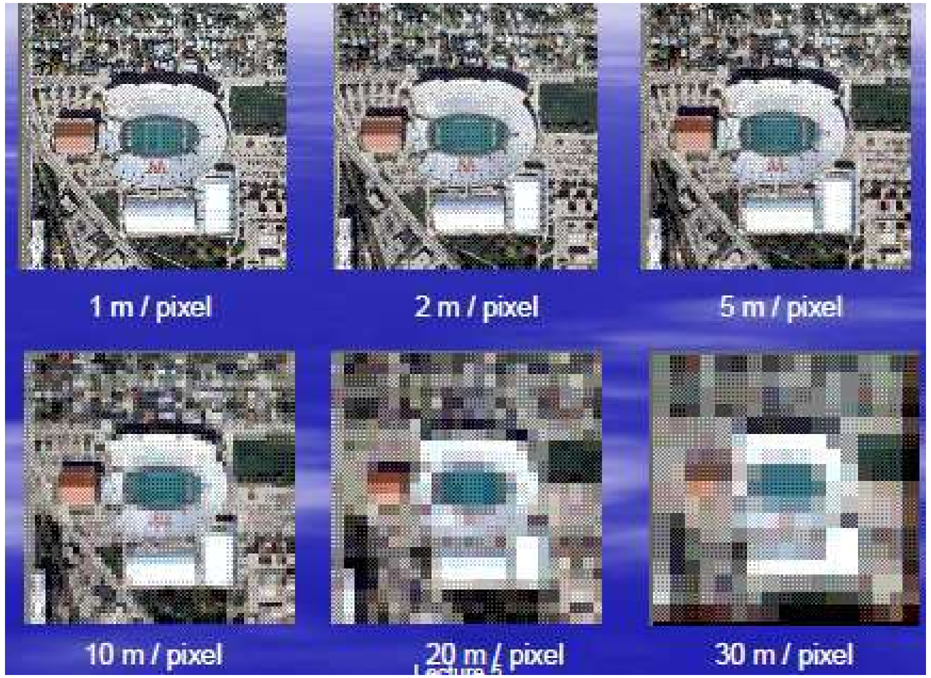
1. Spatial Resolution

The earth surface area covered by a pixel of an image is known as spatial resolution.

❖Large area covered by a pixel means low spatial resolution and vice versa.

❖Spatial resolution = smallest unit-area measured.

❖It is also called Ground Resolution Element (GRE)



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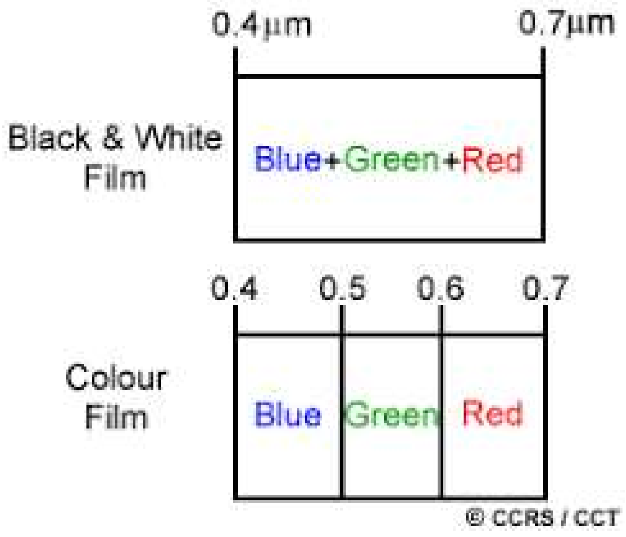
2. SPECTRAL RESOLUTION

Spectral Resolution is the **range of wavelength that satellite imaging system can detect.**

- It refers to the width and number of spectral bands. The narrower the band the greater the spectral resolution.
- Describes the specific wavelength intervals in the EMR that a sensor can record.
- High resolution sensors can discriminate very fine differences in spectral reflectance
- **Multispectral sensors generally ~ 100 nm (0.1 micrometer), Hyperspectral sensors generally ~ 10 nm (0.01 micrometer).**



3. Temporal Resolution

- Frequency at which images are recorded / captured in a specific place on the earth.
- ***The more frequently it is captured, the better or finer the temporal resolution is said to be.***
- Revisit time (temporal resolution) = time between two successive image acquisitions over the same area.
- The **Landsat series** of satellites have a repeat period ranging from **16 – 18 days**, whereas in the case of **IRS, it is 22** days.

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Radiometric Resolution

- Sensitivity of the sensor to the magnitude of the received electromagnetic energy determines the radiometric resolution.
- Finer the radiometric resolution of a sensor, if it is more sensitive in detecting small differences in reflected or emitted energy

Determined by the number of bits of within which the digital information is encoded:

2^1 = 2 levels (0,1)
2^2 = 4 levels (0,1,2,3)
2^8 = 256 levels (0-255)
2^{12} = 4096 levels (0-4095)

IRS MISSIONS

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MISSION	LAUNCH	SENSOR	ALTITUDE (KM)	REVISIT (DAYS)
IRS-IA	17 MARCH-1988	LISS-I & LISS-II	904	22
IRS-IB	29TH AUGUST-1991	LISS-I & LISS-II	904	22
IRS-IC	28TH DECEMBER-1995	PAN, LISS-III, WIFS	817	5 24 5
IRS-ID	29TH SEOTEMBER -1997	PAN, LISS-III, WIFS	817	5 24 5
IRS-P2	15TH OCTOBER - 1994	LISS-II	817	24
IRS-P3	21ST MARCH- 1996	WIFS MOS ASTRONOMY	817	24
IRS-P4	26TH MAY-1999	OCM MSMR	727	3
IRS-P6/RESOURCESAT-1	2003	MONO		
RESOURCESAT-2	20TH APRIL, 2011	LISS-IV, AWiFS	822	5
RESOURCESAT-2A	7TH DECEMBER, 2016	LISS-IV, AWiFS	822	5

SENSOR ON BOARD INDIAN REMOTE SENSING (IRS) MISSIONS

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SENSOR	SPECTRAL RESOLUTION	SPATIAL RESOLUTION	SWATH
LISS-I	0.45- 0.52 0.52-0.59 0.62- 068 0.77- 0.86	72.5	148
LISS-II	0.45- 0.52 0.52-0.59 0.62- 068 0.77- 0.86	36.25	74
LISS-III	0.52-0.59 0.62- 068 0.77- 0.86 1.55- 1.70	23.5 70.5	141 148
LISS-IV	0.52-0.59 0.62- 0.68 0.77- 0.86	5.8	70
(Advance wide Field Sensor) AWiFS	0.52-0.59 0.62- 068 0.77- 0.86 1.55- 1.70	56	740

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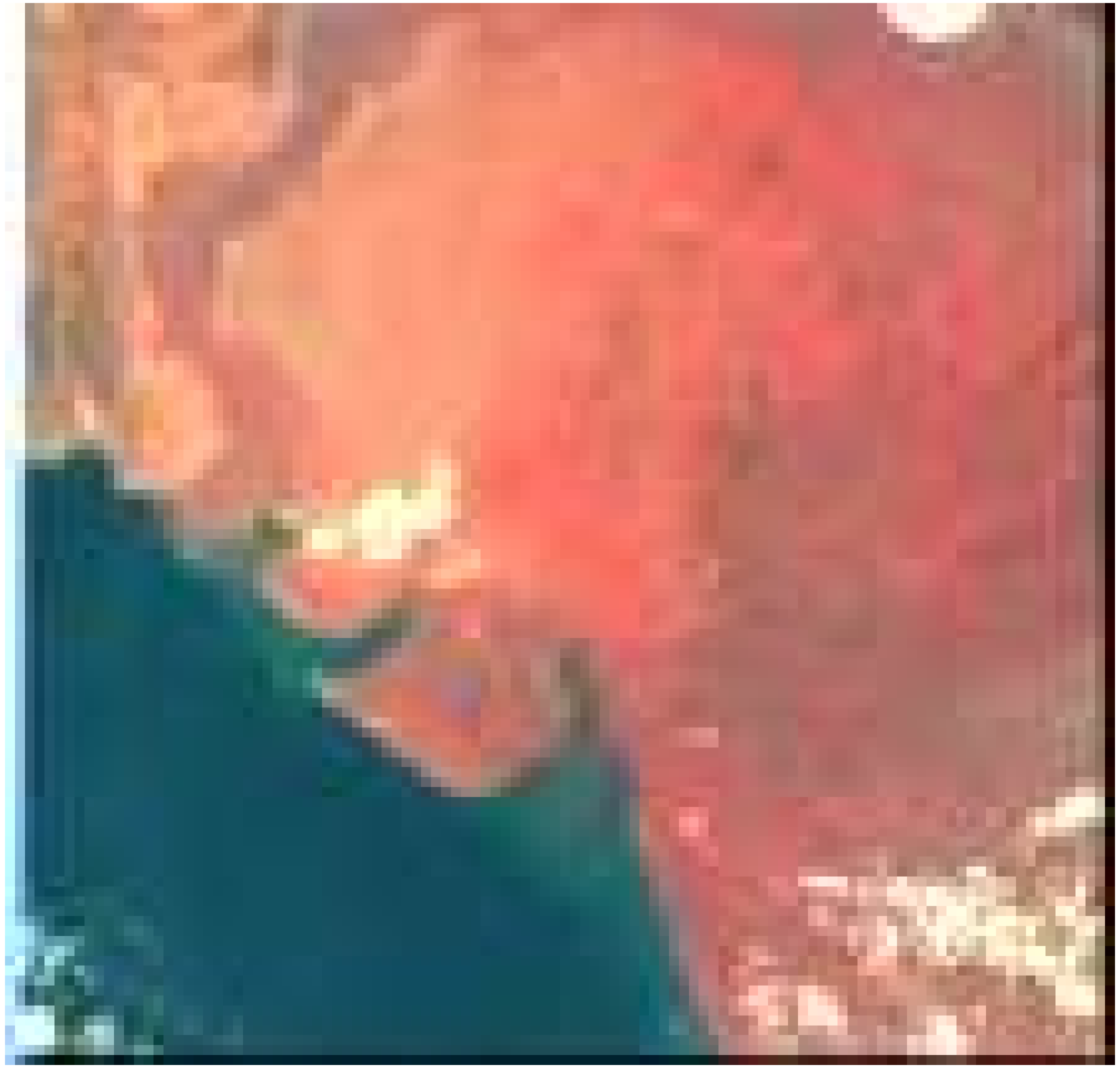

AWIFS image

SALIENT FEATURES

SYNOPTIC VIEW

OCEANOGRAPHIC STUDIES

RESOLUTION-

VERY COARSE 188M.

COVERS AN AREA OF 810KMX810KM

LISS - III

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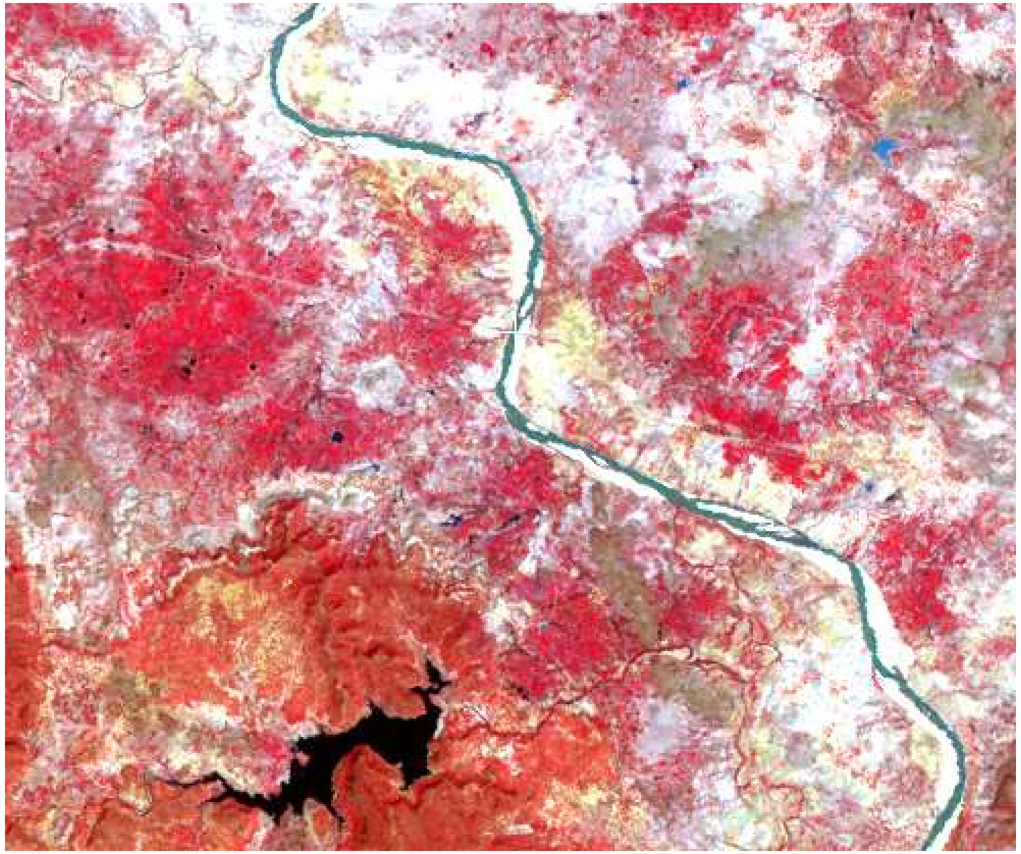
Advantages

- spatial resolution is 23.5m
- Available in four bands
- Synoptic view covers 19,881sq. Km. Area(141*141km)
- (Approximately 28 toposheet area on 1:50000 scale)
- Color composites can be generated
- Change detection due to repetitive coverage

Limitations

- High resolution
- True color composites not possible



PAN

MECL

Advantages

- available in single band
- One full scene view covers 4,900sq. Km. Area (70*70km)
- (Approximately 7 toposheet area on 1:50000 scale)
- Detailed feature extraction Up to cadastral level is possible
- Change detection can be done due to repetitive coverage

Limitations

- Single band data
- Black and white image

IKONOS IMAGE

MECL

ADVANTAGES

- Spatial resolutioN 1m X 1m
- One full scene view covers 121 sq. Km. area (11*11 km)
- Detailed feature extracti0n upto - cadastral level & town planning

IKONOS DATA OF HYDERABAD AREA

REMOTE SENSING DATA SET

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MULTISPECTRAL REMOTE SENSING DATA	RESOURCESAT-1 CARTOSAT-1 LANDSAT-8-OLI ASTER SENTINAL-1
HYPERSPECTRAL REMOTE SENSING DATA	Airborne Visible/Infrared Imaging spectrometer (AVIRIS), HYPERION
THERMAL REMOTE SENSING DATA	Thermal bands of multispectral data
MICROWAVE REMOTE SENSING	ALOS PALSAR, DEM-DATA

DIFFERENT SENSOR AND SATELLITE DATA

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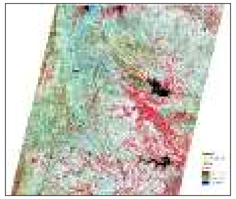
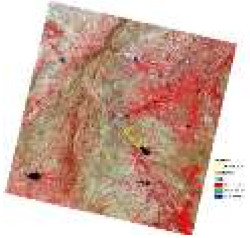
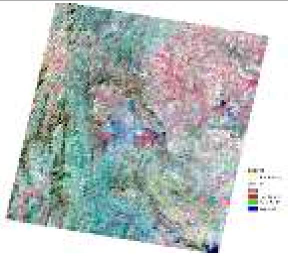
SL No	FEATURES	DETAILS		
1	Satellite	IRS-P6	Landasat-8	ASTER
				
