Co-funded by the Erasmus+ Programme of the European Union

Urban Resilience and Adaptation for India and Mongolia

Curricula, capacity, ICT and stakeholder collaboration to support green & blue infrastructure and nature-based solution

Report on:

Lecture Material

Partner number: P12

Nirma University, Gujarat, India

Disclaimer

Presentation Titles:

1. Intro to GIS Applications and Remote Sensing
2. Maps & Coordinate system
3. ARCmap Intro & Georeferencing
4. ARC MAP Create Shapefile
5. Urban Morphology and Key Terminology
6. Environmental Design and GIS Applications

GIS Applications and Remote Sensing

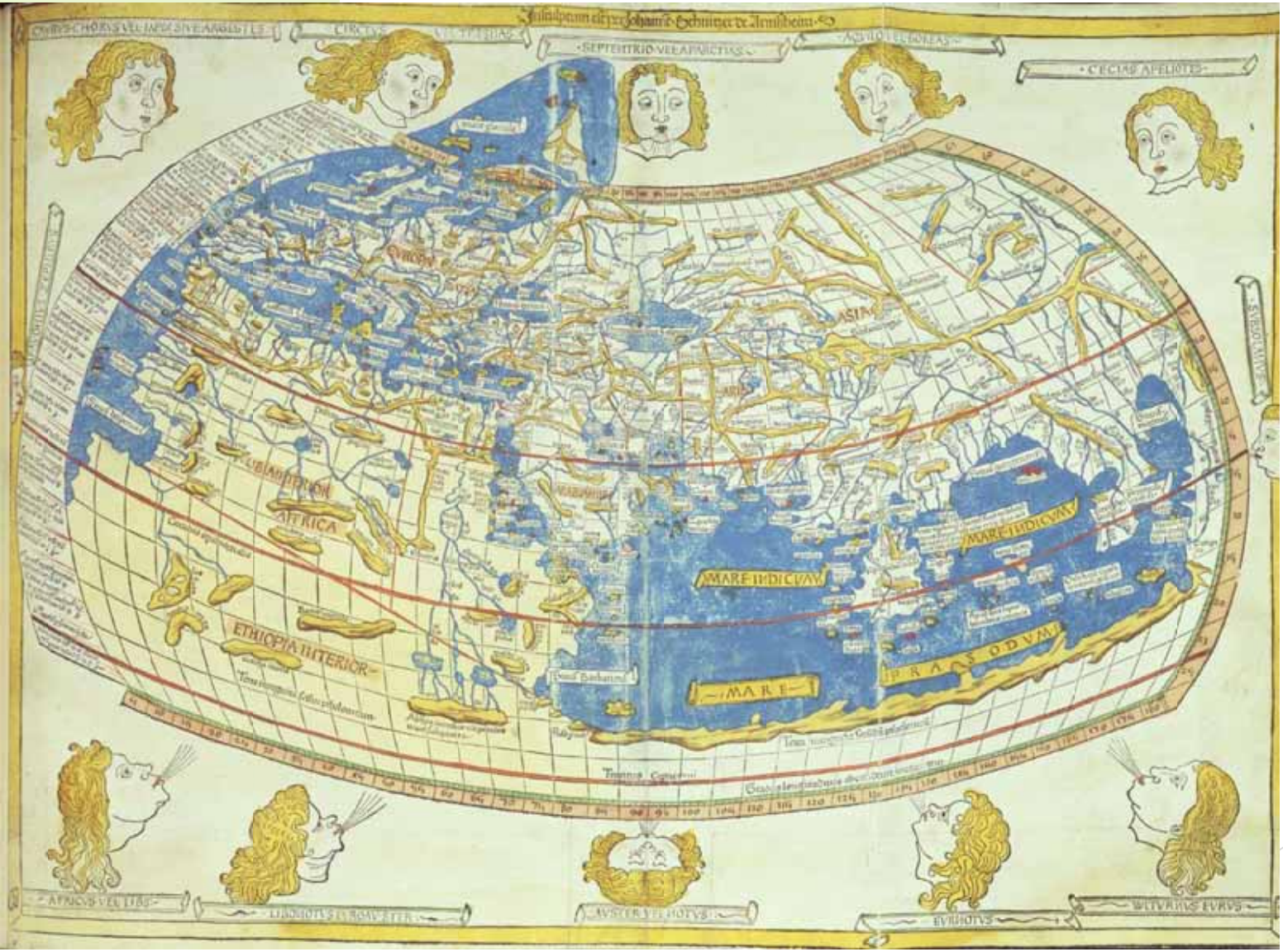
By Peeyush Purohit

- Why Mapping is important?

1. Maps **Simplify Complicated Information**
2. Maps are **Functional Tools**
3. Maps Help Students to **Acquire Life Skills**
4. Maps Can **Save Your Life**
5. Maps are a **Blueprint** of **Our History**
6. Maps **Connect** You to **Your Memories**

• Mapping

The greatest contribution of Ptolemy was not the maps themselves but the **concepts behind the maps.** He offered **three different methods of map projections.**

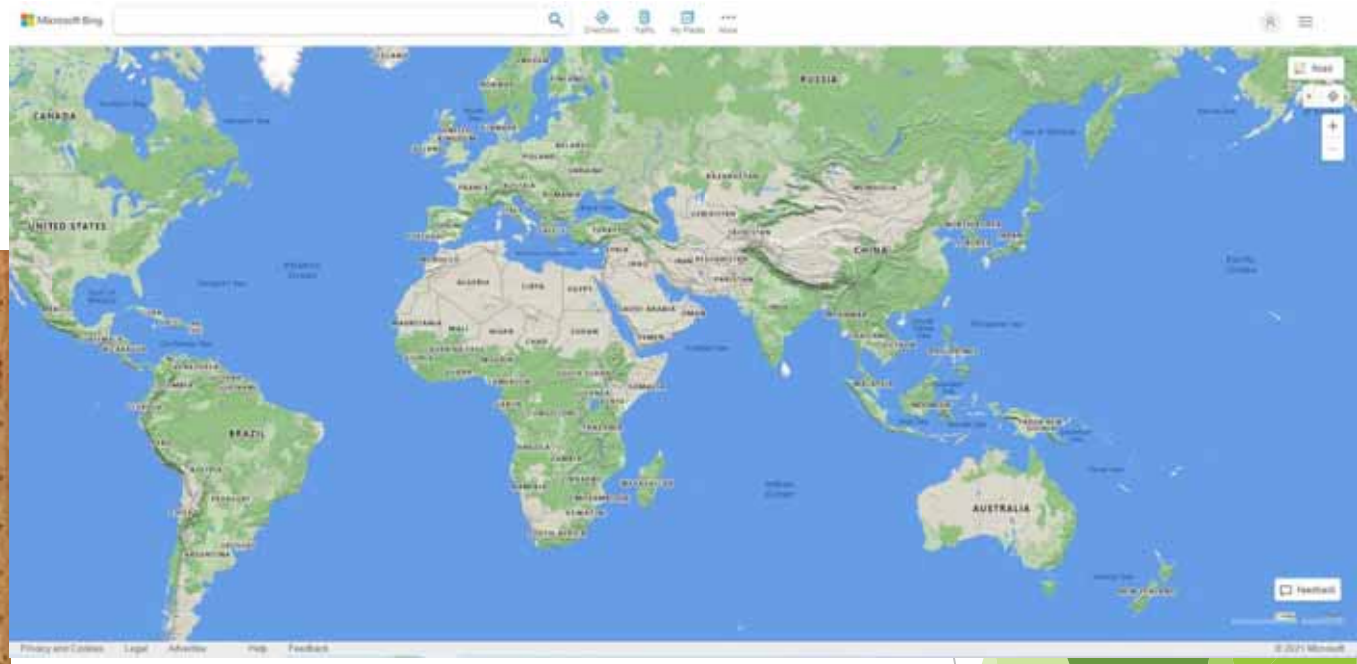


He invented the **concept of latitude and longitude,** a mapping system still commonly used today.