2	Repetitively	24 days	16 days	16 DAYS
3	Revisit	5 days	5 days	5 days
4	Altitude	817 Km	705 Km	705
5	Sensors	**LISS-IV(Mx)**	**Operational Land Imager (OLI)**	**ASTER**
6	Spectral Bands (Micron)	B-2 0.52-0.59 (Green)	B1 0.43 - 0.45 (Coastal)	B1 0.52-0.60
		B-3 0.62-0.68 (Red)	B2 0.45 - 0.51 (Blue)	B2 0.63-0.69
		B-4 0.77-0.86 (INR)	B3 0.53 - 0.59 (Green)	B3 0.78-0.86
			B4 0.64 - 0.67 (Red)	B4 1.60-1.70
			B5 0.85 - 0.88 (NIR)	B5 2.145-2.185
			B6 1.57 - 1.65 (SWIR-1)	B6 2.185-2.225
			B7 2.11 - 2.29 (SWIR-2)	B7 2.235-2.285
			B8 0.50 - 0.68 (Pan)	B8 2.295-2.365
			B9 1.36 - 1.38 (Cirrus)	B9 2.360-2.430
			B10 10.60 - 11.19 (TIRS-1)	B10 8.125-8.825
			B11 11.50 - 12.51 (TIRS-2)	B11 8.475-8.825
				B12 8.925-9.275
				B13 10.25-10.95
				B14 10.95-11.65
7	Swath (Km)	23 Km (MS Mode)	85 KM	60 Km
8	Spatial Resolution	5.8 m	15m Panchromatic	15m VNIR (B1-B3)
			30m VNIR + SWIR	30m SWIR (B4-B9)
			100m TIRS	90m TIR (B10-B14)

LOADING SATELLITE DATA: TO SYSTEM

CAN BE DONE IN 3 STEPS

1. IMPORT:

- IMPORT THE DATA INTO PIX FORMAT USING THE FILE-UTILITY (FILE UTILITY WINDOW WILL APPEAR) -FILE-IMPORT TO PCIDSK

2. SUBSETTING:

- CLIPPING THE REQUIRED PART OF THE IMAGE

3. TRANSFER OF LAYERS:

- BSQ FORMAT FILES CAN BE LOADED INTO ONE FILE

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MEASUREMENT ON THE GLOBE

- **Latitude and longitude are used to locate position on the surface of the Globe. These are the angles measured from the centre of the Earth. In spherical system horizontal lines are called latitude or parallels and vertical lines are called lines of longitude or meridians. These lines encompass the Globe and form a gridded network called a graticule.**

TECHNIQUES FOR GEOREFERENCING

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- **PHYSICAL : S.O.I. TOWERS AS BENCH MARK**
  - Time Taking Due To Conventional Surveying
  - Expensive But Accurate.
  - Updation of Map is Time Consuming
- **GLOBAL POSITIONING SYSTEM (G.P.S)**
  - GPS is A Satellite – Based System That Uses A Constellation Of 24 Satellites to Give An Accurate Position.
  - Less Vertical Accuracy
  - Updation of Maps is Fast
  - Expensive
- **REMOTE SENSING APPLICATION & TOPOSHEET**
  - Fast & Less Time Consuming,
  - Cost Effective & Used to Demarcate Area of Interest For Detailed Work
  - Updation Of Maps Is Possible At Every 21 Days (If Required)

GEOREFERENCING

- Assigning the co-ordinates and projection parameters to the uncorrected image (scanned toposheet or any other coordinated map)

PROCESS:

- Scan the map
- Import to pix format
- Open GCP module of easi/pace
- Select user entered coordinates
- Define projection parameters
- Enter the coordinates
- Get the geo-referenced image (corrected image)

REGISTRATION:

- Registering the co-ordinates and projection parameters to the uncorrected image with reference to the corrected image
- Also called image to image registration

The transformation of three dimensional surface of the Earth to a flat map sheet , usually using a mathematical conversion is commonly referred to as map projection.

Maps are Flat, but the surface they represent are curved.

LATITUDE & LONGITUDE IN A SPHERICAL SYSTEM

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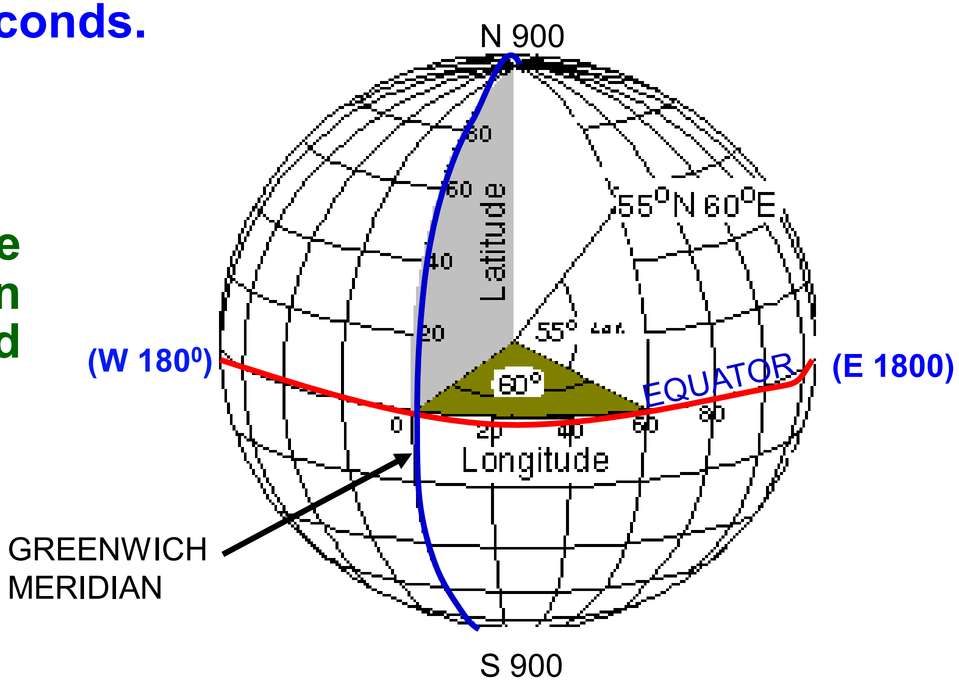
A circle is divided into 360 units called degrees. Each degree is further subdivided into sixty minutes, and each minute into sixty seconds.

Latitude & longitude are traditionally measured in degrees, minutes, and seconds (DMS).



0^0 latitude : 0° ,is at the Equator, 90° is at the North Pole, and -90° is at the South Pole. It divides sphere in two hemisphere ; Northern & Southern

0^0 longitude : 0° , the Prime Meridian, starts at the North Pole, passes through Greenwich, England, and ends at the South Pole. Longitude is measured east, up to 180° , when traveling east from Greenwich and measured west, upto 180° , traveling west from Greenwich.

DIGITISATION & THEMATIC LAYER CREATION

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The Themes Like

- Roads (NH, SH & All Other Roads) And Rail Lines
- Built Up Areas (Villages , Towns & Cities)
- Drainages (First order, Second order, Third order, Streams & Rivers), Ponds , Lakes & Other Waterbodies (Dams etc)
- Contours & Spot heights
- Forest Land Areas As Per SOI Toposheets

INTERPRETATION

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- Interpretation is the extraction of qualitative and quantitative information from the image with the help of image characteristics coupled with enhancement techniques and interpretation elements/keys using the collateral data and experience.

IMAGE CHARACTERISTICS

- TONE / COLOR
- TEXTURE
- SHAPE
- SIZE
- PATTERN
- ASSOCIATION

ENHANCEMENT

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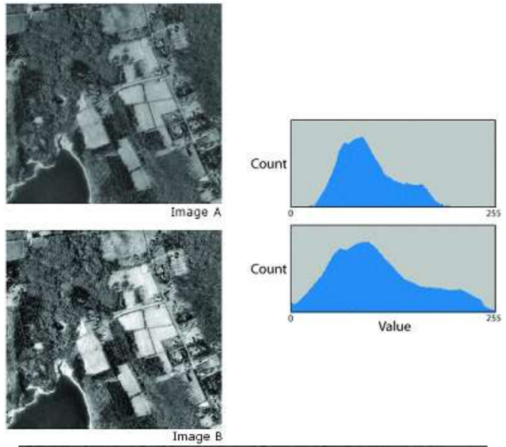
- The data of the raw image is restricted to narrow range of digital values over the grey scale there by giving low contrast image.
- In this process the values will be subjected to enhancement techniques to increase the visibility and clarity of features in the image there by extraction of details is easy.

TECHNIQUES

- **Contrast Stretching**

Contrast stretching (often called normalization) is a simple image enhancement technique that attempts to improve the contrast in an image by 'stretching' the range of intensity values.



- **Edge Enhancement**

Edge enhancement is an **image processing** filter that enhances the **edge** contrast of an **image**

- **Look-up table adjustment**

Look up tables (LUT) are data stored in the computer that is used to substitute new values for each pixel during the processing. It generally use to Reduce image noise, increase visibility of detail and adjust and optimize the image contrast characteristics.

- **Filtering**

Filtering is a technique for modifying or enhancing an image. For example, you can filter an image to emphasize certain features or remove other features. Image processing operations implemented with filtering include smoothing, sharpening, and edge enhancement

- Vector data of different themes along with the imagery will be loaded in the focus module of easi/pace for map composition.

OUTPUTS

- Standard false color composite with vector data
- Final interpreted geological map
- Different thematic maps as per requirement and scale

NOTE: All the vector data and the imagery should Have the same projection and origin for overlay

UTILIZATION OF REMOTE SENSING IN MECL

REMOTE SENSING DATA

- Environmental Monitoring studies including land use/land cover, change detection, geomorphological mapping etc.
- Site characteristics studies for various development project.
- Geo-structural Mapping/Geological Mapping/Mineral Targeting for mineral exploration project.
- Georeferencing of Cadastral maps for the Mining companies.
- Preparation of Ground water Potential Maps

SOFTWARE USED

- ENVI 5.4
- ERDAS 2020
- ARCGIS 10.8

BASELINE ENVIRONMENTAL STUDY

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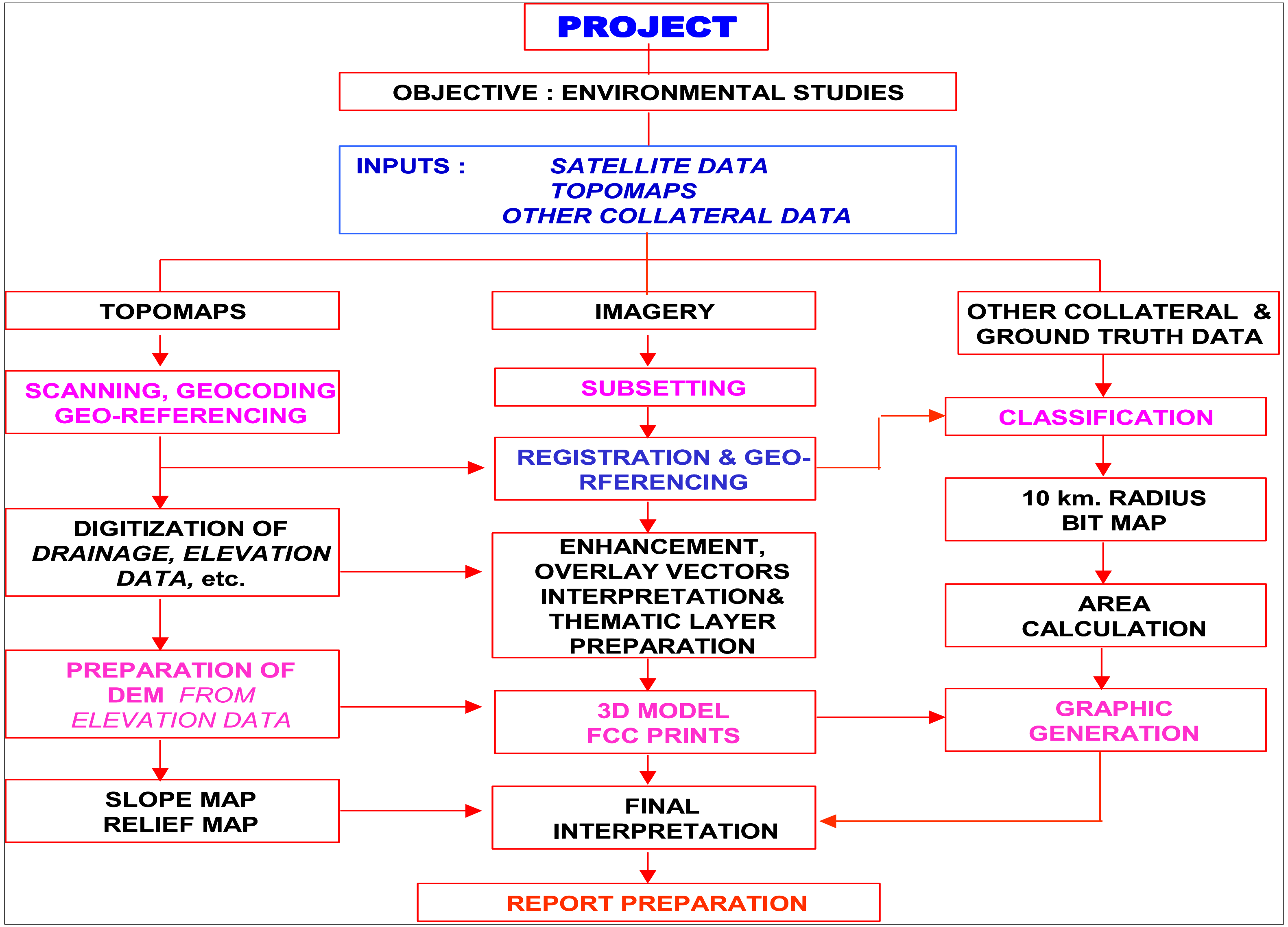

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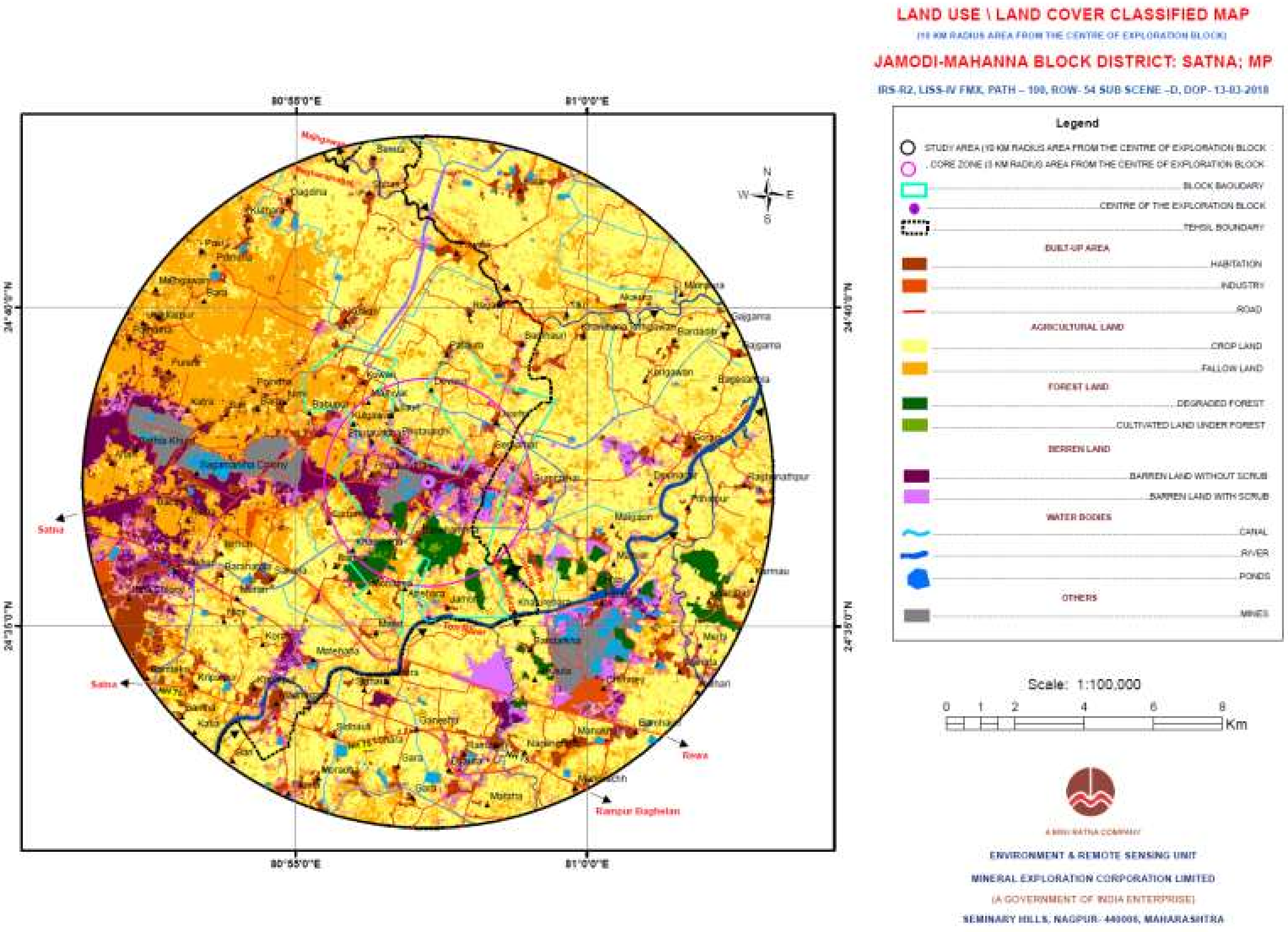
LAND USE LAND COVER CLASSIFICATION MAP OF THE JAMODI - MAHANNA LIMESTONE BLOCK, DISTRICT: SATNA, MADHYA PRADESH



PREPARATION OF GROUNDWATER POTENTIAL MAP

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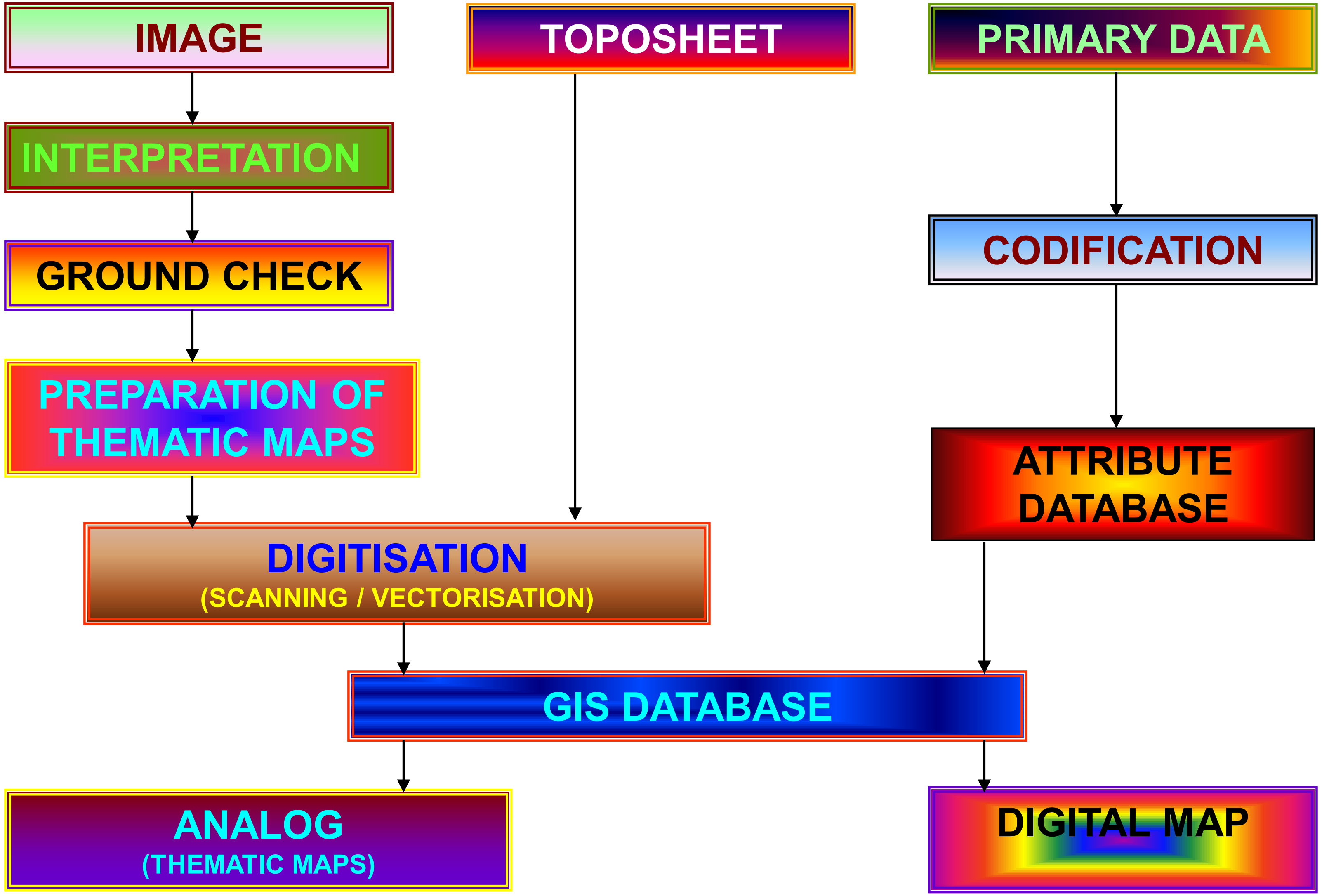

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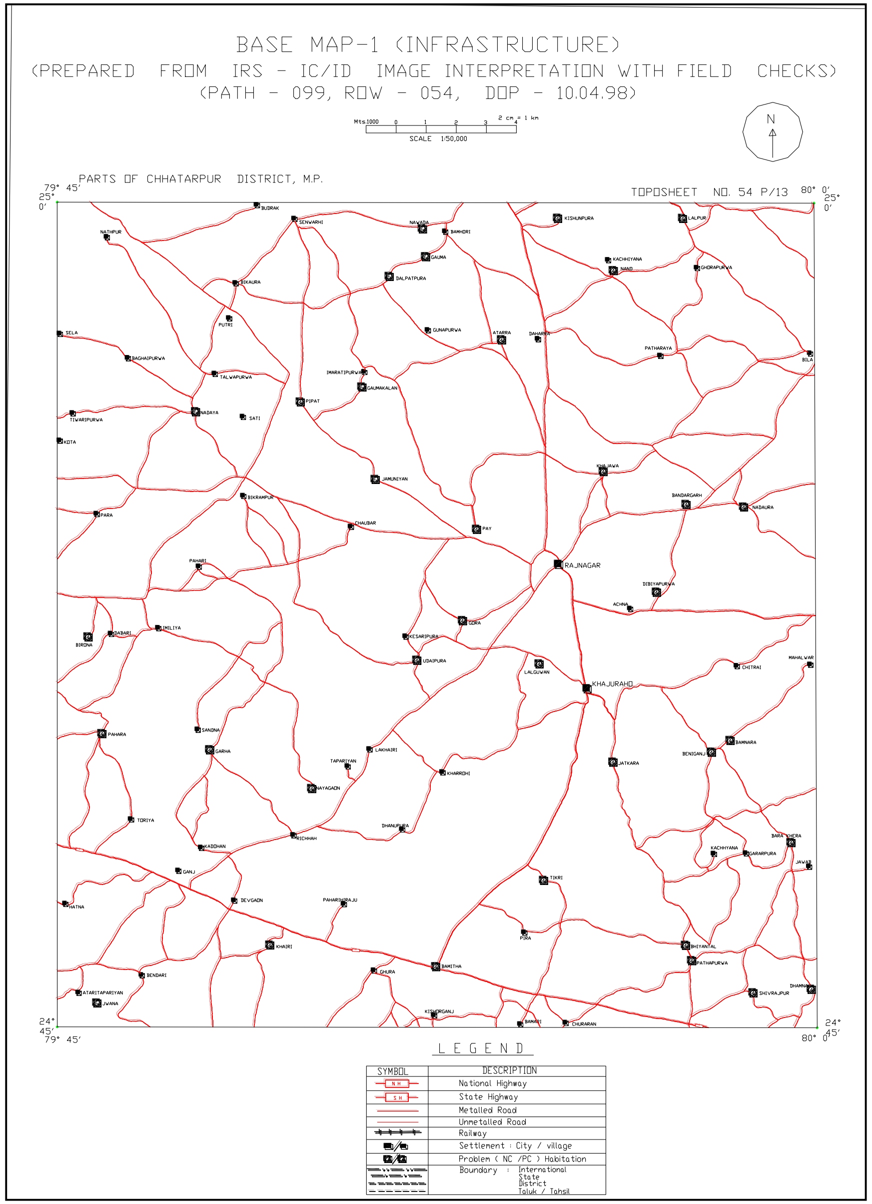
BASE MAP-I

ROADS ,BOUNDARIES, HABITATS



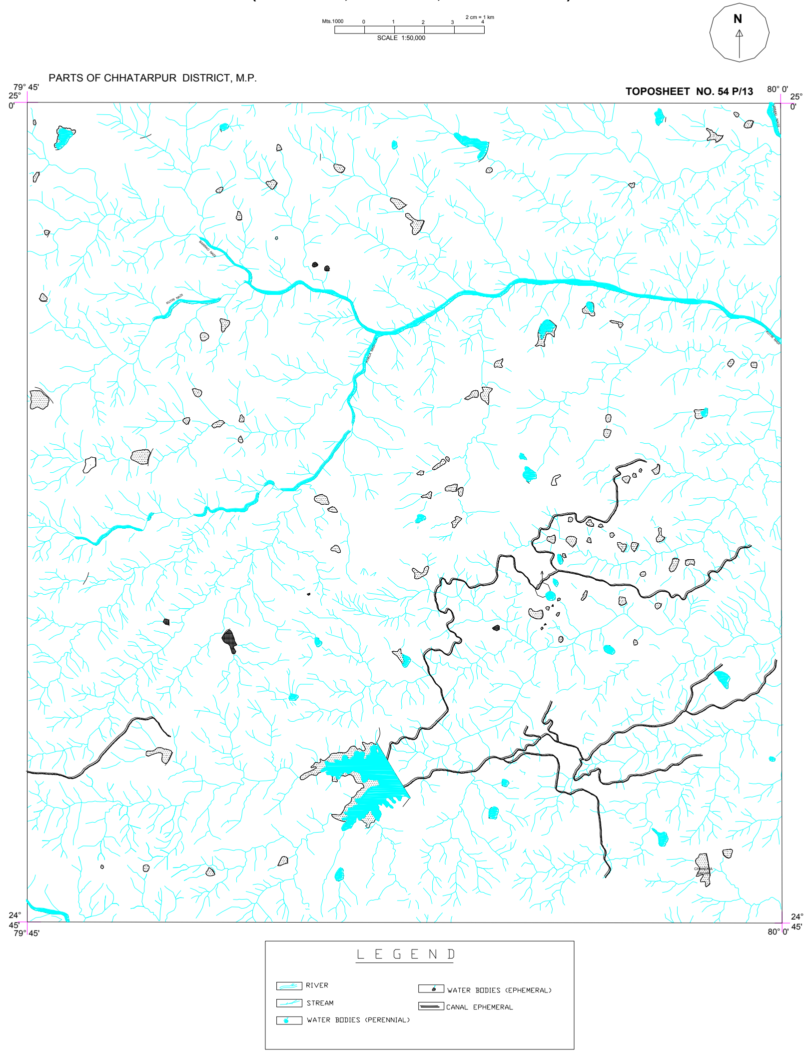
PREPARATION OF GROUNDWATER POTENTIAL MAP

MECL

BASE MAP-II

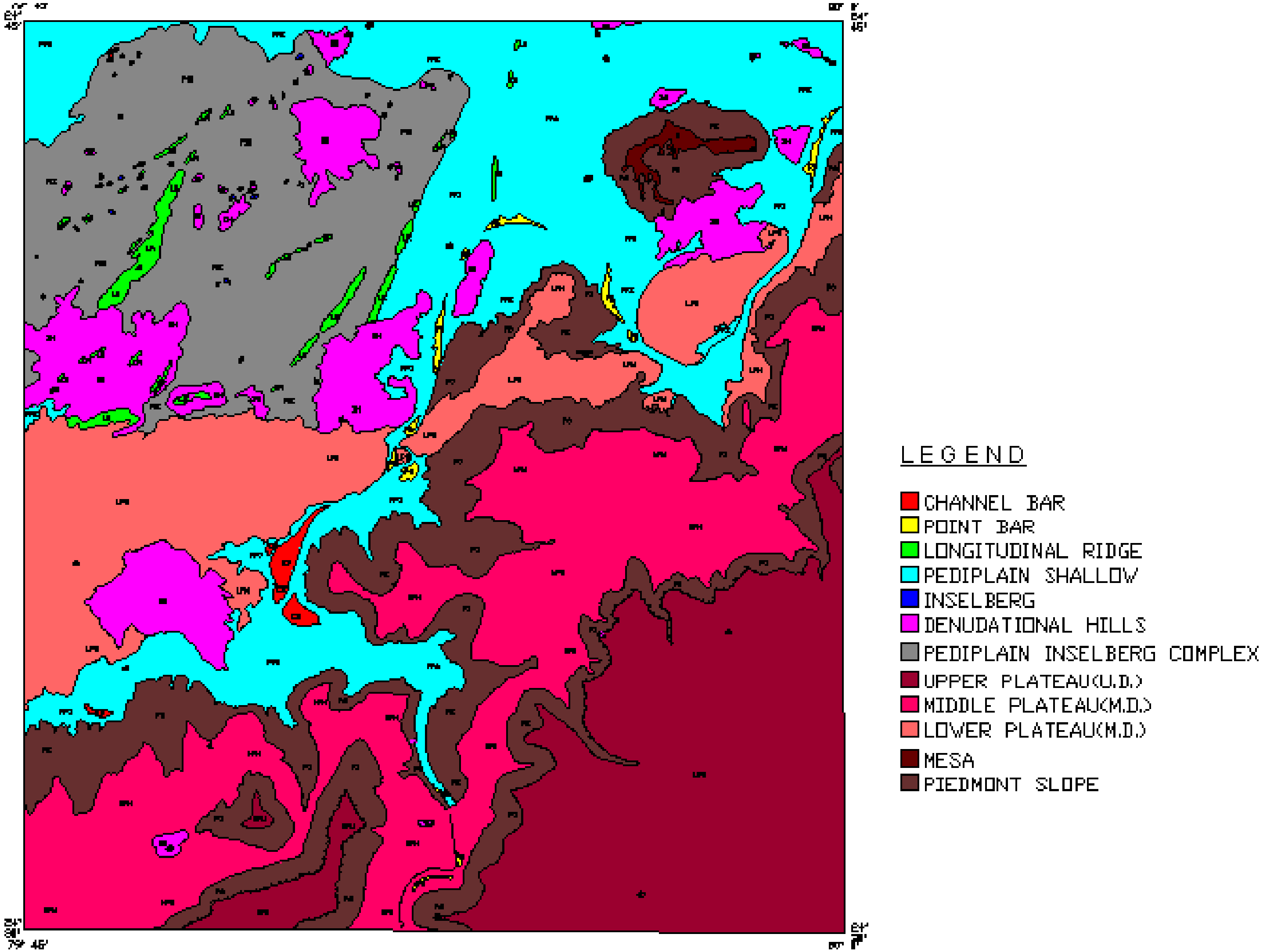
RIVER/STREAMS
&
WATER BODIES

BASE MAP-2 (RIVER/STREAMS & WATER BODIES)
(PREPARED FROM IRS - IC/ID IMAGE INTERPRETATION WITH FIELD CHECKS)
(PATH - 099, ROW - 054, DOP - 10.04.98)