Claudius Ptolemy
AD 150

• Mapping

Microsoft Bing - Maps

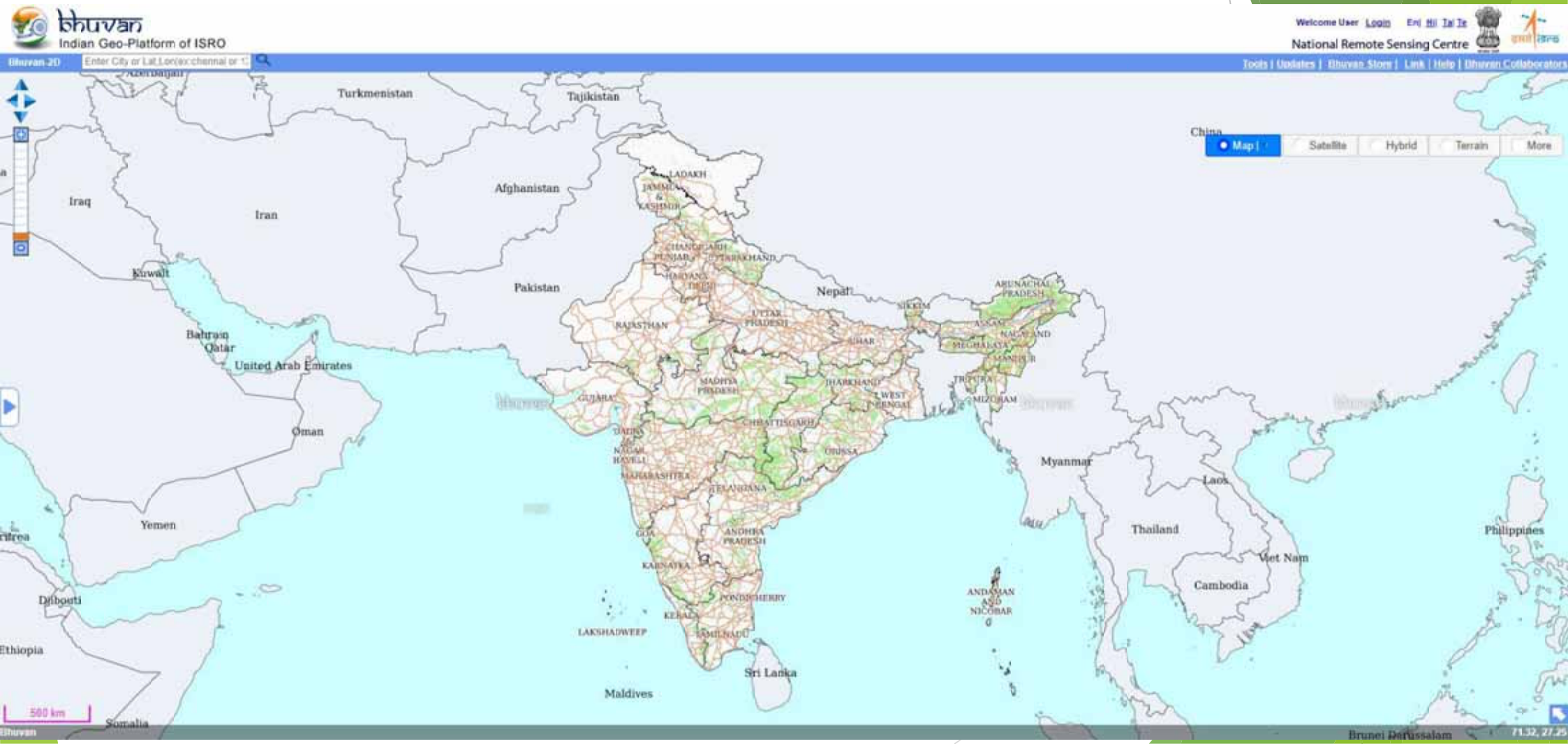


Old Map

ESRI Map Layers

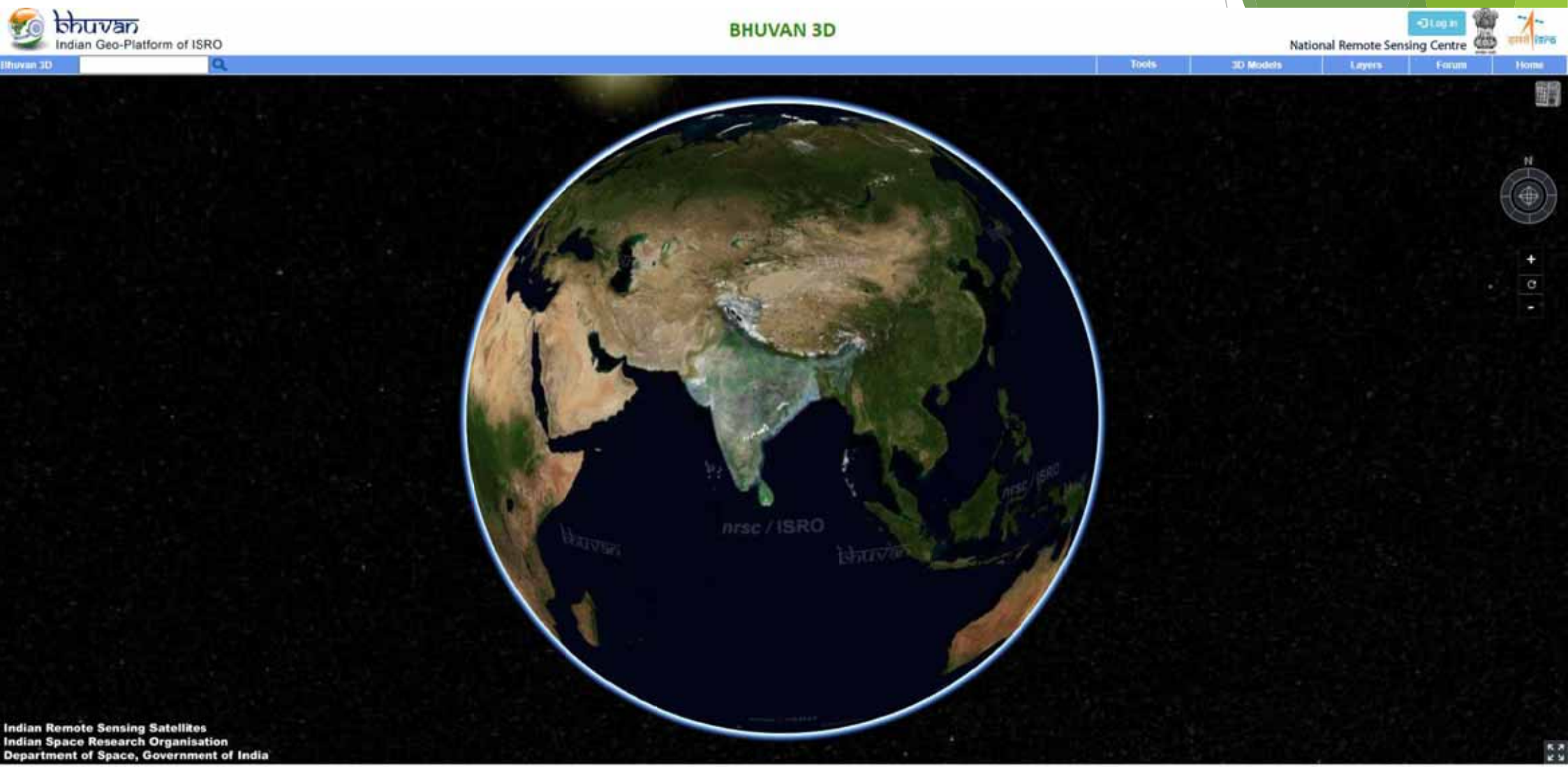
- Mapping

Bhuvan – 2D Maps



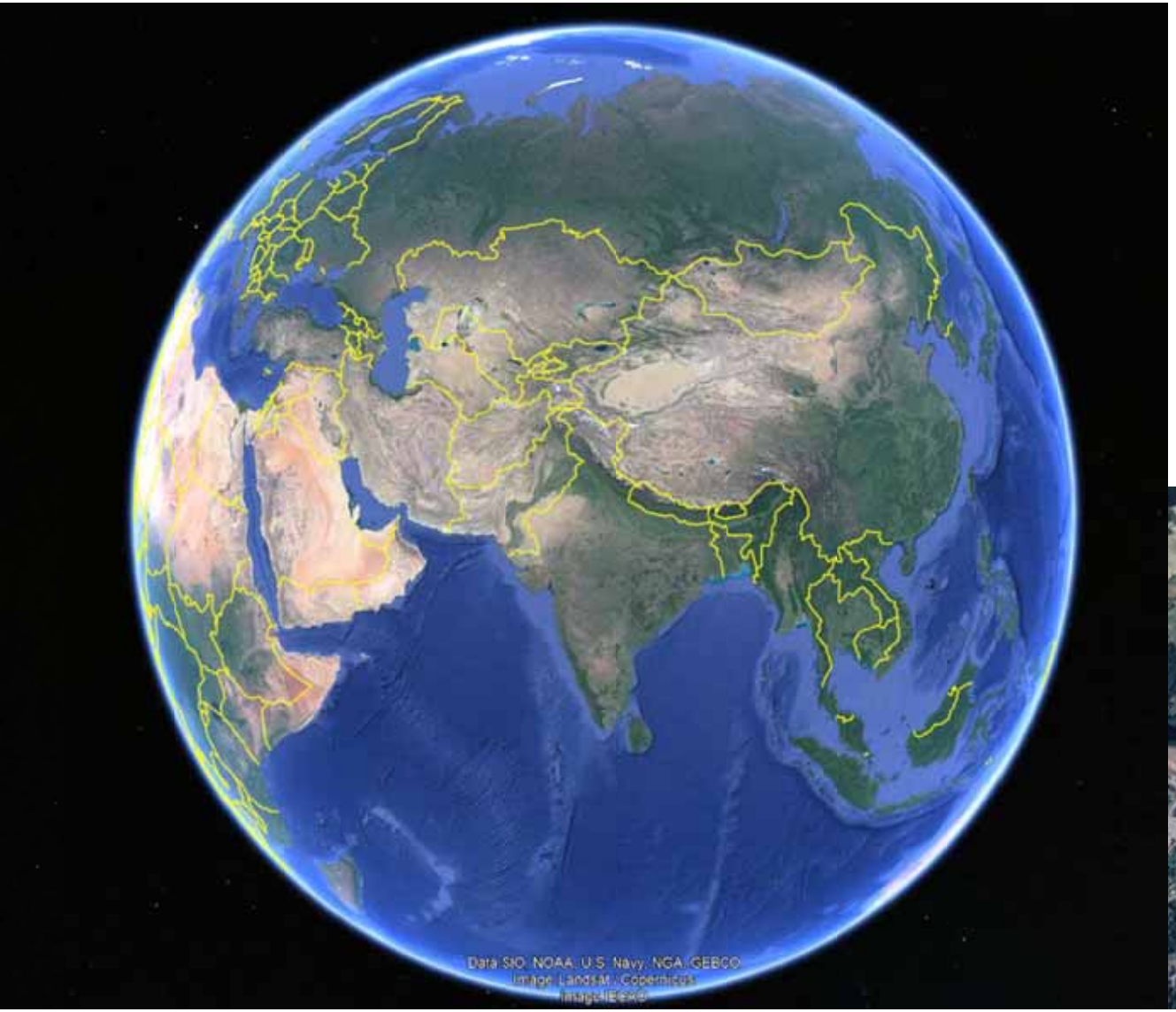
- Mapping

Bhuvan – 3D Maps



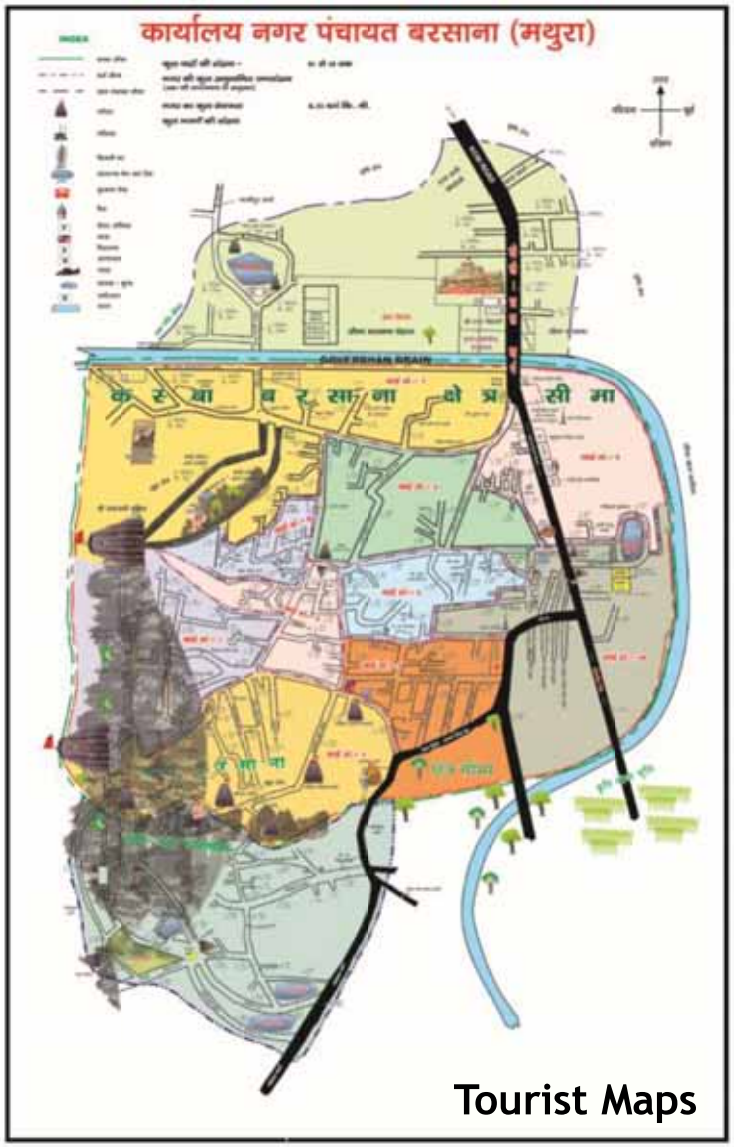
- Mapping

Google Earth – 3D Maps



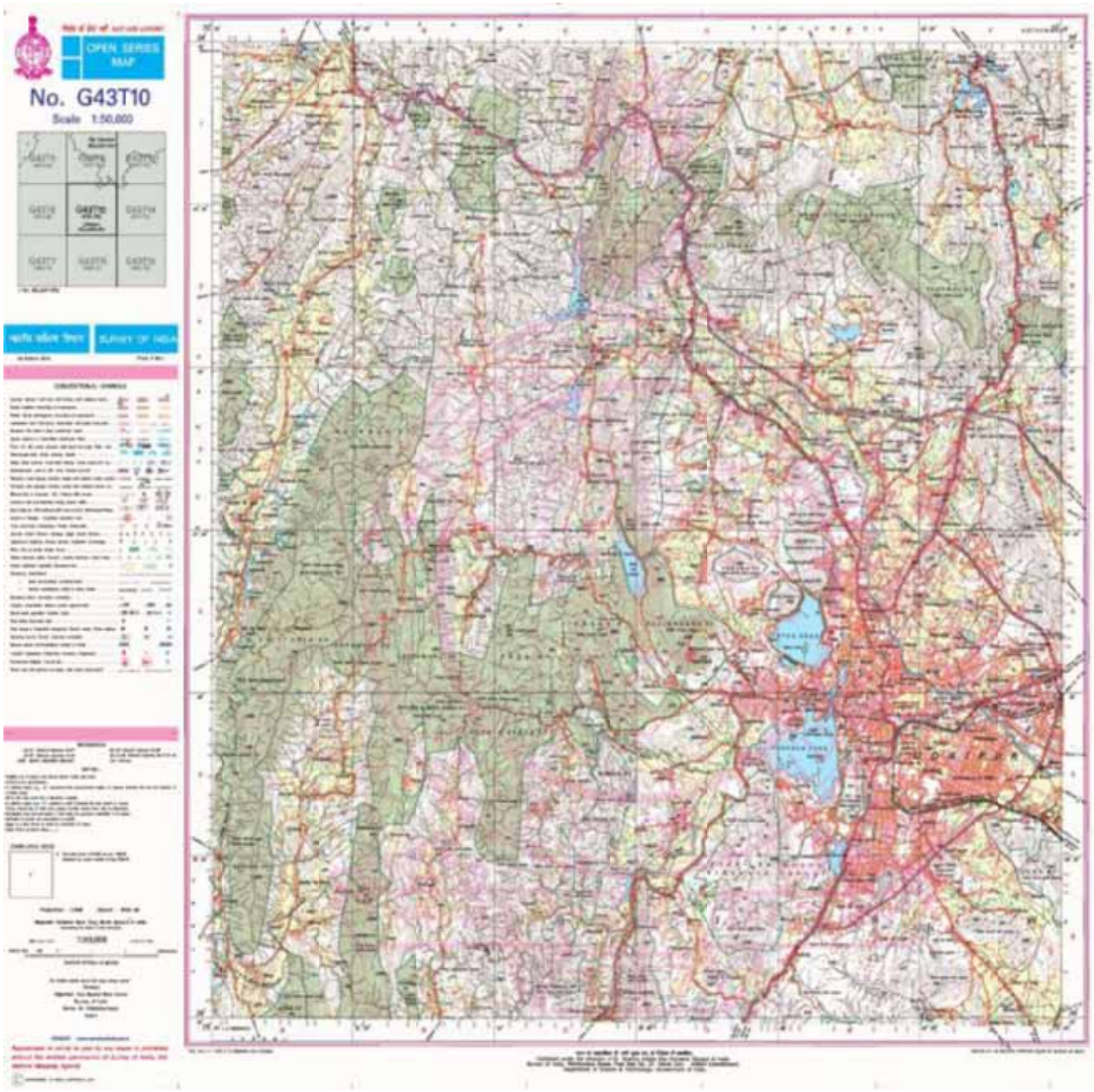
Google Earth – 3D Maps

- Mapping



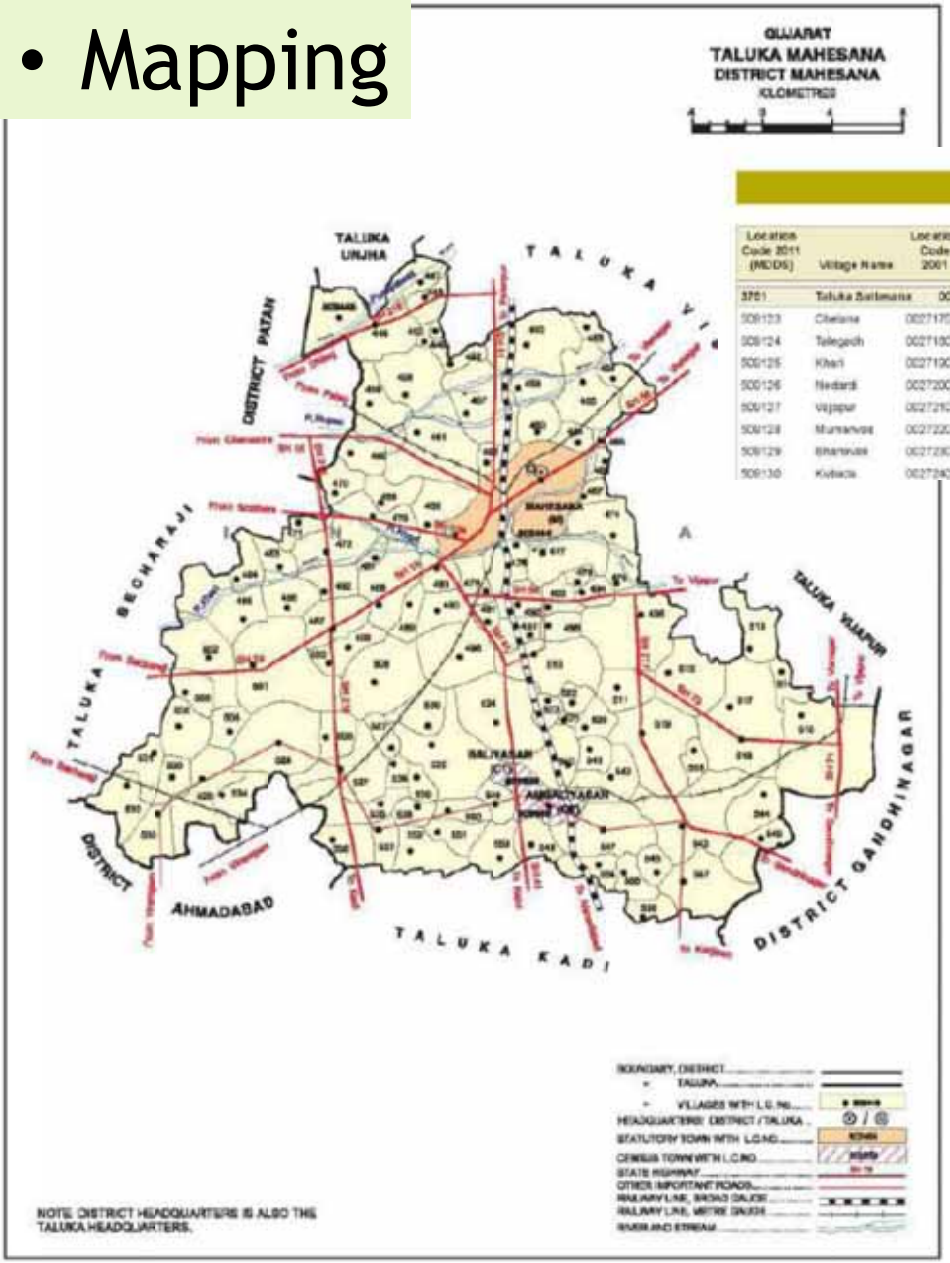
Tourist Maps

Toposheet

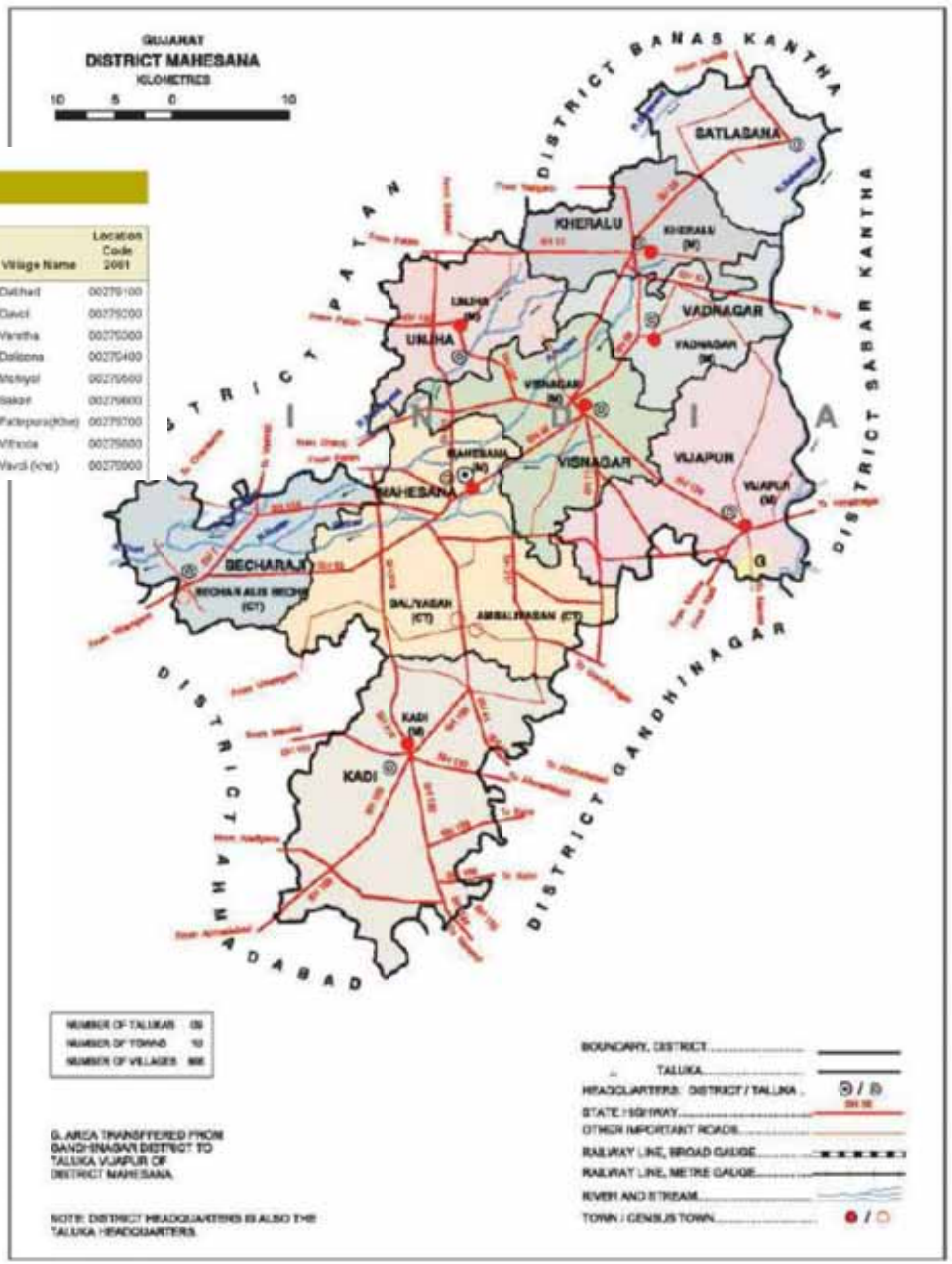


- Mapping

Census Maps



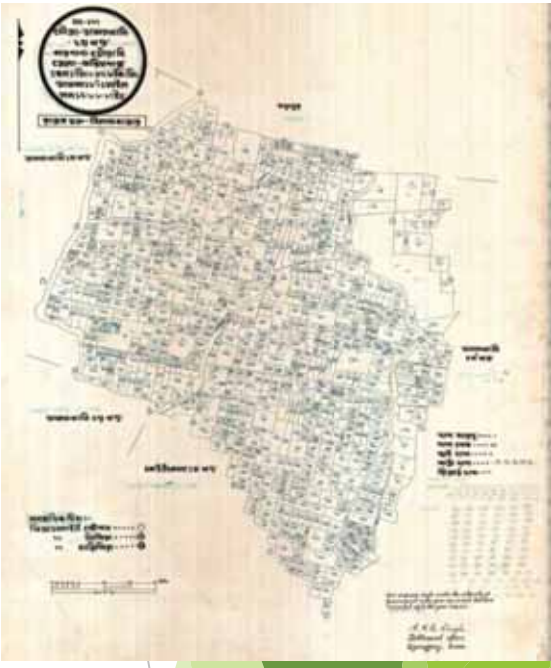
Census Maps



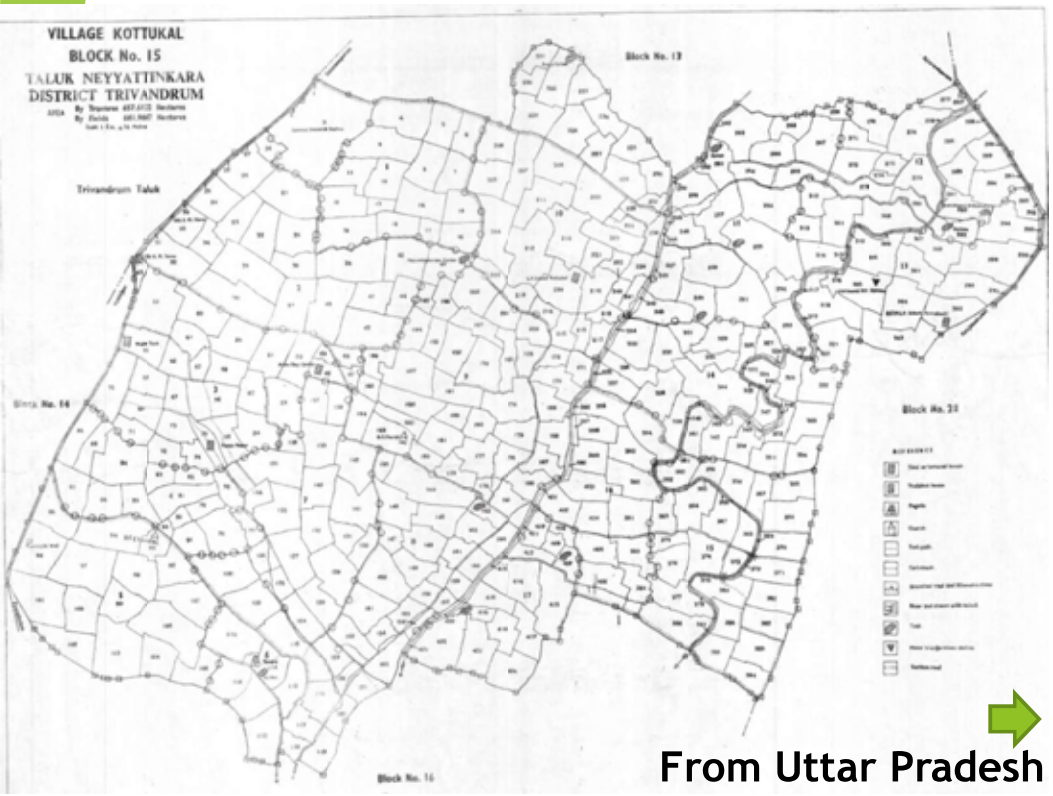
- Mapping

Revenue Sheets

From Assam



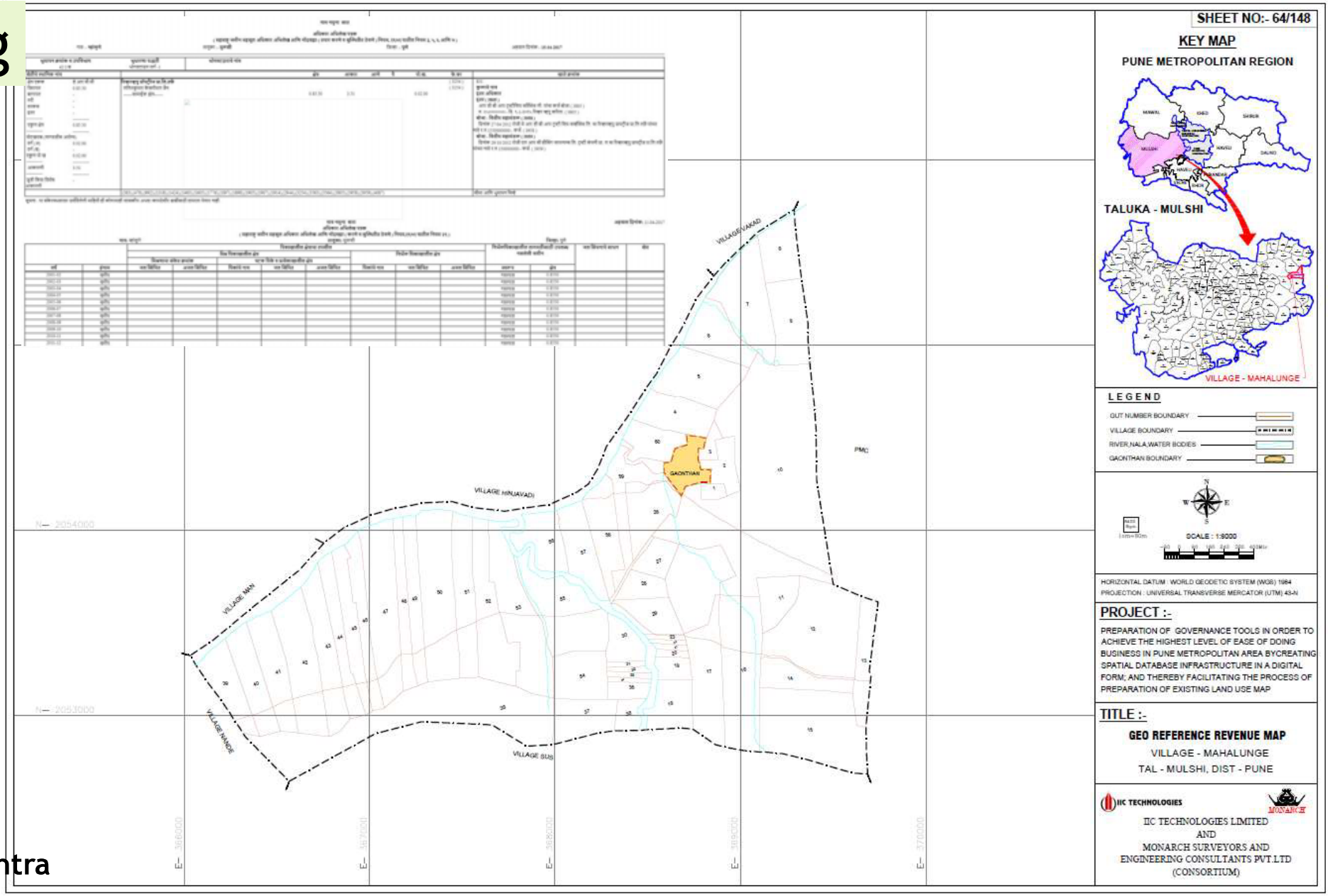
From Kerala



From Uttar Pradesh

- Mapping

Revenue Sheets



From Maharashtra

So, For Mapping & Analysis purpose we use GIS and Remote Sensing as a Decision making Tool

- Fundamentals of GIS
- Define GIS
  - GIS, is defined as an information system to input, retrieve, process, analyze and output geographically referenced data or geospatial data in order to support decision making for planning and management of natural resources and environment

An analysis of the three letters of the acronym GIS gives a clear picture of what GIS is all about:

G: Geographic*: Implies an interest in the spatial identity or locality of certain entities on, under or above the surface of the earth.*

I: Information*: Implies the **need** to be informed in order to **make decisions**. Data or raw facts are interpreted to create information that is **useful for decision-making**.*