MECL

GEOMORPHOLOGICAL LAYER



PREPARATION OF GROUNDWATER POTENTIAL MAP

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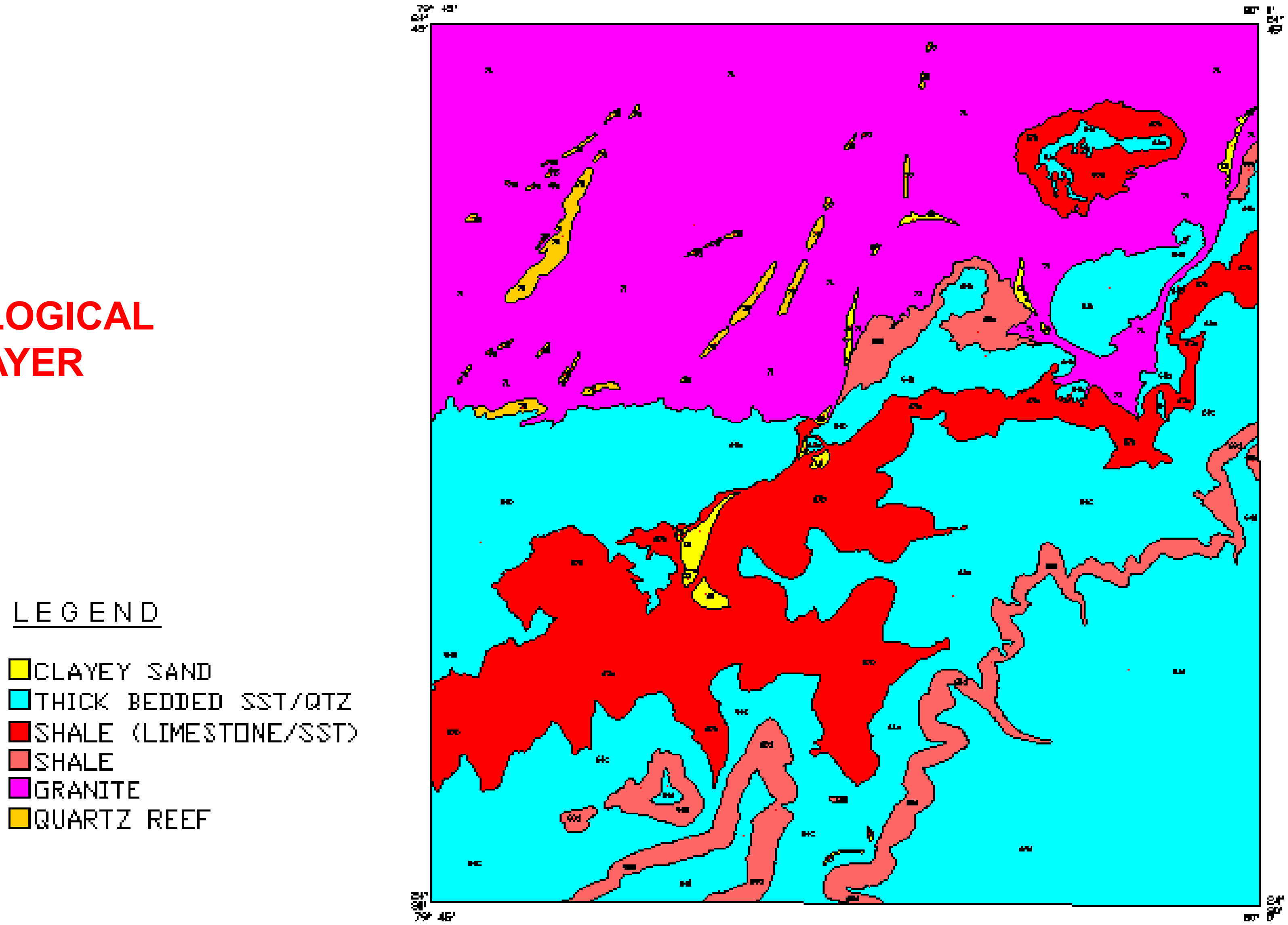
LITHOLOGICAL LAYER



PREPARATION OF GROUNDWATER POTENTIAL MAP

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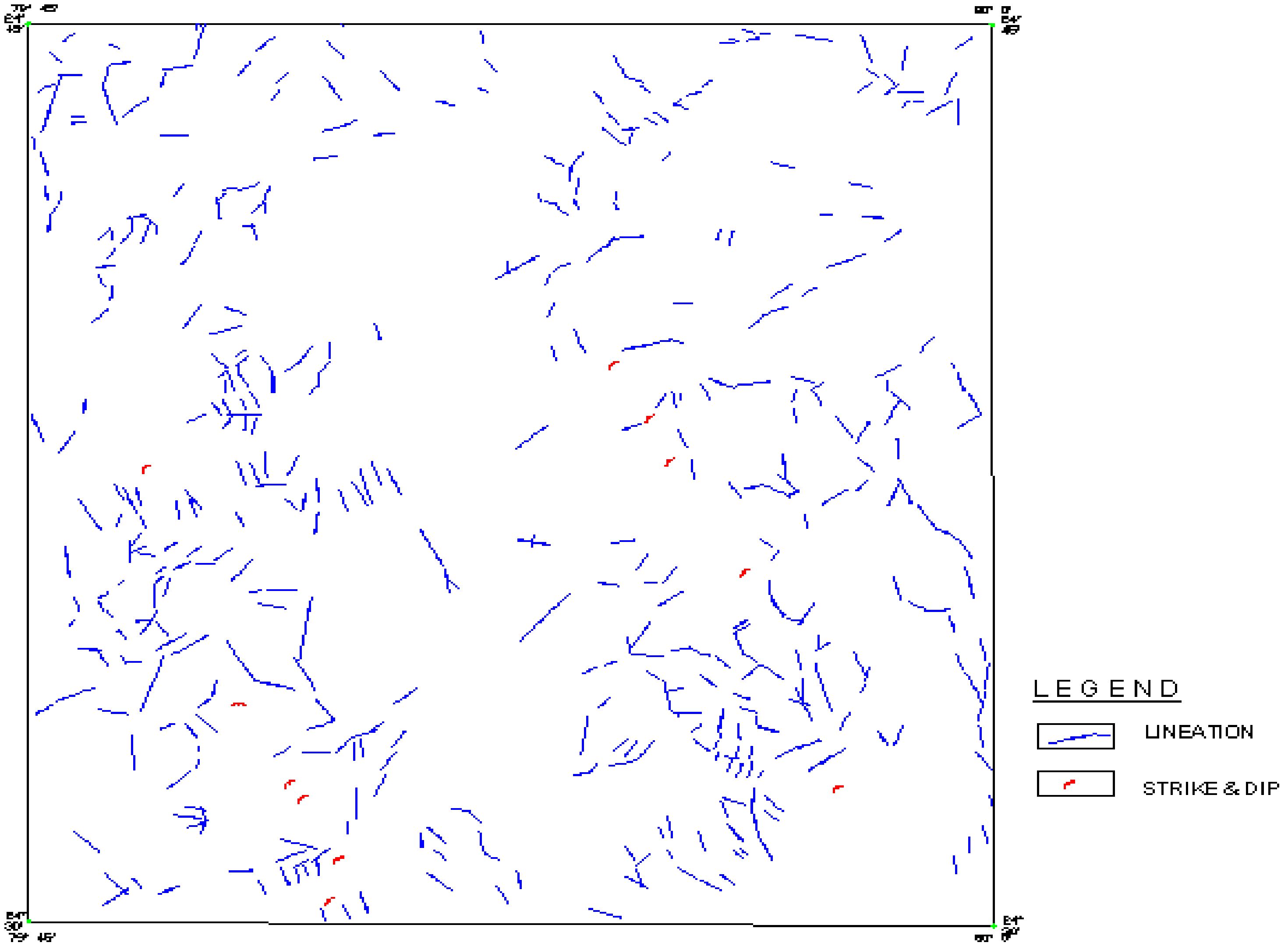
STRCUTURAL LAYER



PREPARATION OF GROUNDWATER POTENTIAL MAP

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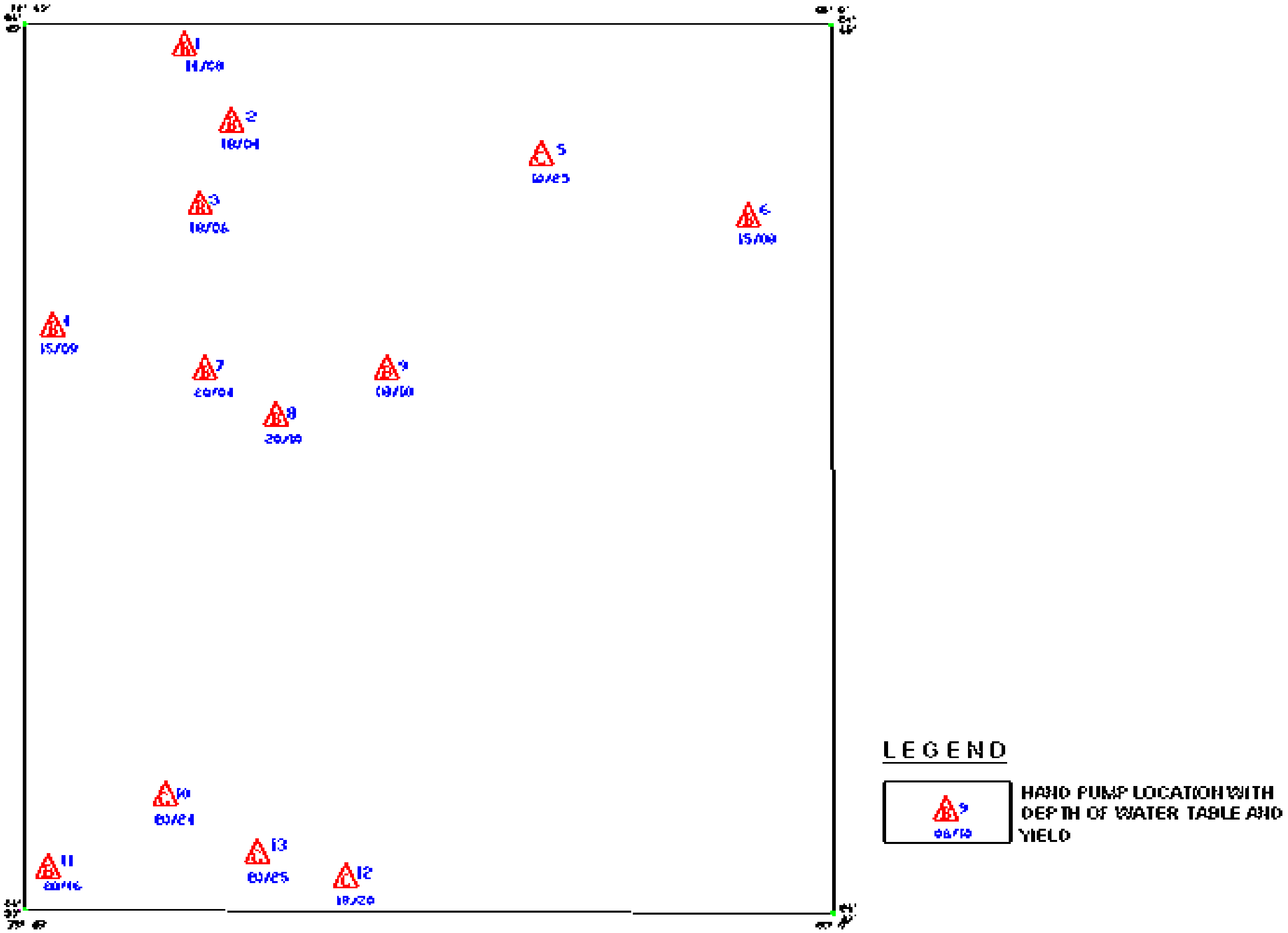
HYDROLOGICAL LAYER



MECL

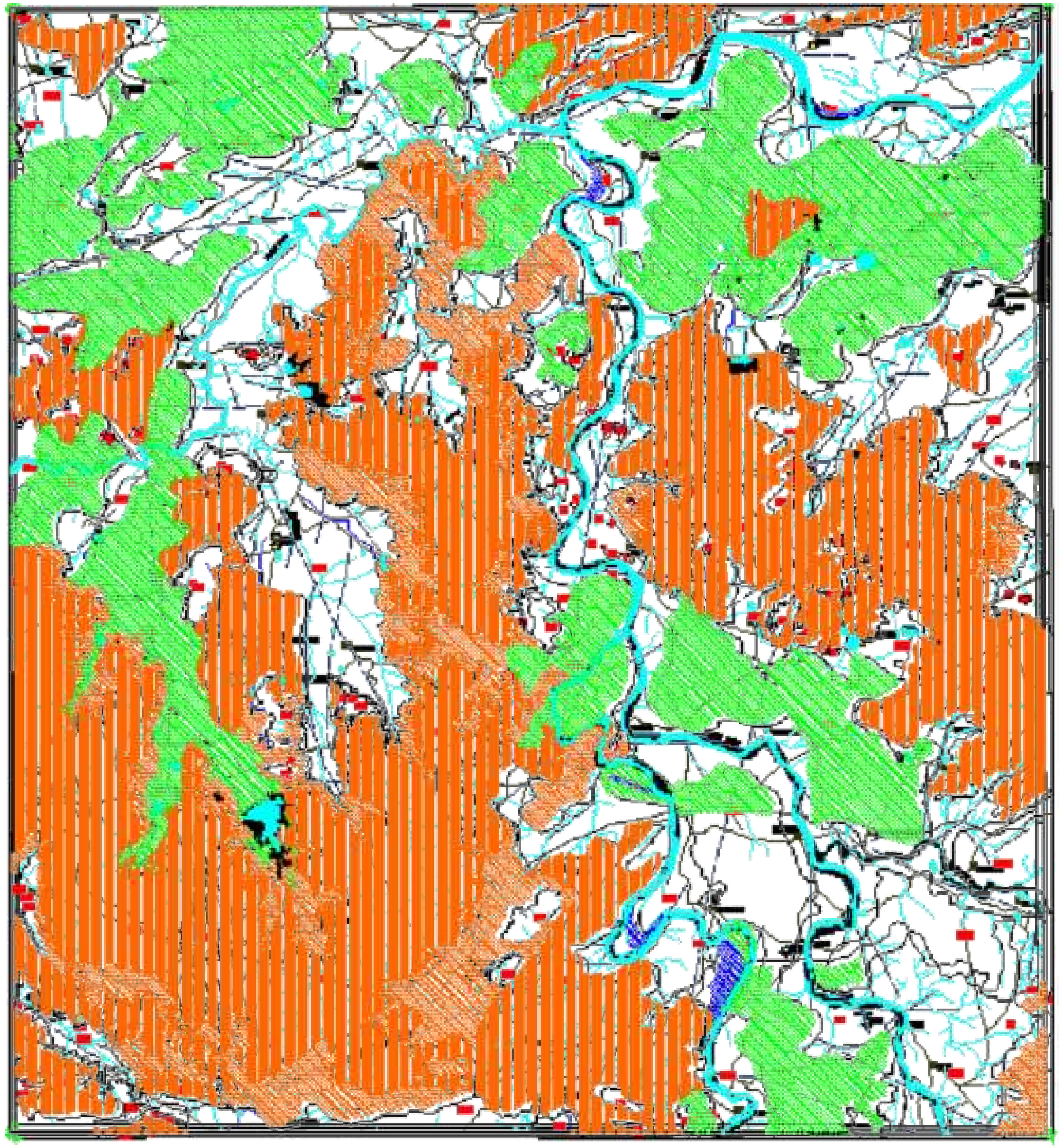
INFRASTRUCTURE

DRAINAGE

LINEAMENTS

LITHOLOGY

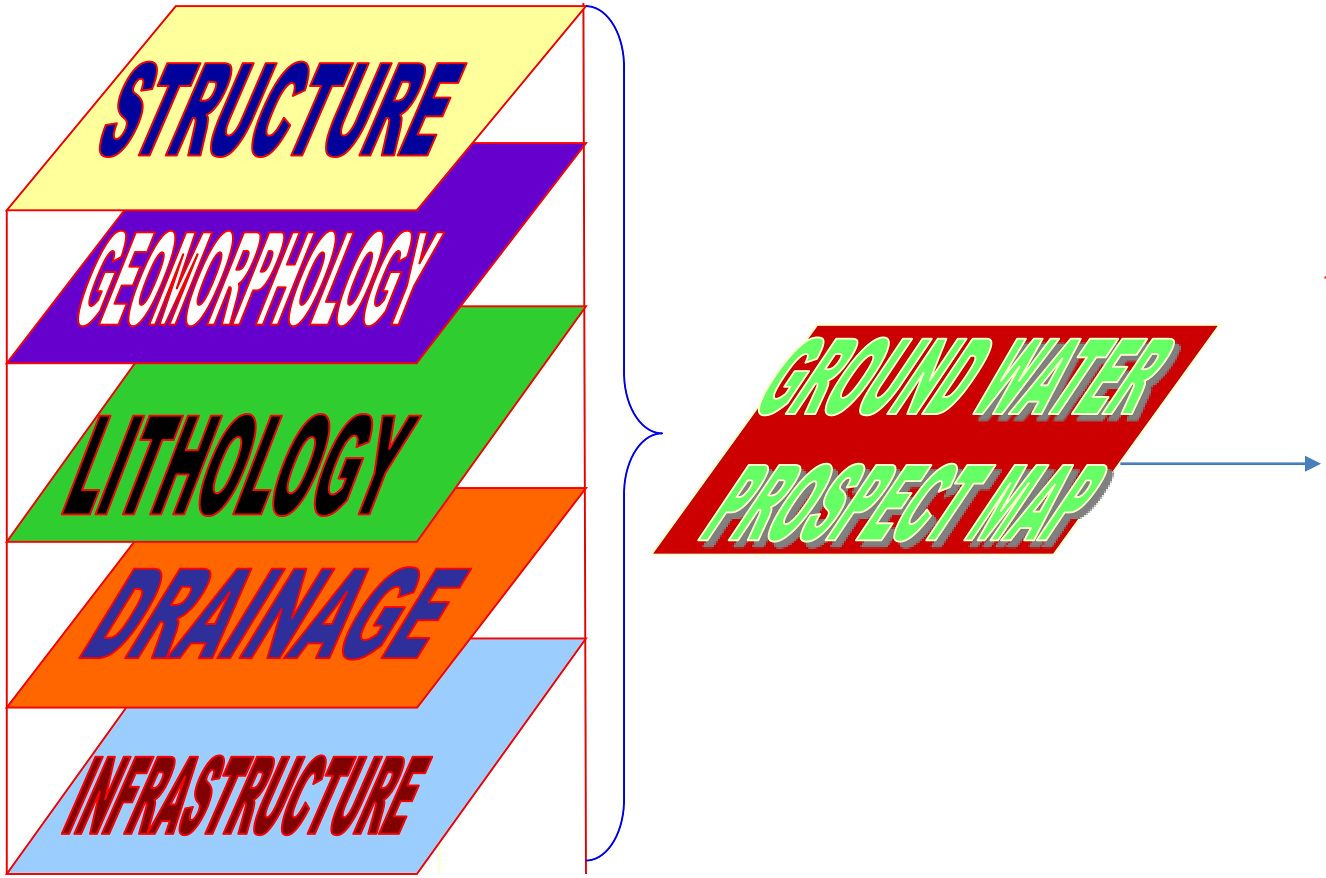
GEOMORPHOLOGY

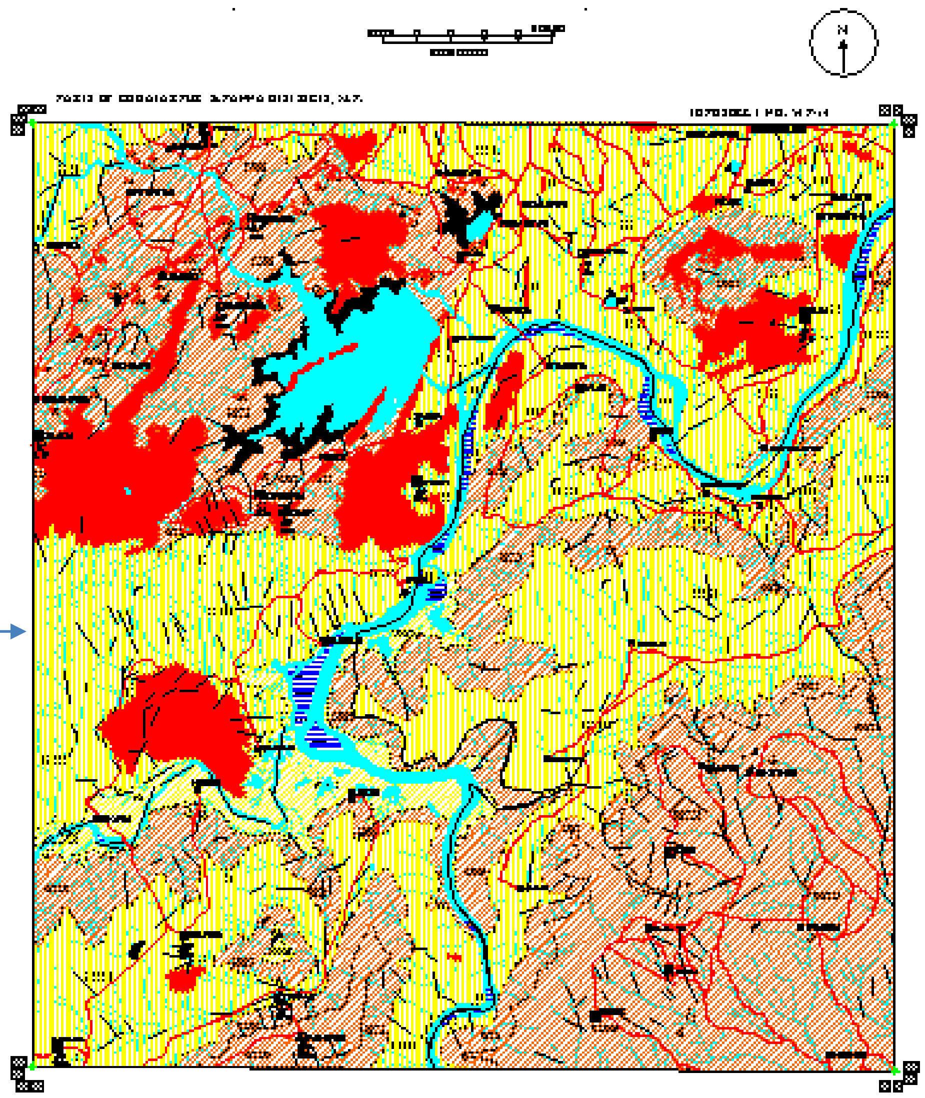


GROUND WATER POTENTIAL COMPOSITE MAP

GROUNDWATER POTENTIAL ZONE MAPPING

MECL

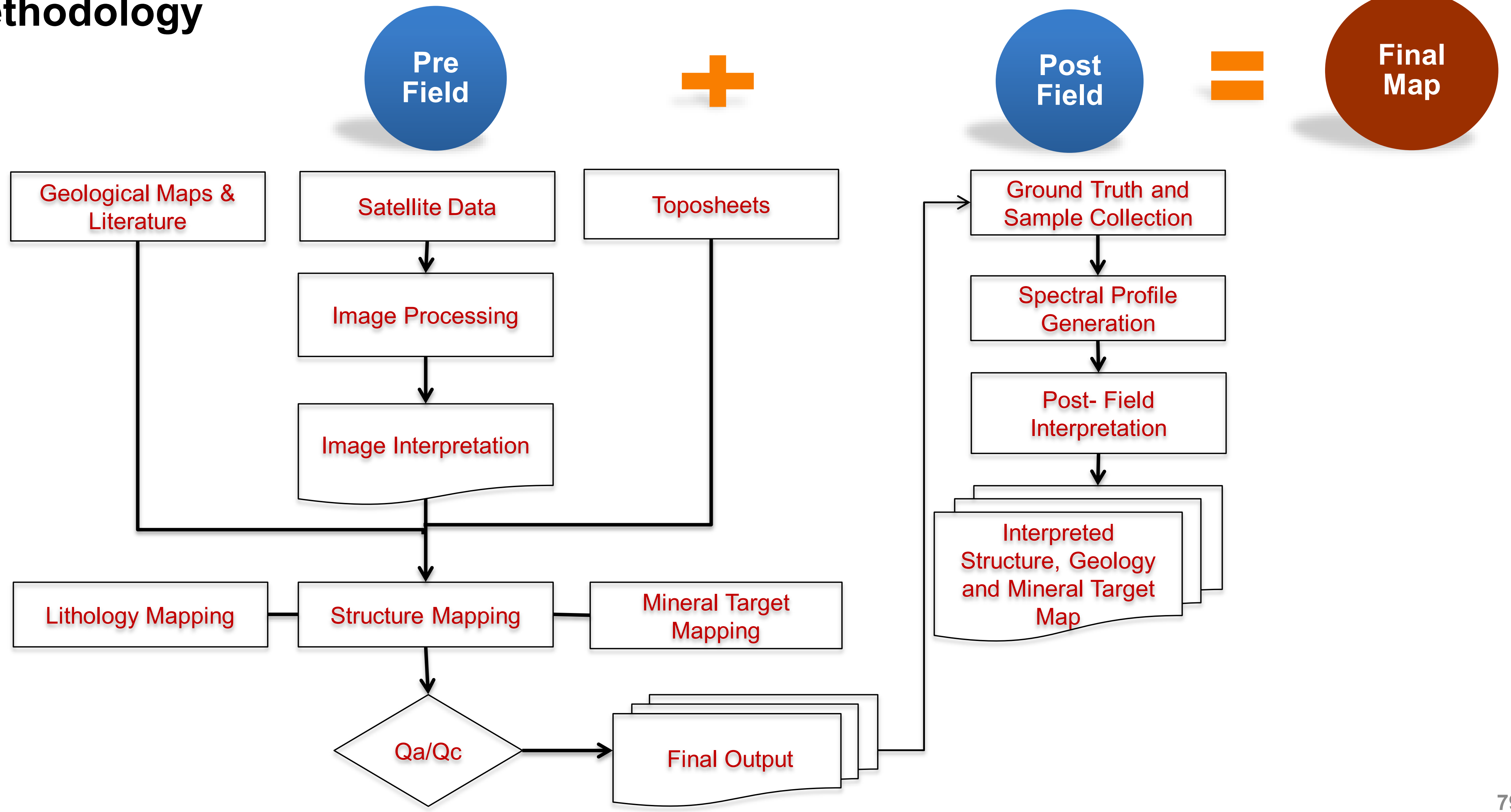




Parts of Chhatarpur District, MP

MECL

Methodology



Band Ratio

- All the minerals have peculiar and significant absorption and reflection characteristic in discrete bandwidths, which are diagnostic of its presence. A significant contrast can be achieved through ratio of the bands showing absorption and reflection to generate an output image, which is perceived as target mineral.

Principal Component Analysis (PCA)

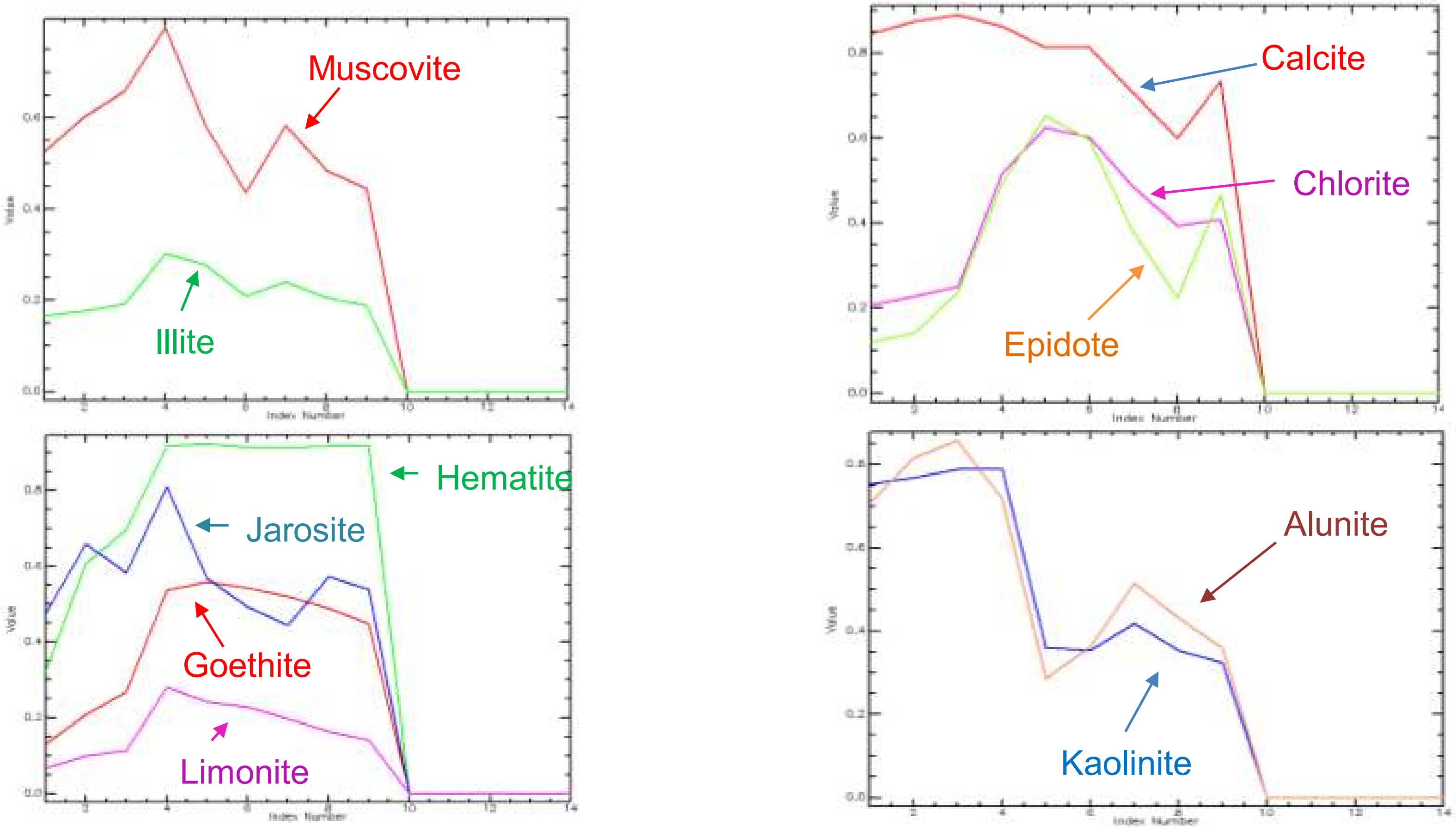
- Every feature on the earth's surface is sensed at different magnitude of reflection in different bandwidth in the high-resolution dataset. Every feature when passes at certain band shows characteristic spectral signature. PCA technique accumulates the characteristic signature of features into a single component that enable the interpretation of features as anomalous to the surrounding that renders easy interpretation.
- PCA attempts to statistically maximize the amount of information (or variance) from the original data into the least number of new components (PC Bands)

Minimum Noise Fraction (MNF)

- MNF is similar to PCA technique of multispectral remote sensing.
- And this technique is applied on hyperspectral data to segregate noise, determine the inherent dimensionality and to reduce the computational requirements for subsequent processing

Spectral Angle Mapper (SAM)

- The algorithm determines the spectral similarity between two spectra by calculating the angle between the spectra. Smaller angles represent closer matches to the reference spectrum.