S: System*: Implies the need for staff, computer hardware and procedures, which can produce the information required for decision-making that is data collection, processing, and presentation.*

• Fundamentals of GIS

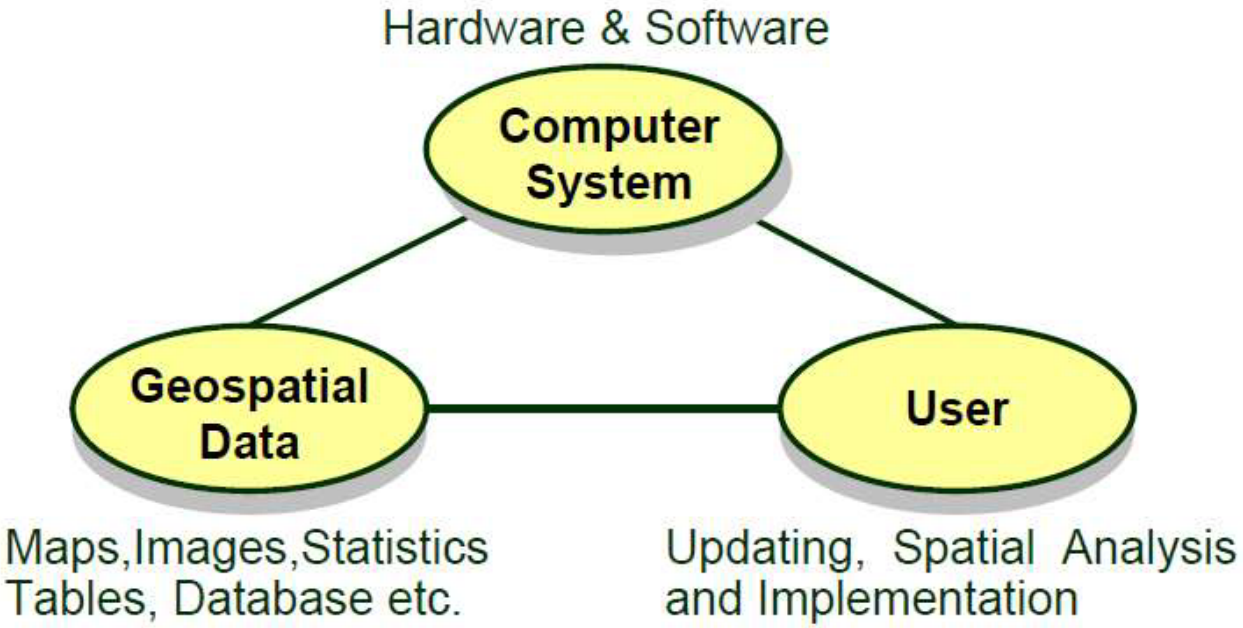
What is GIS?

A geographic information system (GIS) is a **computer-based tool** for **mapping and analyzing** things that exist and **events** that **happen on Earth**.

GIS technology **integrates common database operations** such as **query** and **statistical analysis** with the **unique visualization** and **geographic analysis benefits** offered by maps.

These abilities distinguish GIS from other information systems and make it valuable to a wide range of public and private enterprises for explaining events, predicting outcomes, and planning strategies.

- Key Components of GIS



• Why is a GIS needed ?

- Geospatial data are **poorly maintained**
- **Maps** and **statistics** are **out of date**
- **Data** and **information are inaccurate**
- Geographic data are **inconsistent**
- There is **no standard**
- There is **no data sharing**
- There is **no data recovery service**
- There is **no scientific decision making**

• Benefits of GIS

- Geospatial data **better maintained** in a **standard format**
- **Revision** and **updating** easier
- **Search**, **analysis** and **representation** is easier
- More **value added** products
- **Data** can be **shared** and **exchanged**
- **Productivity** more **improved**
- **Time** and **cost** saved
- **Better decision making**

- Basic functions of GIS

Functions	Sub-functions