Spectral Profile of Minerals Associated With Copper and Gold Deposit. ([Source : USGS](#))

PCA

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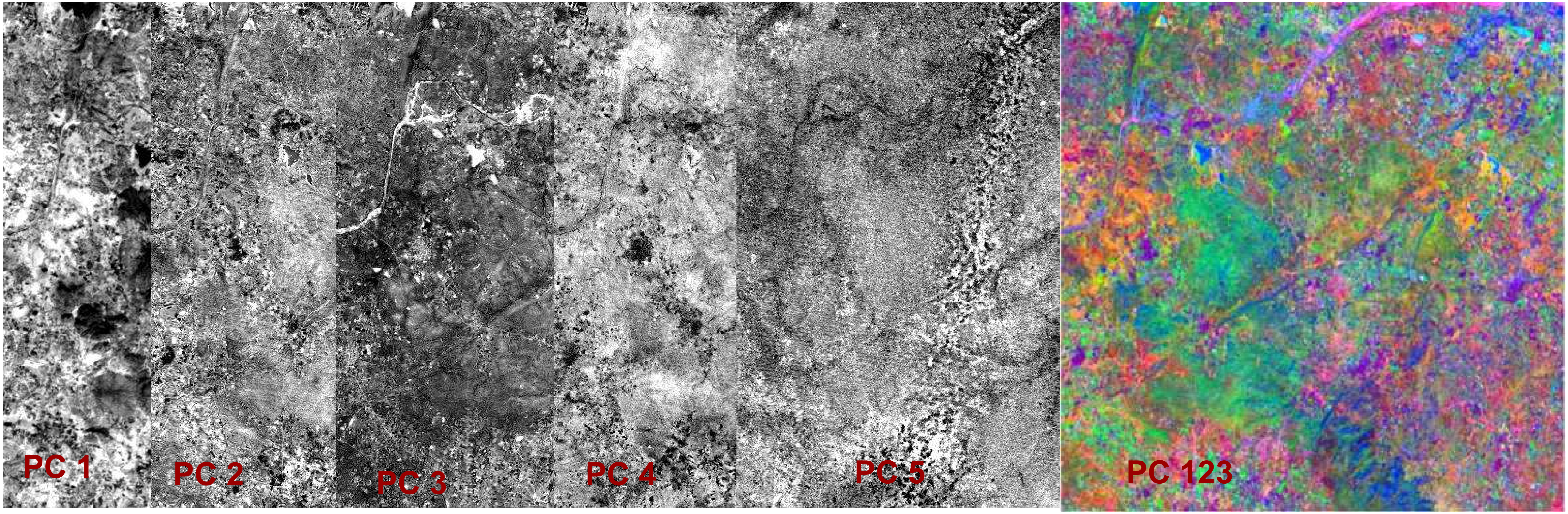

ENHANCEMENT OF ALTERATION MINERALS

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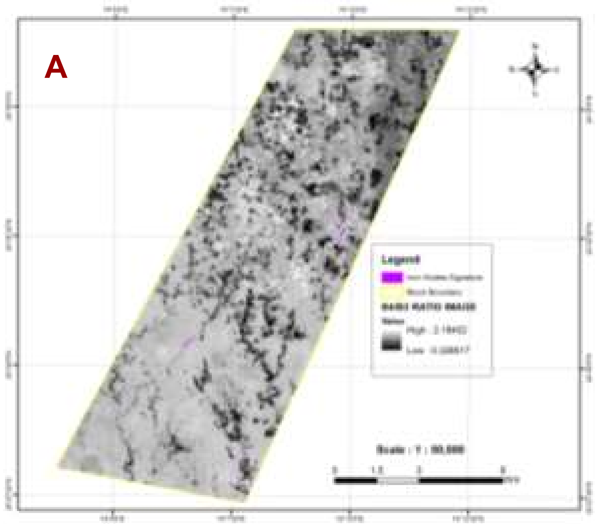
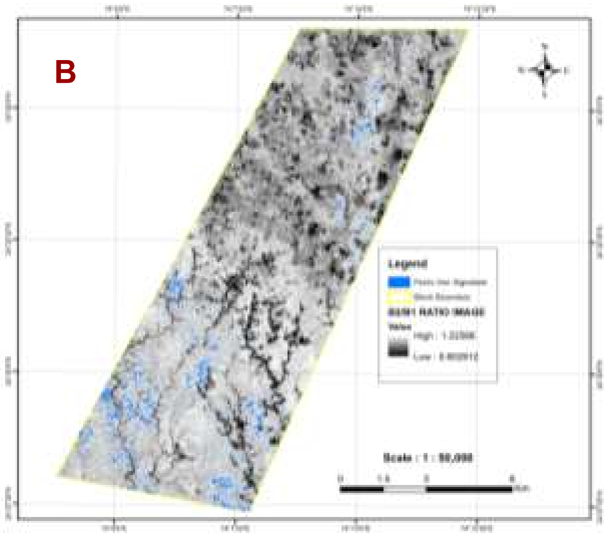
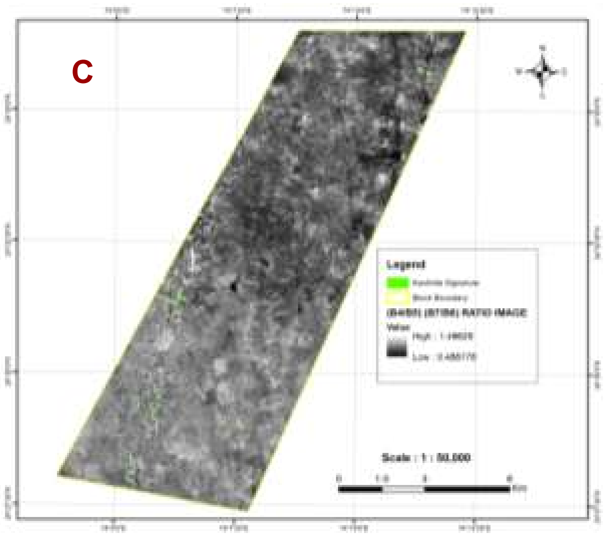


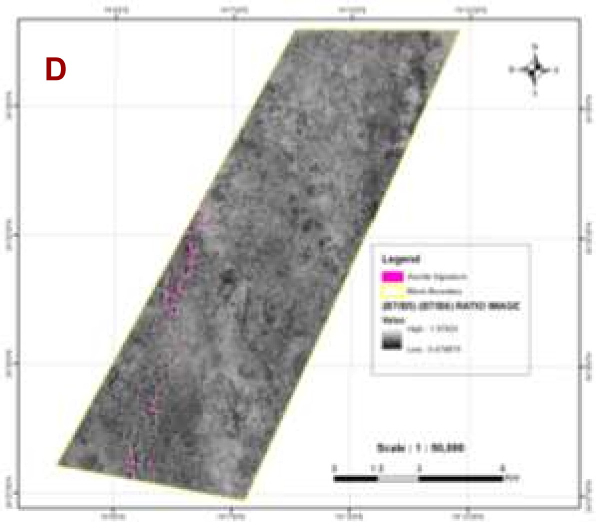
A. Aster B4/B3 Ratio Image For Iron Oxides



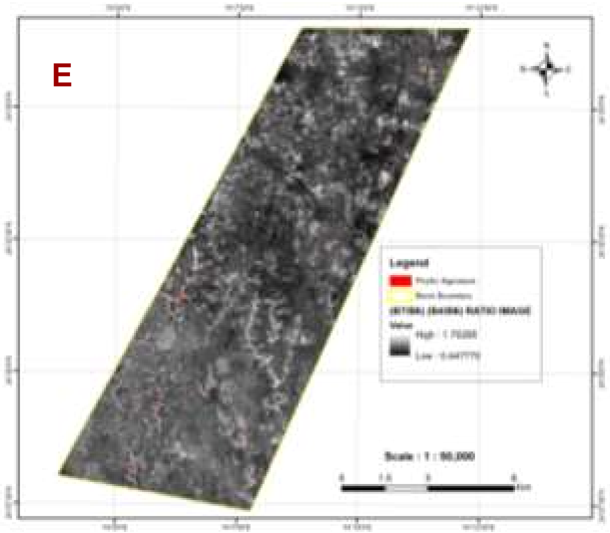
B. Aster B2/B1 Ratio Image For Ferric Iron



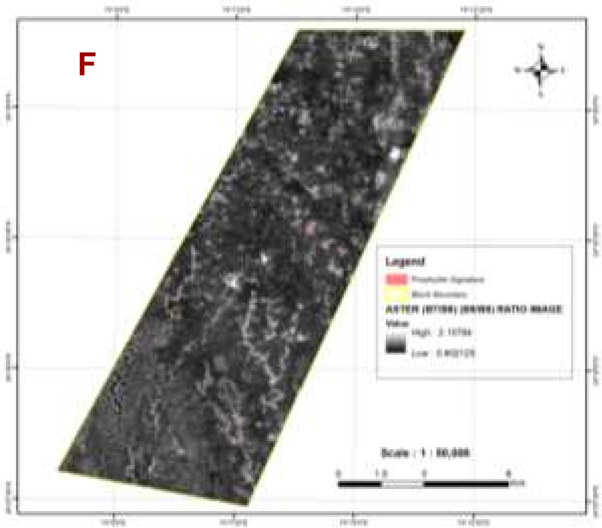
C. Aster (B4/B5) (B7/B6) Ratio Image For Kaolinite



D. Aster (B7/B5) (B7/B6) Ratio Image For Alunite



E. Aster (B7/B6) (B4/B6) Ratio Image Phyllic Alteration



F. Aster (B7/B8) (B9/B8) Ratio Image For Propylitic Alteration

LITHO STRUCTURAL MAP

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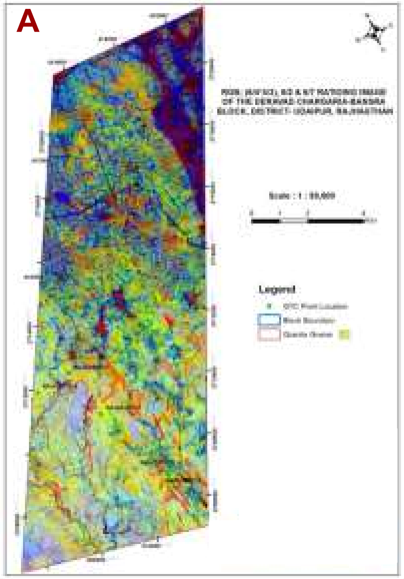
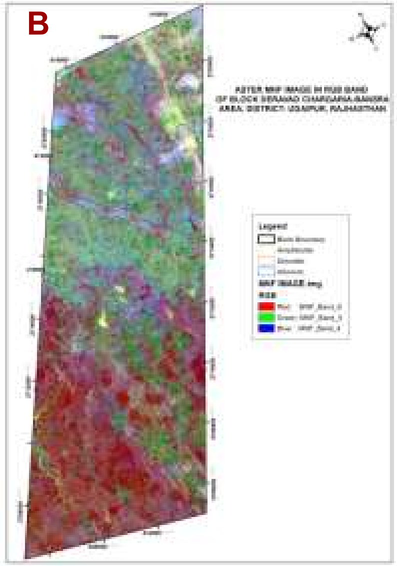
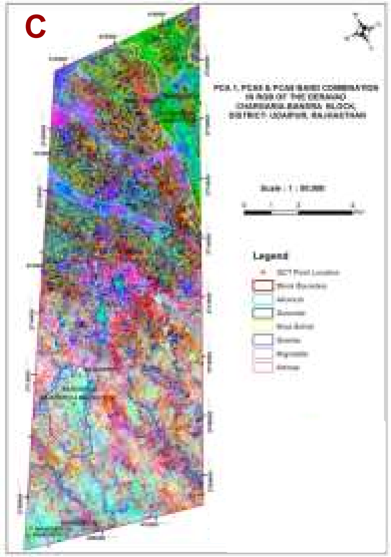


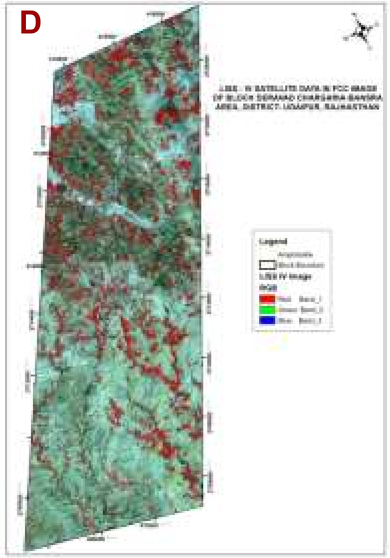
A. Landsat Band Ratio Image In RGB



B. ASTER MNF Image

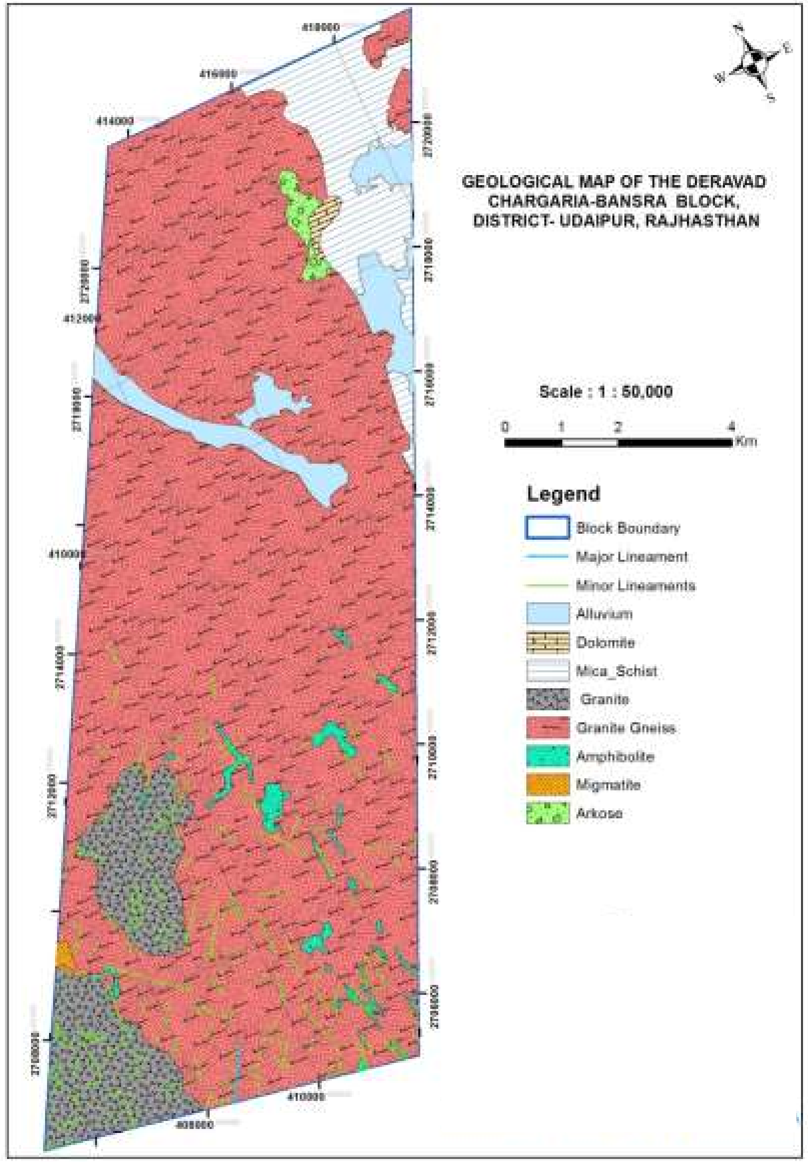


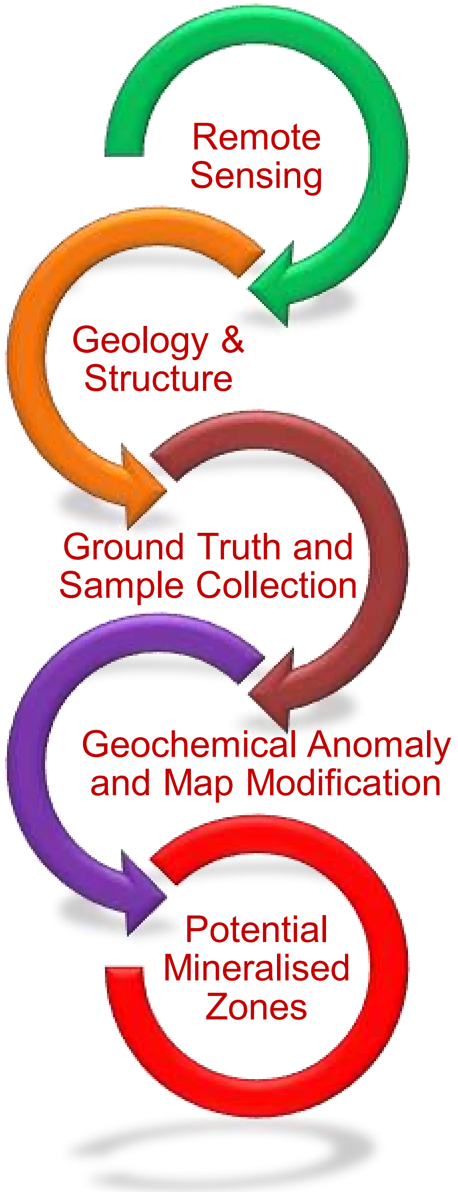
C. LANDSAT PCA Image



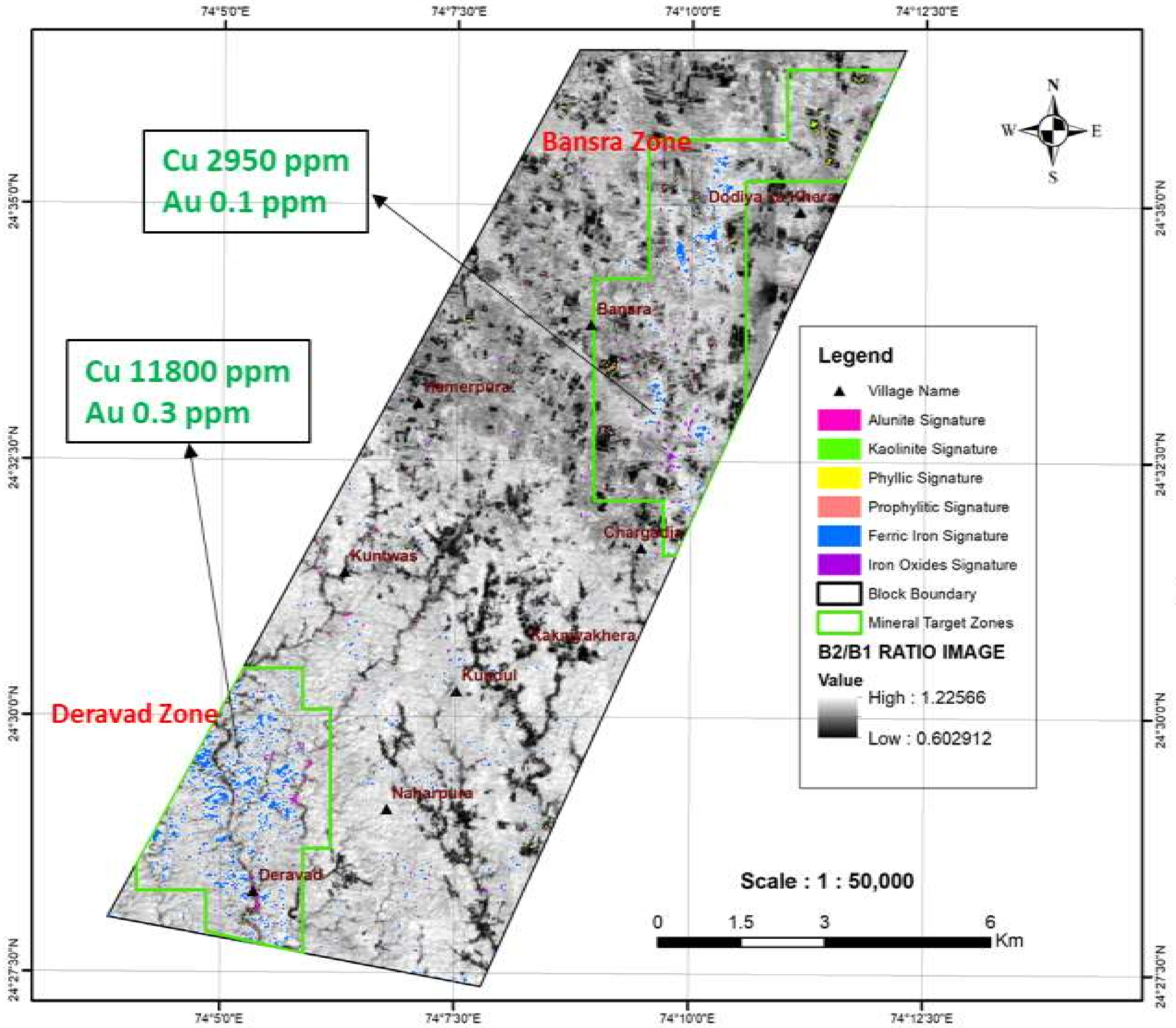
D. LISS-IV FCC Image

Litho Structural Map of The Block





Potential Mineralised Zones Map of The Study Area



GENERATION OF 3-D SURFACE

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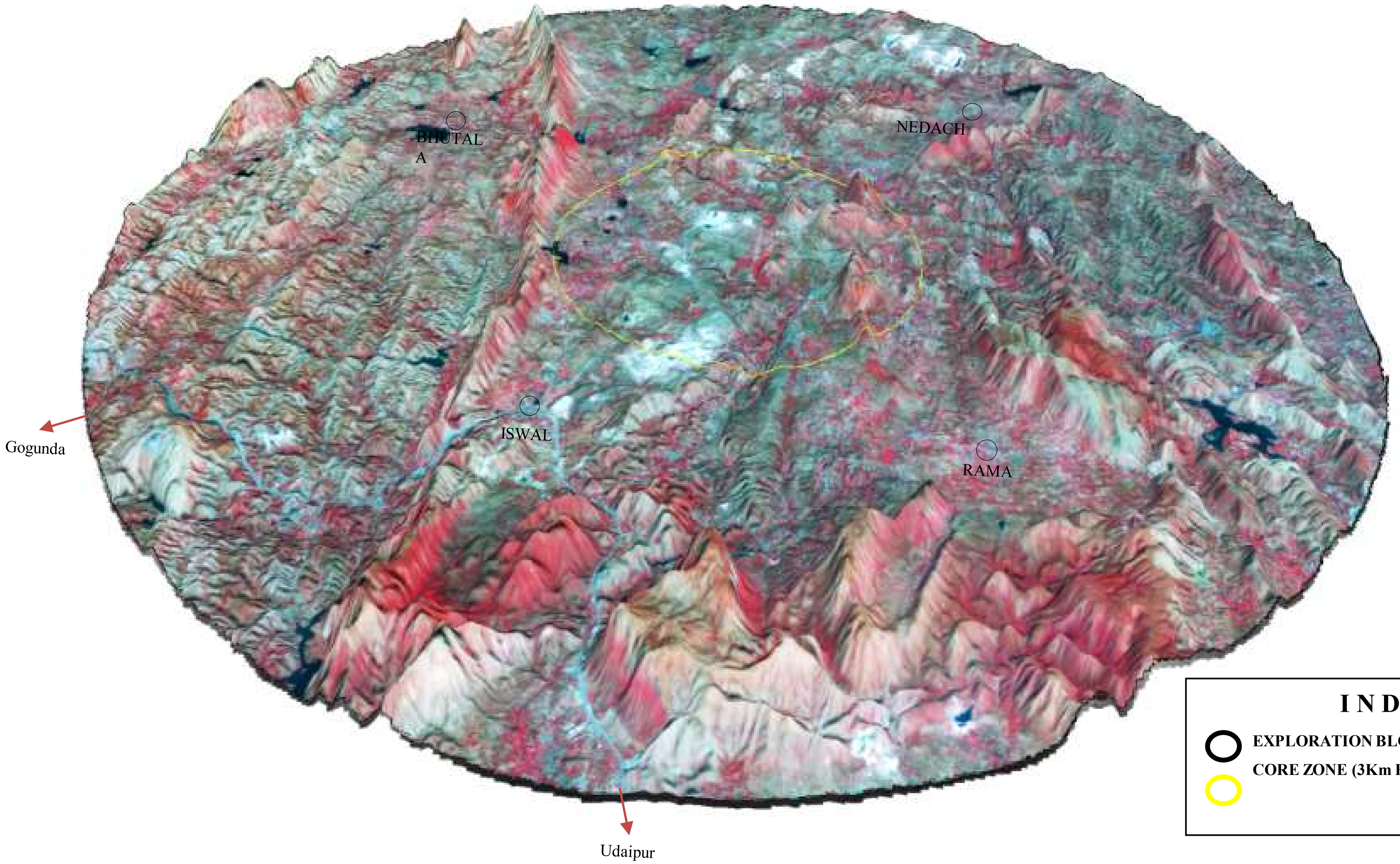
(10 km. RADIUS AREA FROM THE CENTRE OF EXPLORATION BLOCK)

IRS-R2, LISS-IV FMX, PATH – 093, ROW- 054
SUB SCENE –D. DOP- 10-12-2019

DIGITAL TERRAIN MODEL



SELU

INDEX

EXPLORATION BLOCK (10 Km Radius Area)
CORE ZONE (3Km Radius Area)

SELU MAGNESITE BLOCK, UDAIPUR, RAJASTHAN

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Geographic Information System

- ***Geographic***
  - relates to places on the Earth's surface *where* something is
  - *what* is at a given location
- ***Information System***
  - query, edit, visualize, manipulate, summarize
  - work with information stored in computer databases

- Geographic Information System (GIS) is a computer based information system designed to accept large volumes of spatial data derived from variety of sources and to efficiently store, retrieve, analyze, model and display (output) these data according to user defined specifications.
- GIS handles Spatial Information

  - Information referenced by its location in space

- GIS makes connections between activities based on spatial proximity

GIS: Historical Background

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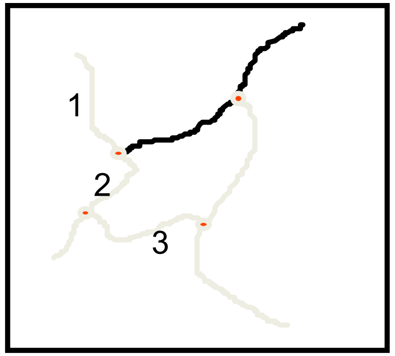
This technology has developed from:

- *Digital cartography and CAD*
- *Data Base Management Systems*



CAD System

ID	X,Y
1	
2	
3	

ID	ATTRIBUTE
1	
2	
3	

Data Base Management System

Components of a GIS

1. Hardware

- *Hardware is the computer on which a GIS operates.*
- *Today, GIS software runs on a wide range of hardware types, from centralized computer servers to desktop computers used in stand-alone or networked configurations*

2. Software

GIS software provides the functions and tools needed to store, analyze, and display geographic information.

- *Key software components are:*
  - *Tools for the input and manipulation of geographic information*
  - *A database management system (DBMS)*
  - *Tools that support geographic query, analysis, and visualization*
  - *A graphical user interface (GUI) for easy access to tools*

3. Data

- *Possibly the most important component of a GIS is the data*
- *Geographic data and related tabular data can be collected in-house or purchased from a commercial data provider*

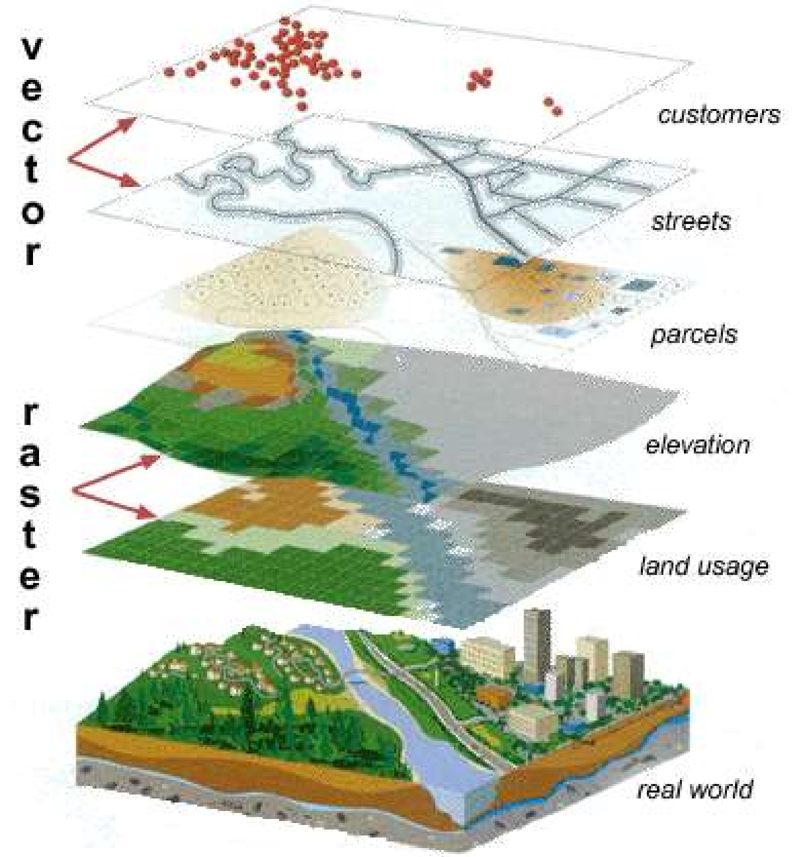
4. People

- *GIS technology is limited without the people who manage the system and develop plans for applying it to real-world problems*
- *GIS users range from technical specialists who design and maintain the system to those who use it to help them perform their everyday work*