Data Acquisition and Preprocessing	Editing, Topology Building,Format Conversion etc.
Database Management and Retrieval	Data archiving, Query etc.
Spatial Measurement and Analysis	Buffering, Overlay Operations etc.
Graphic Output and Visualization	Mapping, Bird's Eye View etc.

• Data Types

- ►Vector – Discrete Entities *within* space
  - Points
  - Lines
  - Polygons

- ►Raster – Contains Field/Surface *across* space
  - Elevation
  - Growth Potential as secondary data based on above

• Attributes

- Vector – Multiple Attributes (Properties)
  - Attributes are of each feature (point, line, poly)
- Raster – Single Attribute (Value)
  - Each cell has a different value of this attribute
  - BUT! Can also have in turn *Value Attributes* e.g.
    1 = Acid, 7 = Neutral, 14 = Alkaline
  - BUT! Again only one per value!

• GIS as a Multidisciplinary science

- Geography
- Cartography
- Remote sensing
- Photogrammetry
- Surveying
- Statistic
- Operation research
- Computer science
- Mathematics
- Civil engineering
- Urban planning

• GIS History / Software

►Geography Techniques (by hand) pre 1960s: John Snow, Minard's Map (Napoleon)

►Forestry – Canada (+E Africa) - CGIS
First GIS – Roger Tomlinson- the father of GIS: 1960+, operational from 1971+

►USA – Government Organisations: USGS, US Forest Service, others incl. CIA

►Academia
Edinburgh – GIMMS 1970+ (Sold from 1973), MSc GIS 1985+
Harvard – Computer Graphics and Spatial Analysis Lab 1965

►ESRI 1969 Env. Consultancy – Arc/Info 1982 -> ArcView Desktop 1995 -> ArcGIS 1999

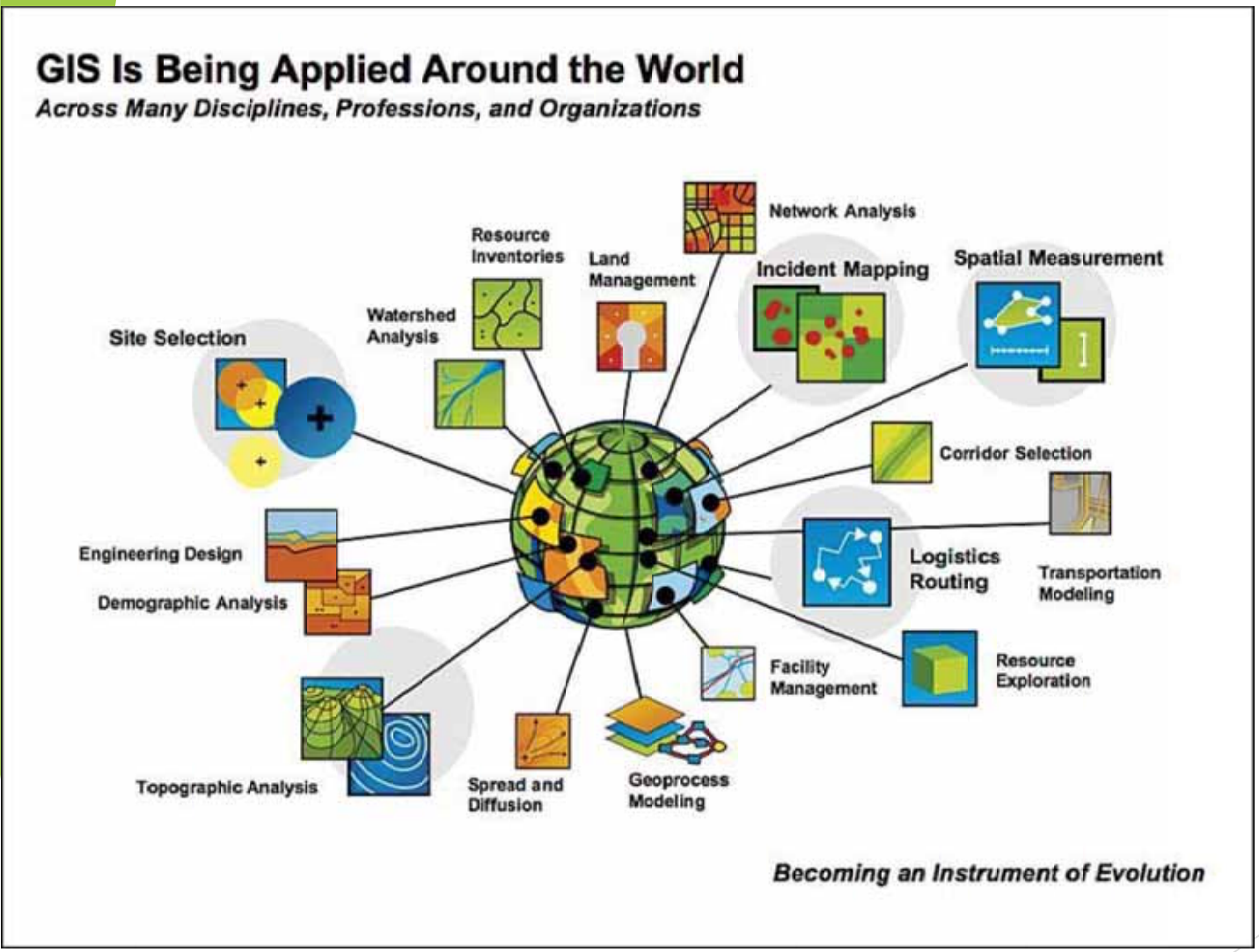
►Physics/Space (Moon landings) later CAD/Utilities – Laser Scan/Intergraph 1969