5. Methods

- *A successful GIS operates according to a well-designed plan and business rules, which are the models and operating practices unique to each organization.*

Spatial data are organized into layers



GIS Thematic Layers and Data Sets

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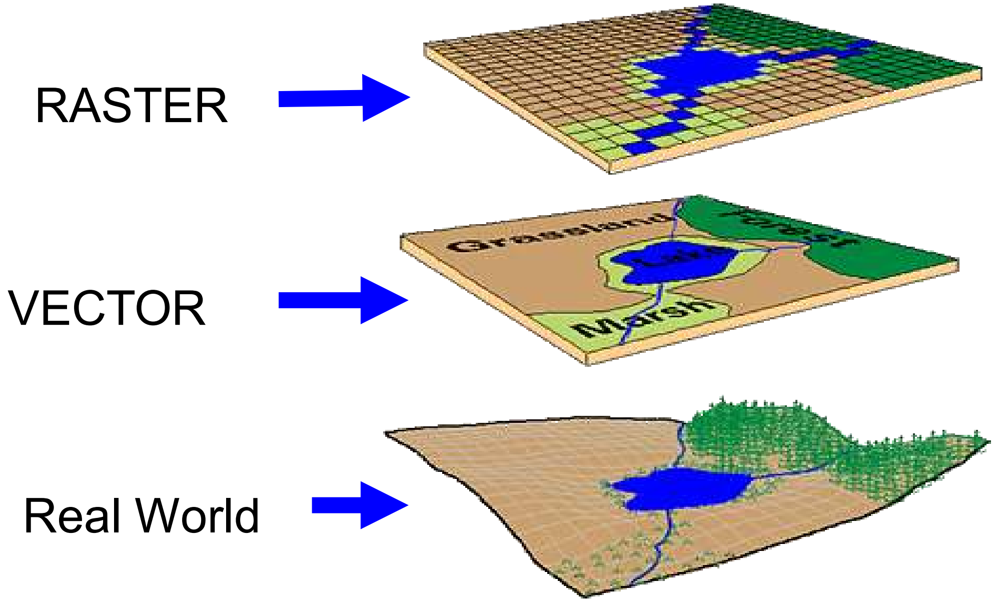
- GIS organizes geographic data into a series of thematic layers and tables
- Data in a GIS are referenced to geography, they have real-world locations and could overlay one another

Geospatial data

- **Two main components:**
  - **<u>Spatial</u> component: *Where is it?***
  - **<u>Non-spatial (thematic)</u> component: *What is it?***

Representing Spatial Elements



Representing Spatial Elements

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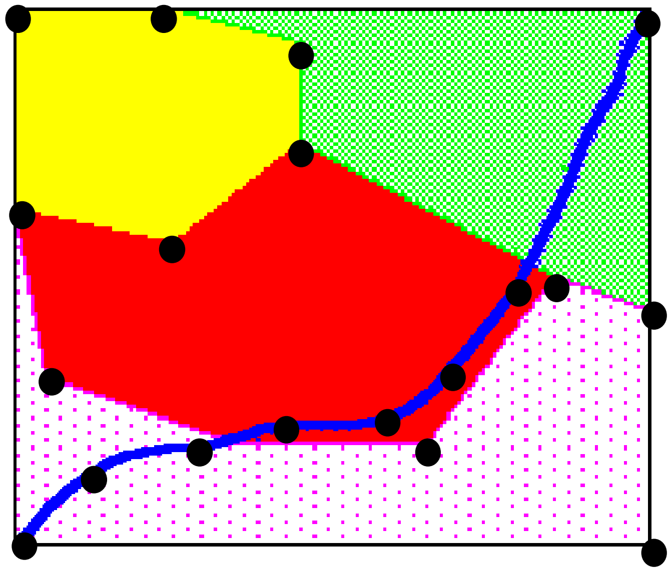
Vector

- Allows user to specify specific spatial locations and assumes that geographic space is continuous, not broken up into discrete grid squares
- We store features as sets of X,Y coordinate pairs.



Vector Data Types

- Vector data is composed of discrete coordinates
- e.g. points, line (also polylines) and polygons
- Coordinates are typically provided in geographic format (latitude/longitude) or UTM

Vector Data Types

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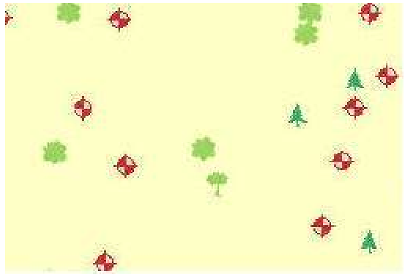
Points: A 0-dimensional object is a point that specifies a geographic location on the surface of the planet . e.g. water well



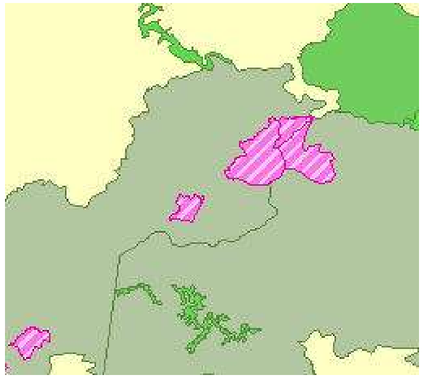
Lines: The simplest 1-dimensional object is a straight line between two points or polyline when there are more than two points.

Lines are having direction and magnitude (length) hence a vector data

e.g. Roads, canals, rivers etc.

Polygons (area): It is 2-dimensional object.

- An area is fully encompassed by a series of connected lines
- Because lines have direction, the system can determine the area that falls within the lines comprising the polygon.
- Each polygon contains one type of data (e.g., vegetation, streets, and dispatch locations would be different polygons)



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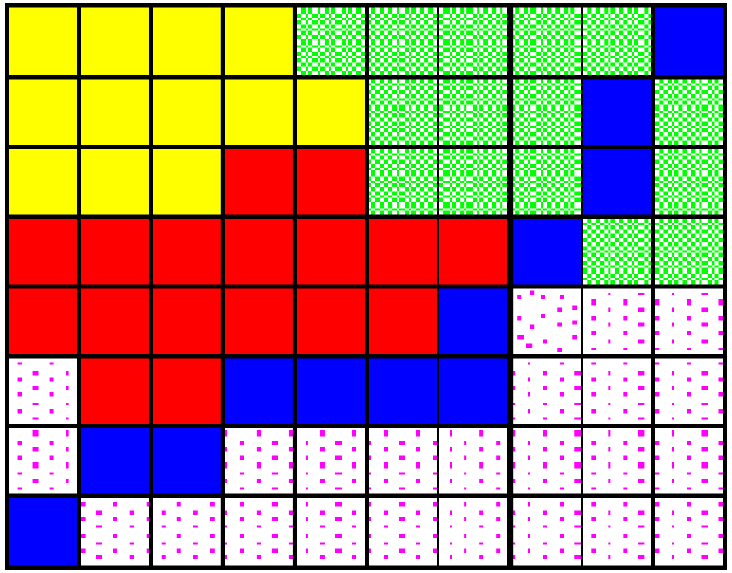
Raster

- Stores images as rows and columns of numbers with a Digital Value/Number (DN) for each cell
- Units are usually represented as square grid cells that are uniform in size
- Data is classified as "*continuous*" (such as in an image), or *"thematic"* (where each cell denotes a feature type.
- Numerous data formats (TIFF, GIF, ERDAS.img etc)



Vector vs. Raster

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Vector Advantages

- Accurate positional information that is best for storing discrete thematic features (e.g., roads, shorelines, sea-bed features.
- Compact data storage requirements
- Can associate unlimited numbers of attributes with specific features

Raster Advantages

- The most common data format
- Easy to perform mathematical and overlay operations
- Satellite information is easily incorporated
- Better represents “continuous”- type data

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GEO-REFERENCING

OF

CADASTRAL MAPS

MOSAIC CADASTRAL MAP OF TALAIPALLI (NTPC BLOCK) DISTRICT-RAIGARH,CHHATISHGARH

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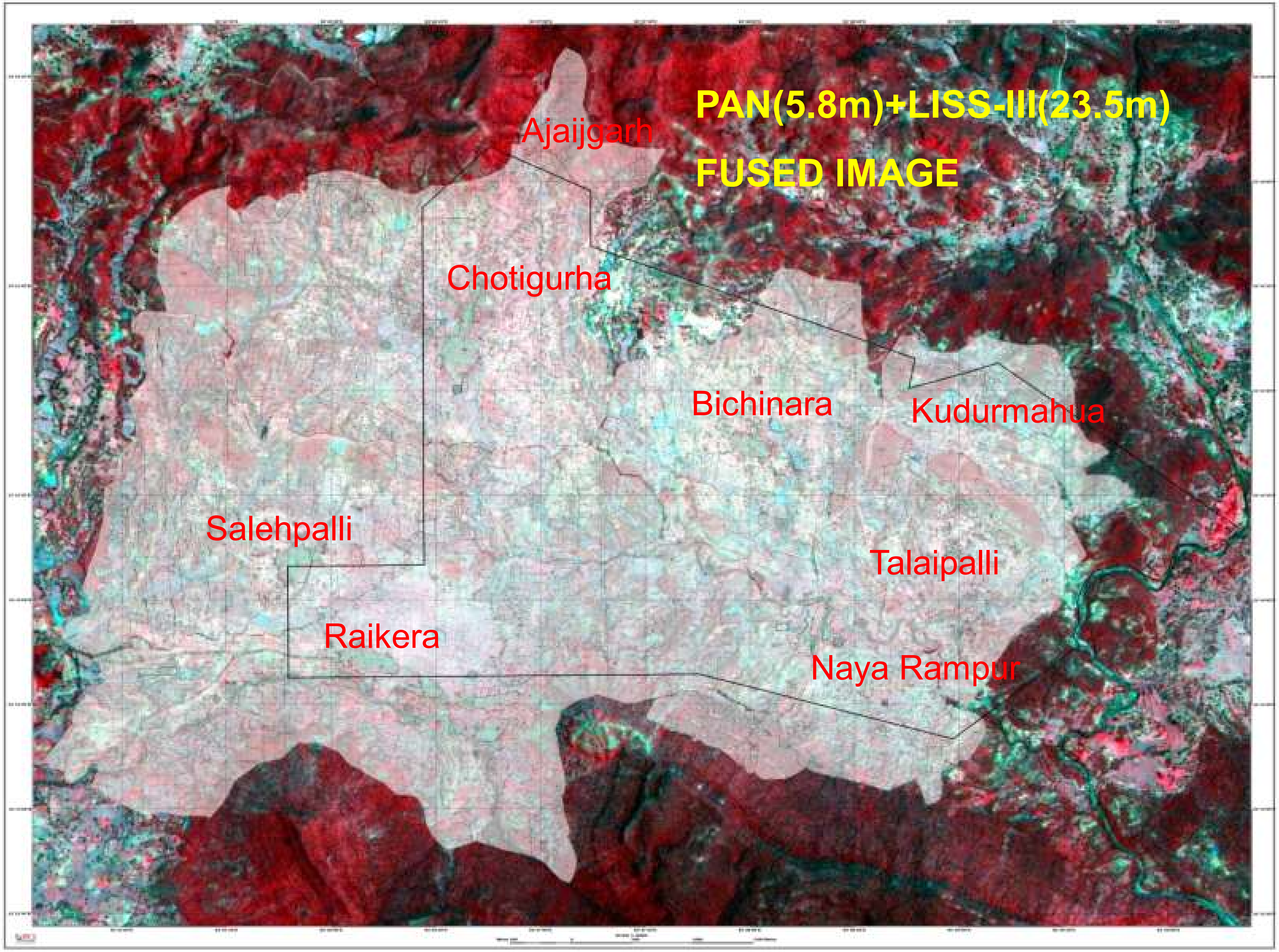

MOSAIC CADASTRAL MAP OF TALAIPALLI (NTPC BLOCK) DISTRICT-RAIGARH,CHHATISHGARH

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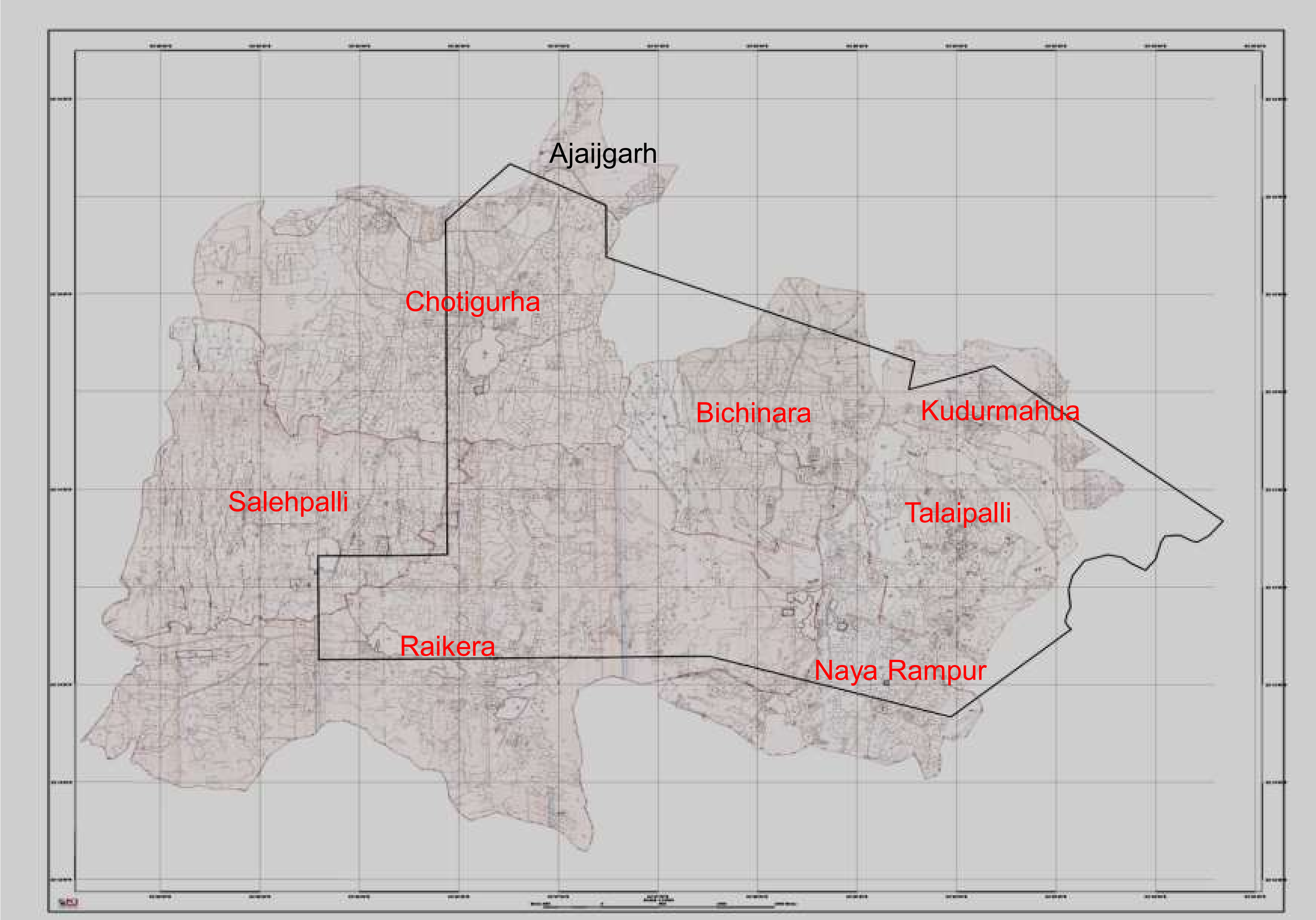

Thank You for Kind Attention