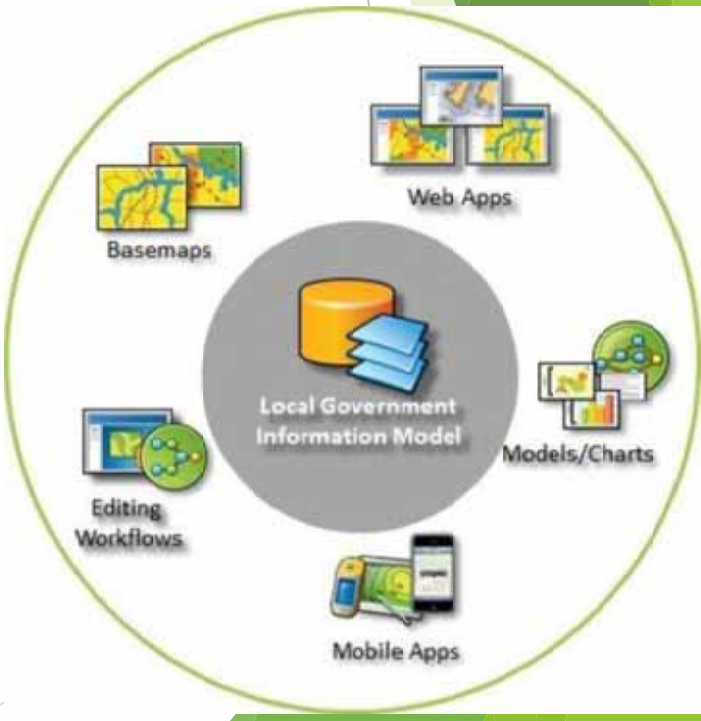
►Demographics/Consultancy – MapInfo 1986

►Open Source – GRASS, Quantum GIS (QGIS), gvSIG, … link to DBMS

►Web GIS – WMS, WFS, Google Maps, Google Earth, OGC, OpenStreetMap

• Areas of GIS Applications





https://www.esri.com/news/arcnews/fall07articles/gis-the-geographic-approach.html

• Computer Systems for GIS

System Software

Operating System (OS)
GIS Software

System Hardware	Supported and Recommended
CPU speed	2.2 GHz minimum; Hyper-threading (HHT) or Multi-core recommended
Platform	x86 or x64 with SSE2 extensions
Memory/RAM	Minimum: 4 GB Recommended: 8 GB or higher ArcGlobe may require 8 GB minimum when used.
Display properties	24-bit color depthAlso see Video/Graphics adapter requirements below.*
Screen resolution	1024x768 recommended minimum at normal size (96 dpi)
Disk space	Minimum: 4 GB Recommended: 6 GB or higher ArcGlobe creates cache files when used. If using ArcGlobe, additional disk space may be required.
Video/Graphics adapter	64 MB RAM minimum; 256 MB RAM or higher recommended. NVIDIA, AMD, and Intel chipsets supported. 24-bit capable graphics accelerator OpenGL version 2.0 runtime minimum is required, and Shader Model 3.0 or higher is recommended. Be sure to use the latest available drivers.

https://desktop.arcgis.com/en/system-requirements/latest/arcgis-desktop-system-requirements.html

• Major Vendors of GIS

ArcGIS

62 ratings | 38 reviews ★ Top Rated (Environmental Systems Research Institute- ESRI)

Esri in Redlands, California offers ArcGIS, a geographic information system.

QGIS

14 ratings | 10 reviews

QGIS (formerly Quantum GIS) is a free and open source geographic information system.

Mapbox

6 ratings | 5 reviews

Mapbox in Washington, DC presents a geographic information system.

CARTO (formerly CartoDB)

2 ratings | 4 reviews

Carto (formerly CartoDB) in Brooklyn, New York offers their location intelligence solution.

SCANPOINT GEOMATICS LIMITED

Makers of iGiS - an indigenous technology which brings GIS, Image Processing, Photogrammetry and CAD together on a single platform

iGiS

GIS & IP Desktop

GIS & IP Enterprise Suite

Photogrammetry Suite

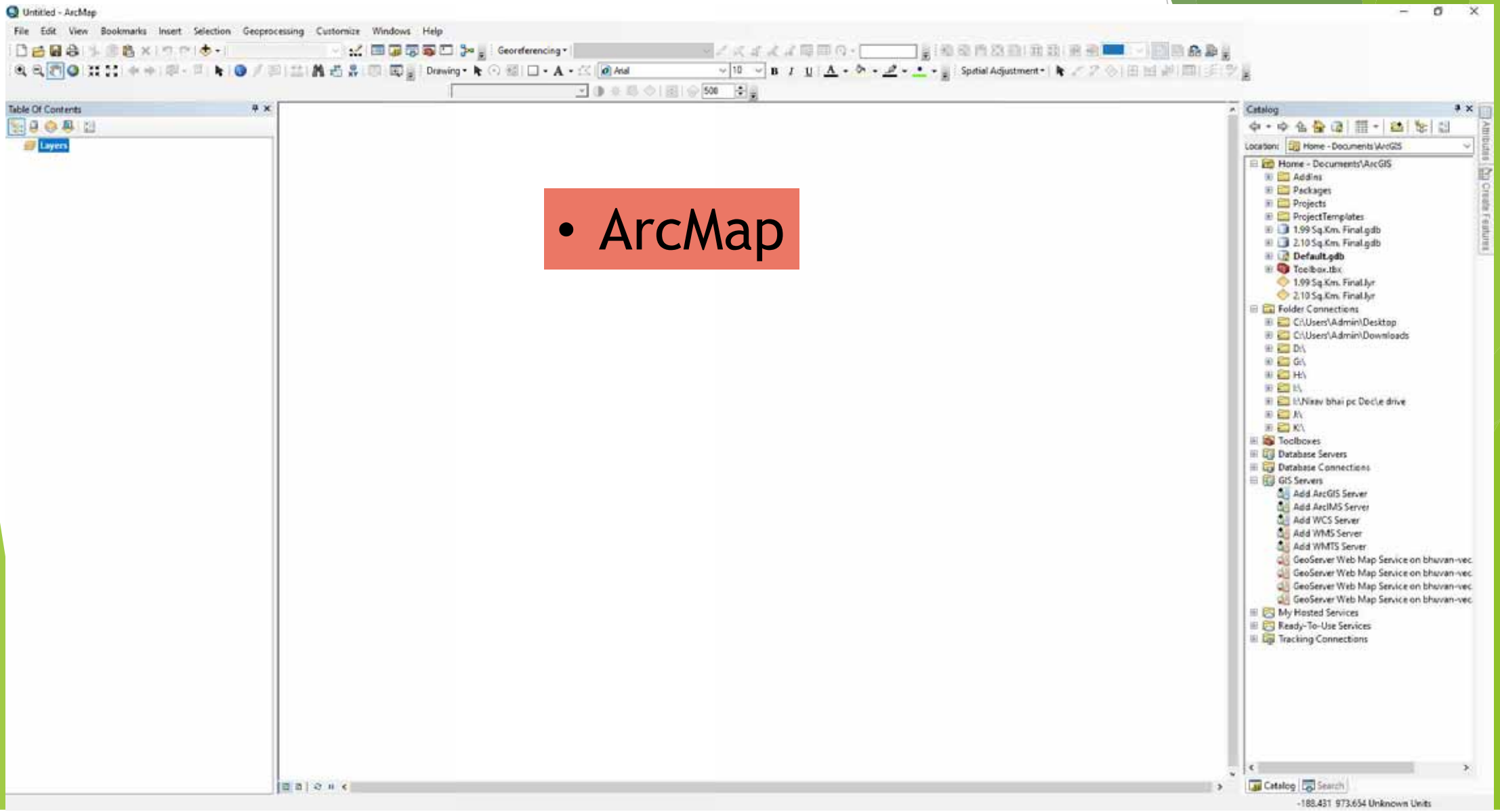
CAD

https://www.trustradius.com/geographic-information

• ArcGIS Software

ArcGIS consists of the following Windows desktop software:

- ArcReader, which allows one to view and query maps created with the other ArcGIS products;
- ArcGIS Desktop (often referred to as "ArcMap" to distinguish it from ArcGIS Pro), made up of four fundamental applications:
  - ArcMap, for viewing and editing spatial data in two dimensions and creating two-dimensional maps;
  - ArcScene, for viewing and editing three-dimensional spatial data in a local projected view;
  - ArcGlobe, for displaying large, global 3D datasets;
  - ArcCatalog, for GIS data management and manipulation tasks.
- ArcGIS Pro, a new, integrated GIS application, planned to eventually supersede ArcMap and its companion programs. ArcGIS Pro works in 2D and 3D for cartography and visualization, and includes Artificia Intelligence (AI)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Georeferencing
Drawing
Spatial Adjustment
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2.10 Sq.Km. Final.gdb
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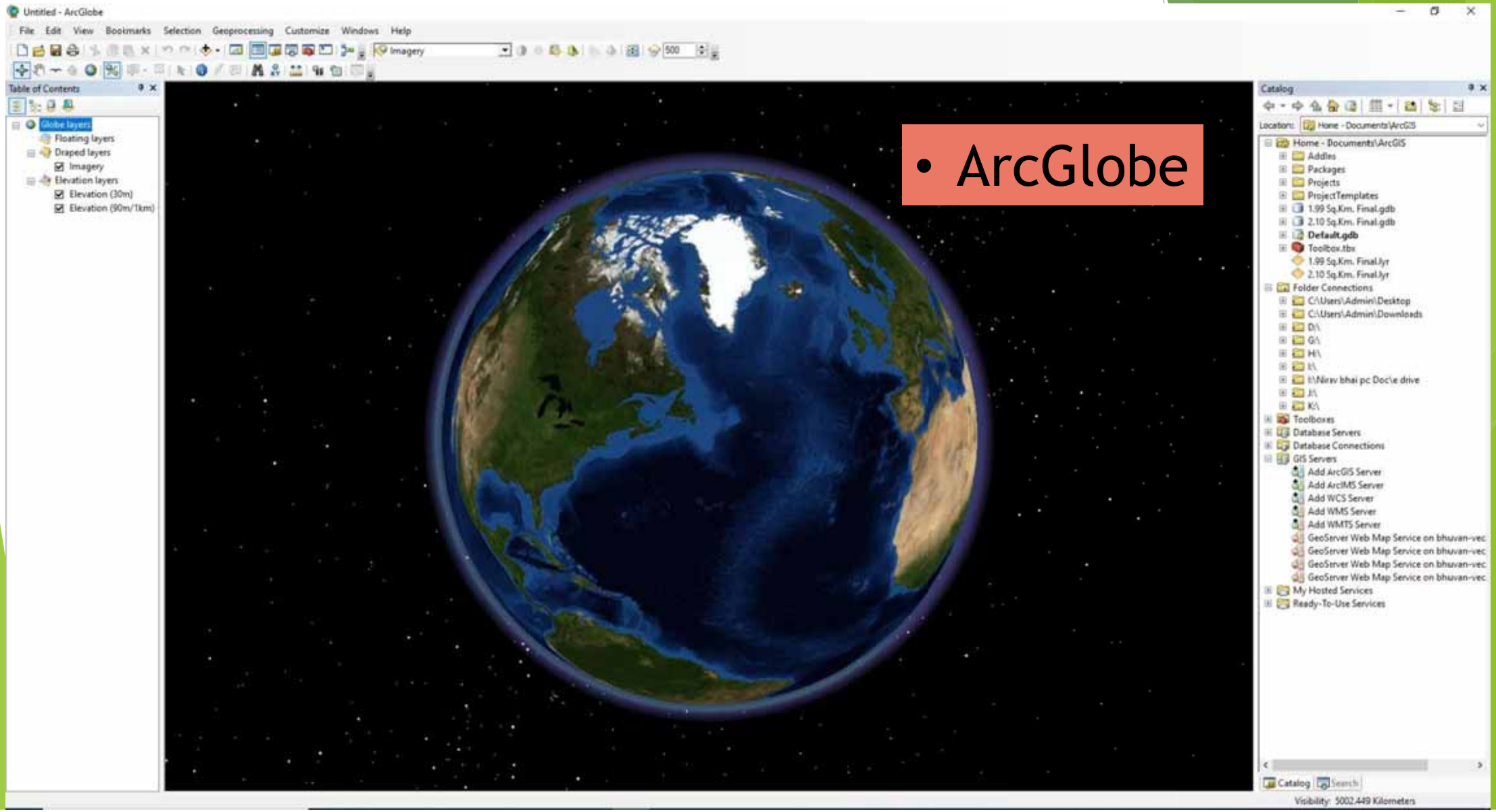
- ArcMap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Draped layers
Imagery
Elevation layers
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Elevation (90m/1km)
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Projects
ProjectTemplates
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Ready-To-Use Services
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Search
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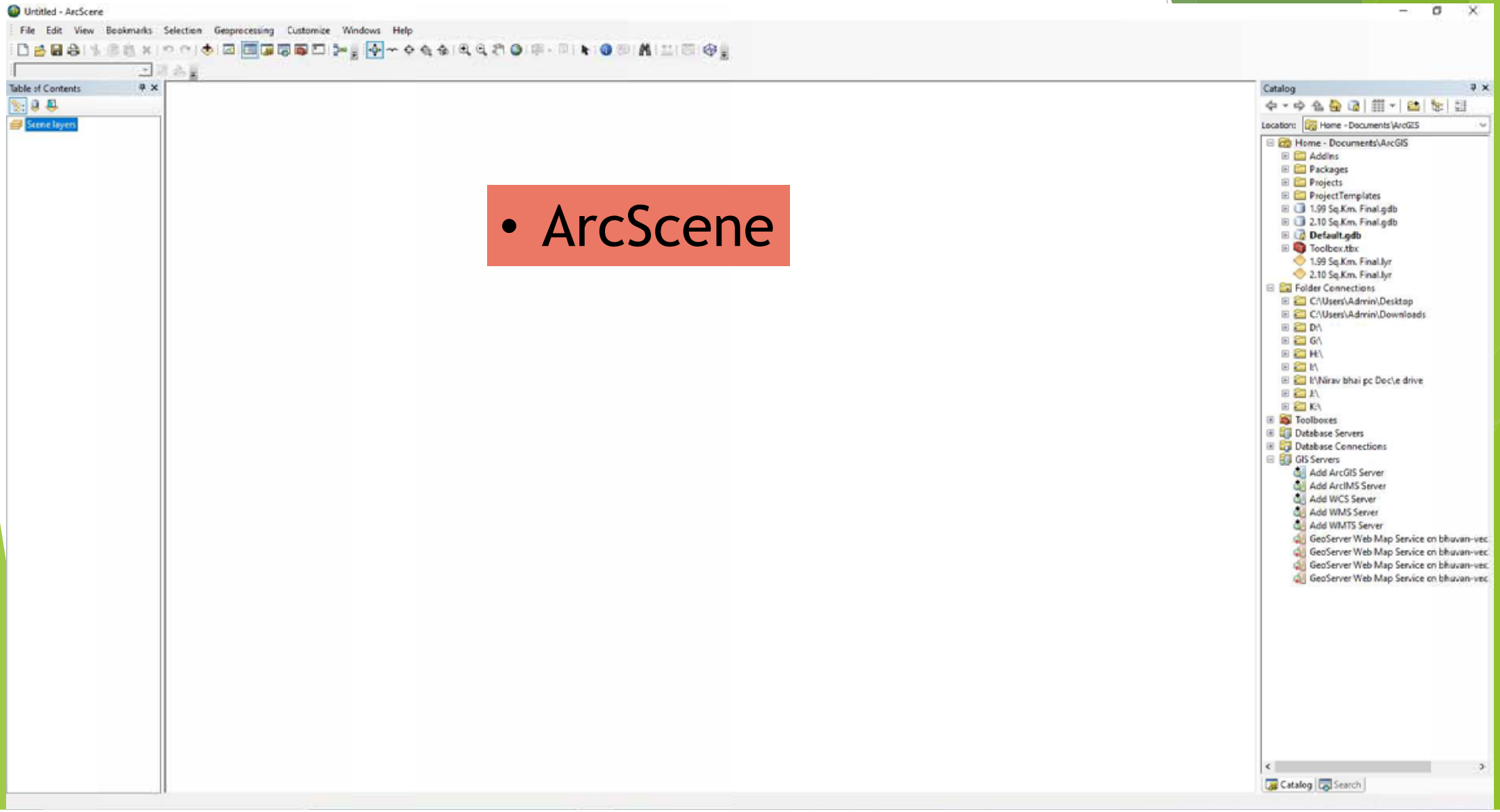
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Database Servers
Database Connections
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GeoServer Web Map Service on bhuvan-vec
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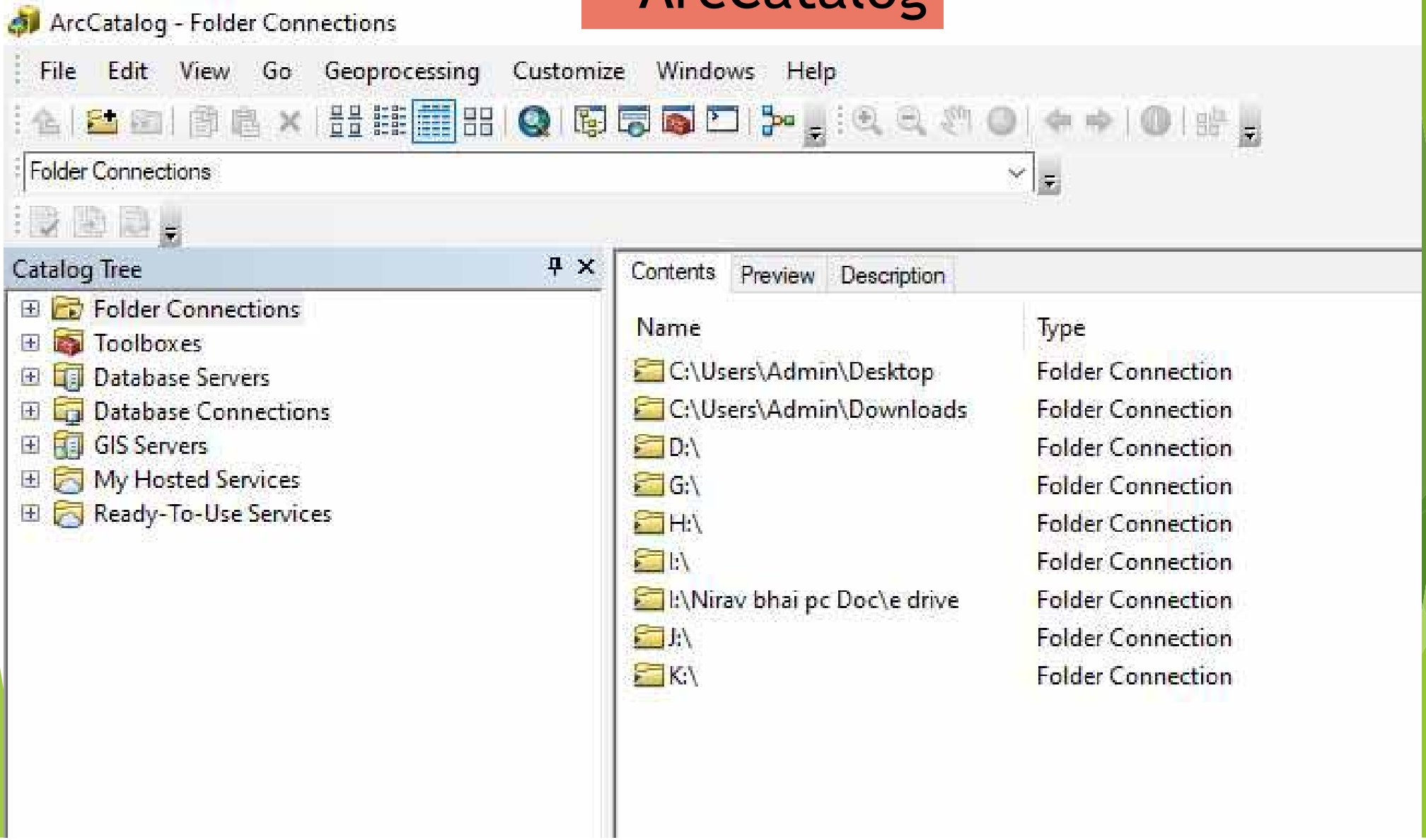
Catalog
Search

- ArcScene

• ArcCatalog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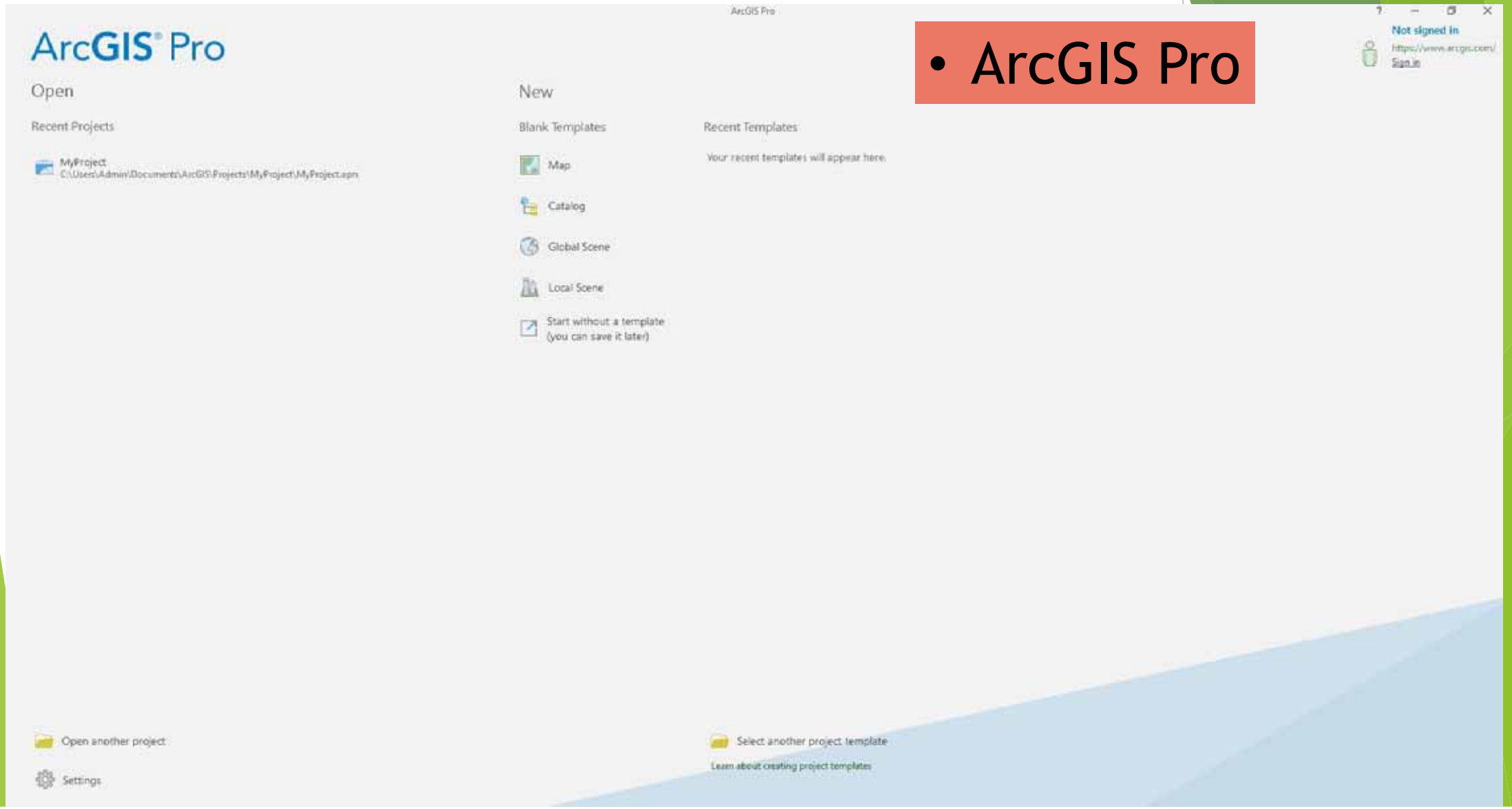
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Blank Templates
Map
Catalog
Global Scene
Local Scene
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(you can save it later)
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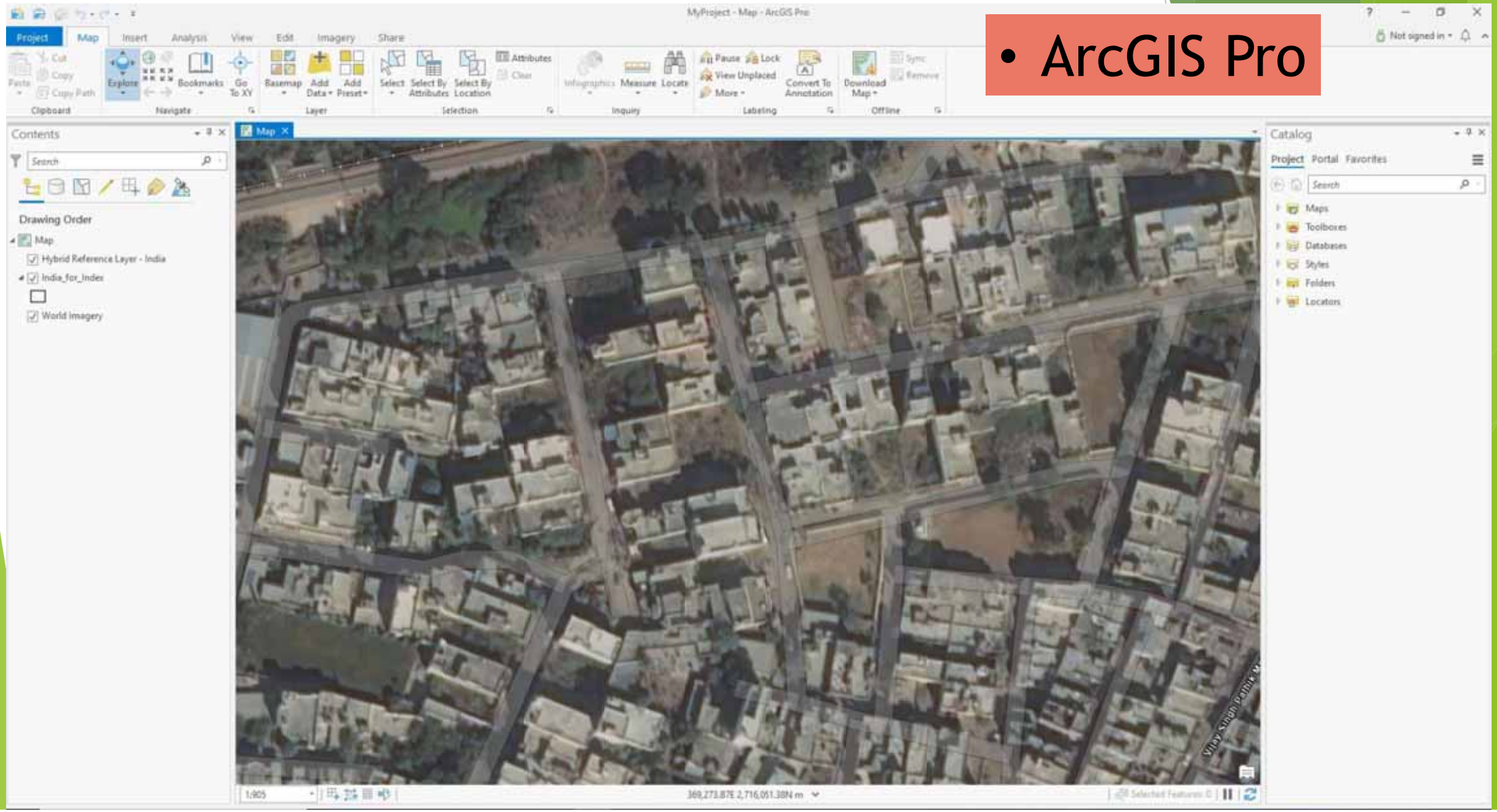
Open another project
Settings
Select another project template
Learn about creating project templates

- ArcGIS Pro

- ArcGIS Pro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Download Map
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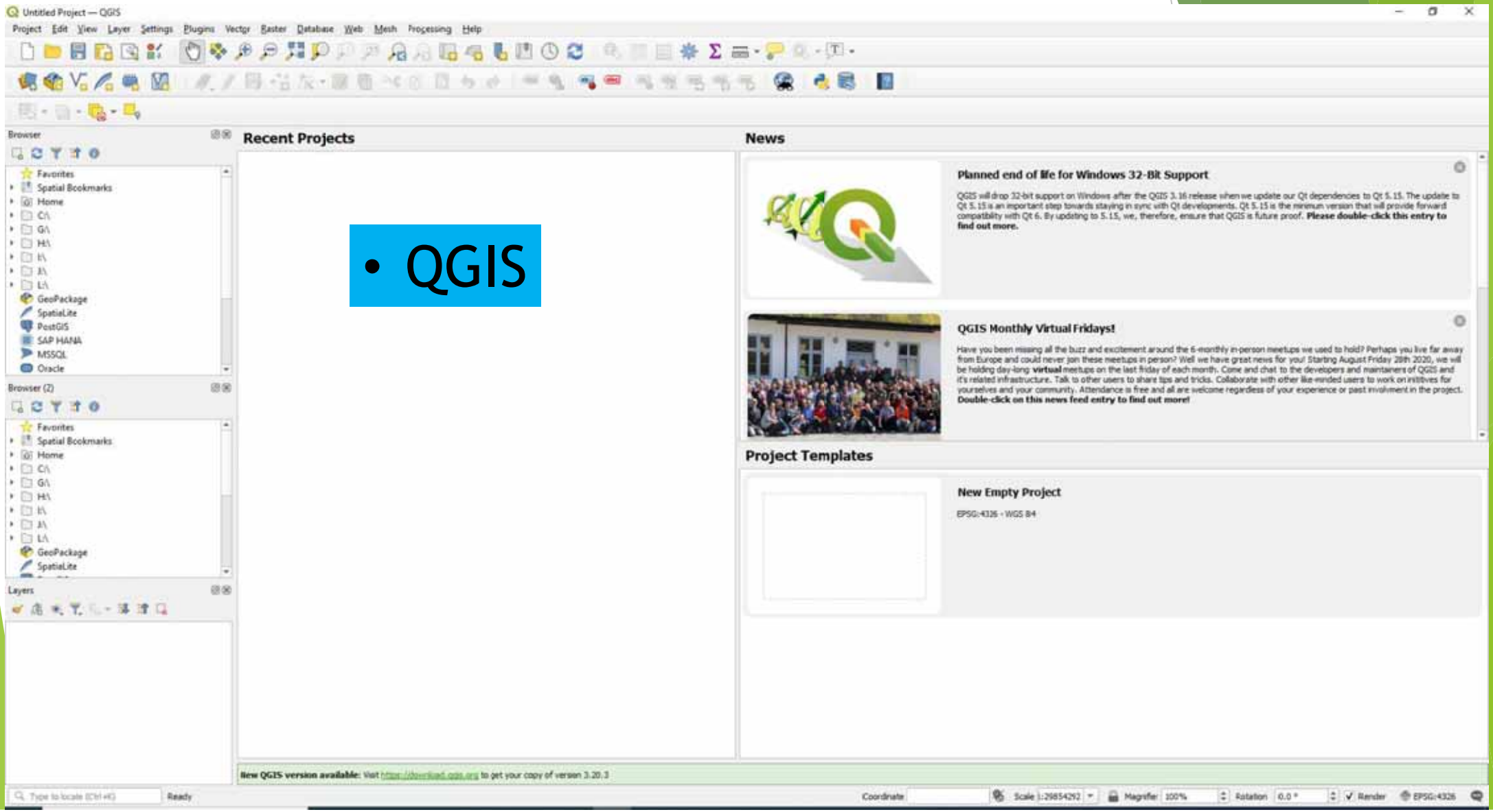
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Favorites
Spatial Bookmarks
Home
GeoPackage
SpatiaLite
PostGIS
SAP HANA
MSSQL
Oracle
Browser (2)
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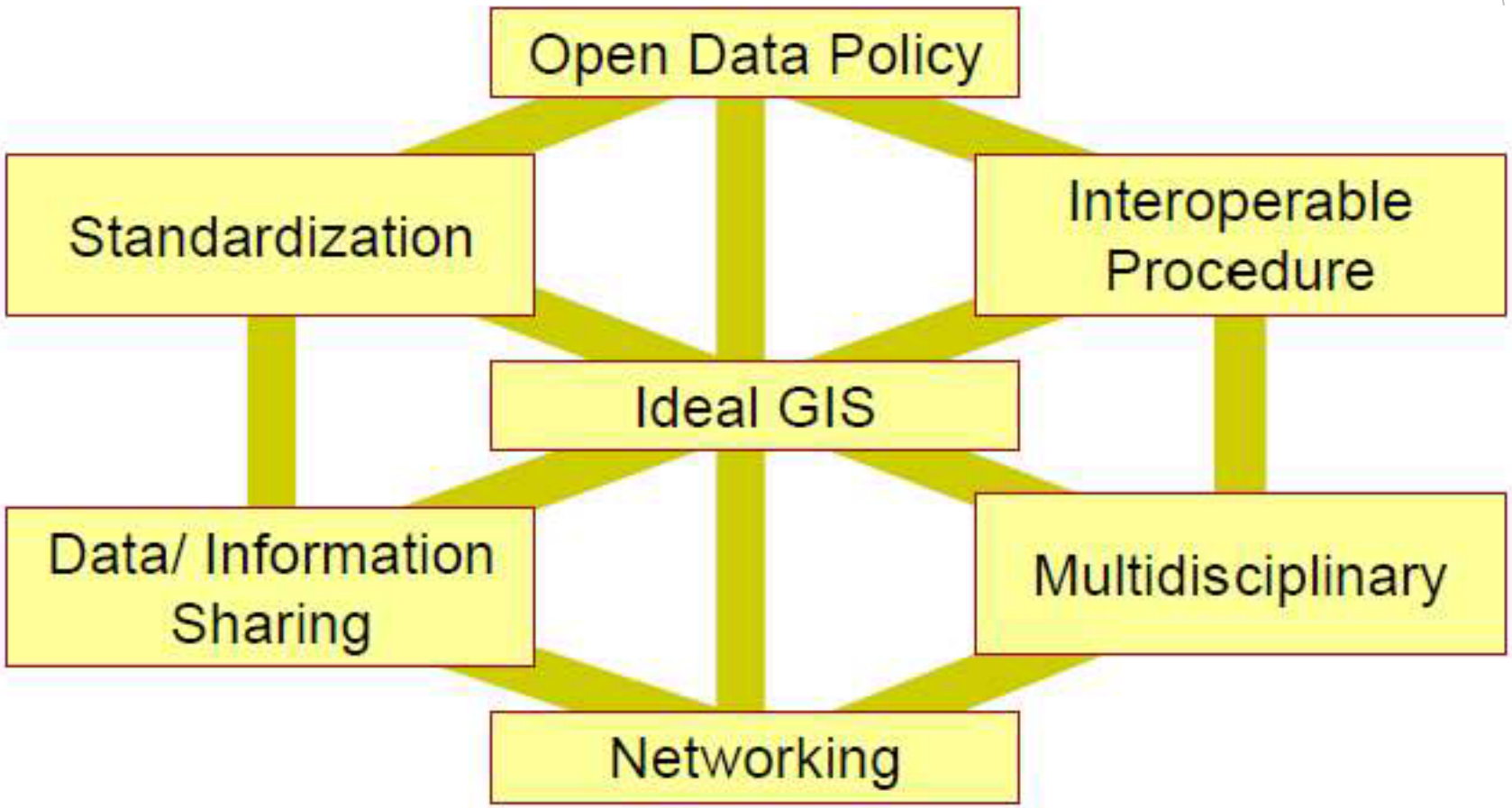
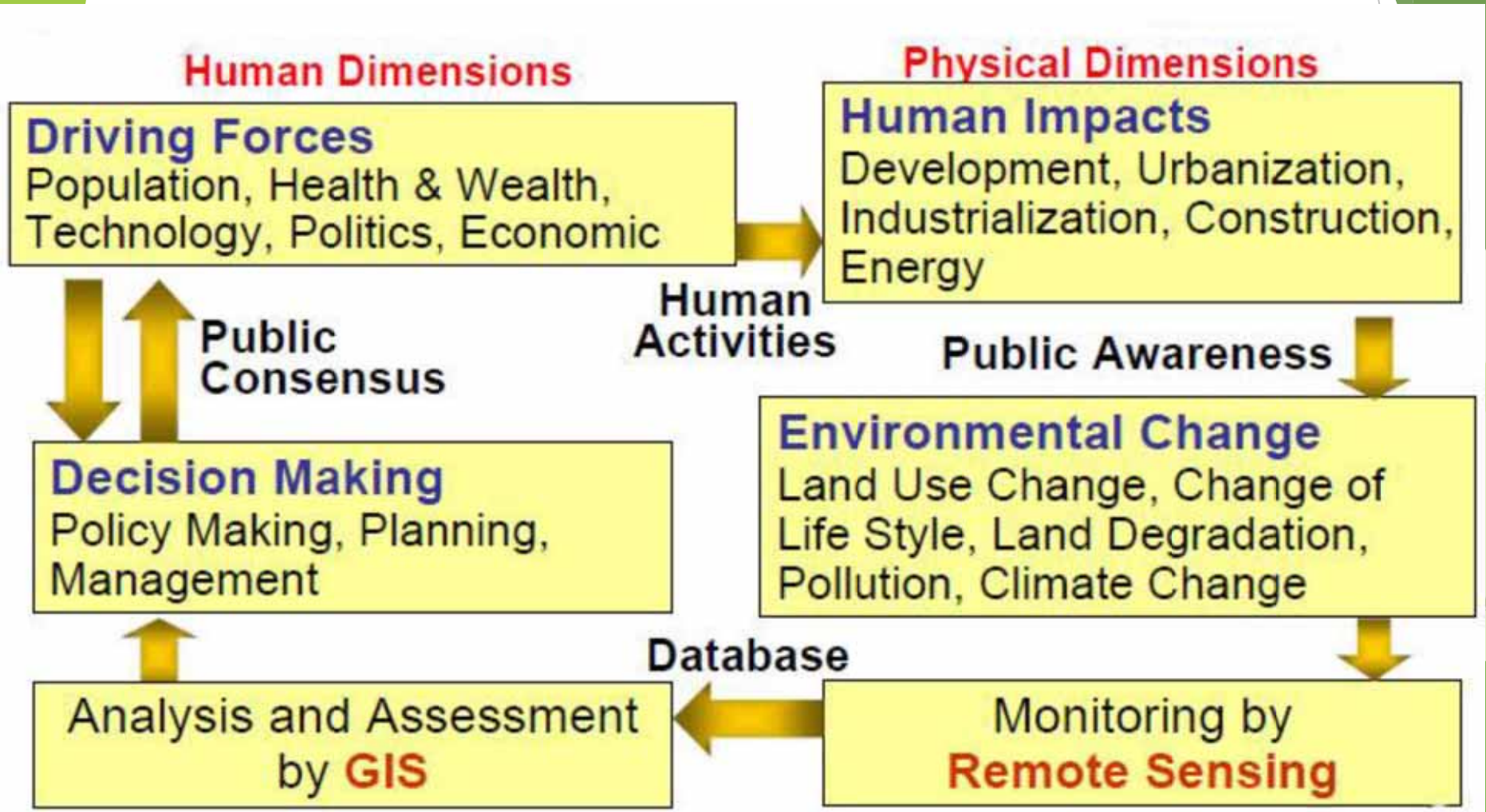
News
Planned end of life for Windows 32-Bit Support
QGIS will drop 32-bit support on Windows after the QGIS 3.16 release when we update our Qt dependencies to Qt 5.15. The update to Qt 5.15 is an important step towards staying in sync with Qt developments. Qt 5.15 is the minimum version that will provide forward compatibility with Qt 6. By updating to 5.15, we, therefore, ensure that QGIS is future proof. Please double-click this entry to find out more.
QGIS Monthly Virtual Fridays!
Have you been missing all the buzz and excitement around the 6-monthly in-person meetups we used to hold? Perhaps you live far away from Europe and could never join these meetups in person? Well we have great news for you! Starting August Friday 28th 2020, we will be holding day-long virtual meetups on the last friday of each month. Come and chat to the developers and maintainers of QGIS and it's related infrastructure. Talk to other users to share tips and tricks. Collaborate with other like-minded users to work on initiatives for yourselves and your community. Attendance is free and all are welcome regardless of your experience or past involvement in the project. Double-click on this news feed entry to find out more!
Project Templates
New Empty Project
EPSG:4326 - WGS 84
New QGIS version available: Visit https://download.qgis.org to get your copy of version 3.20.3
Ready
Coordinate
Scale 1:29854292
Magnifier 100%
Rotation 0.0 °
Render
EPSG:4326

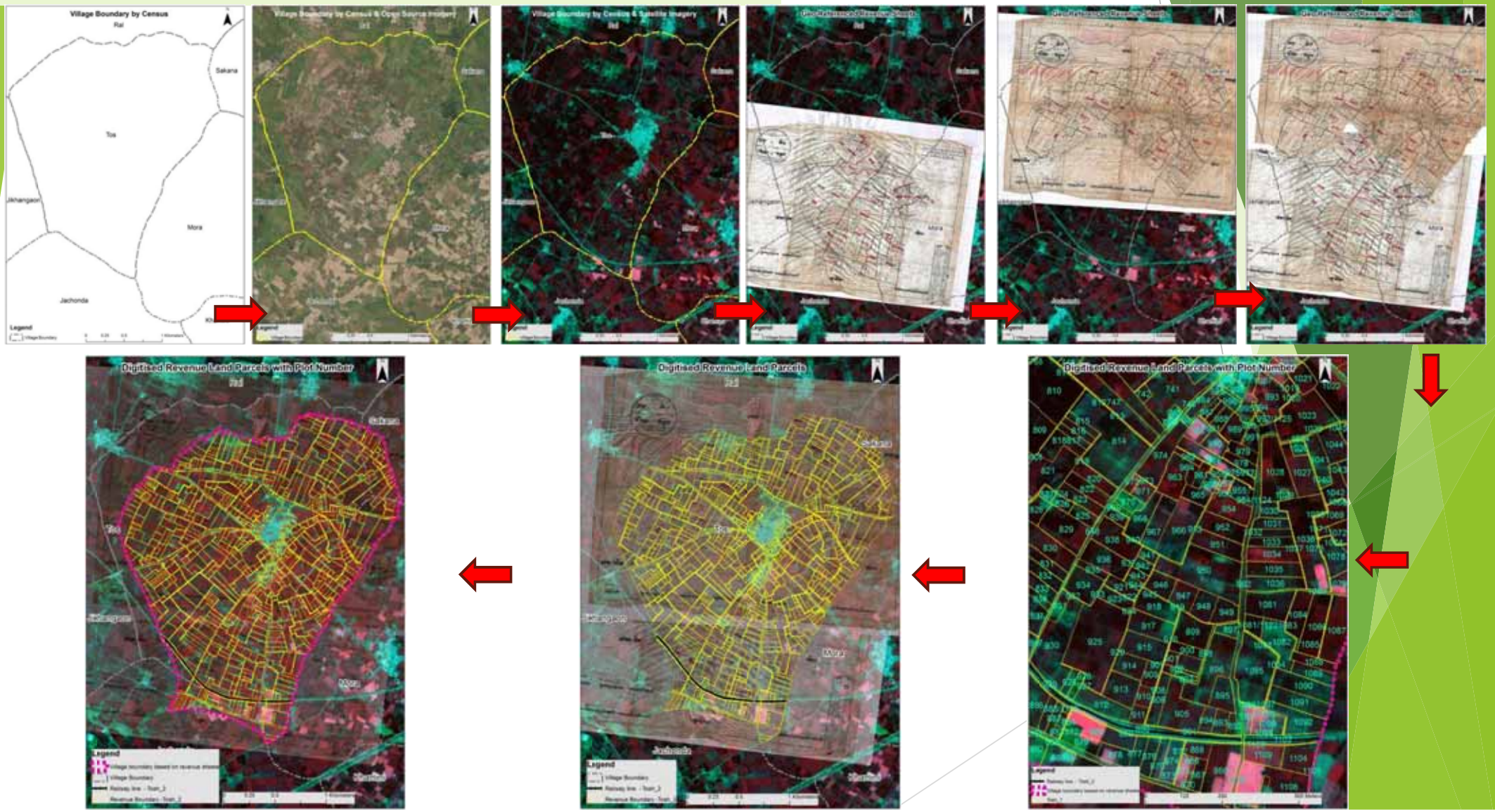
- What is an Ideal GIS?



- Role of GIS for Decision Support

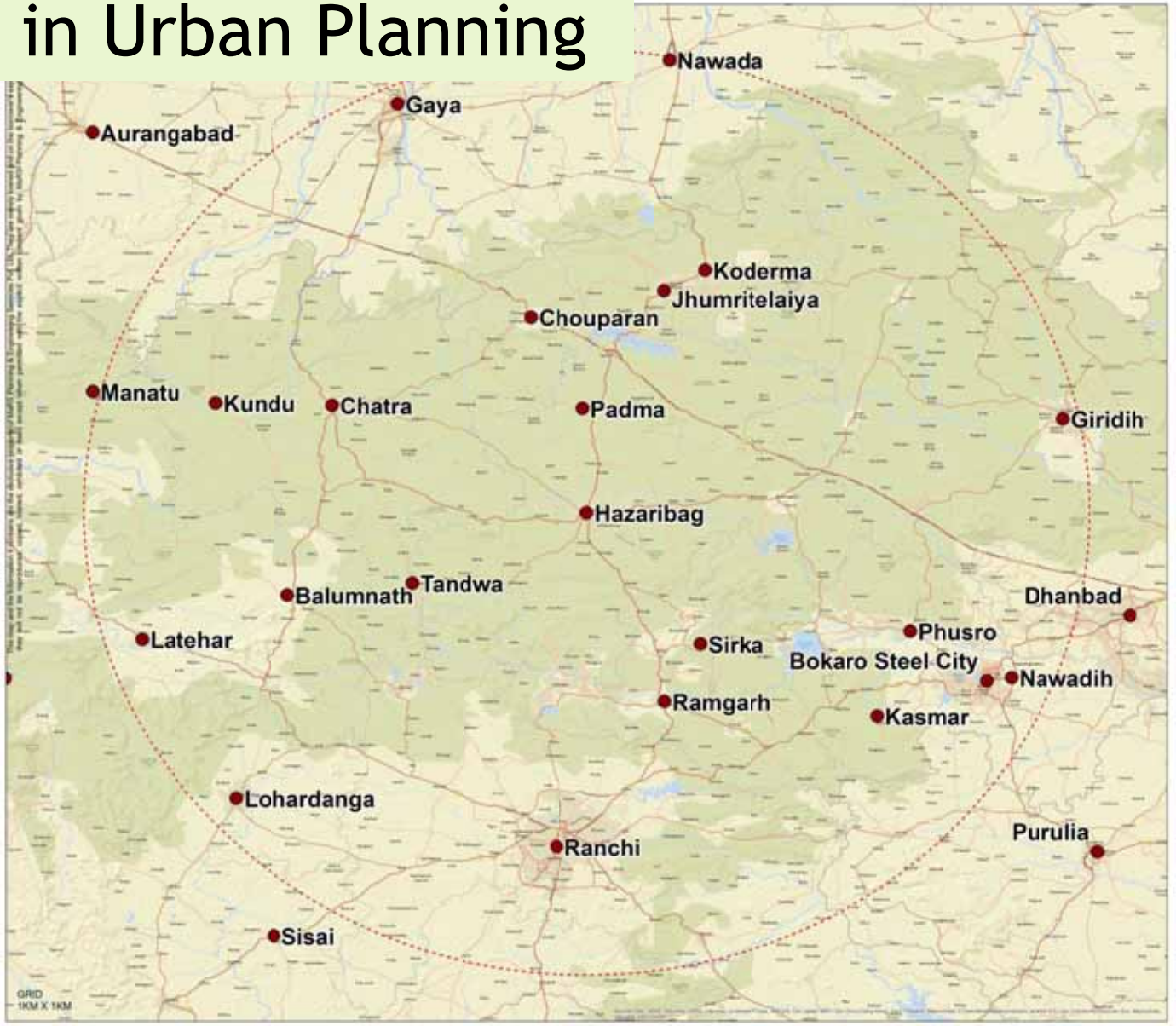


- Use of GIS in Urban Planning



- Use of GIS in Urban Planning

Regional Connectivity



Project:

Legend

- Nearby Cities
- 100 km City Buffer

Source: Existing Landuse

Dwg No.

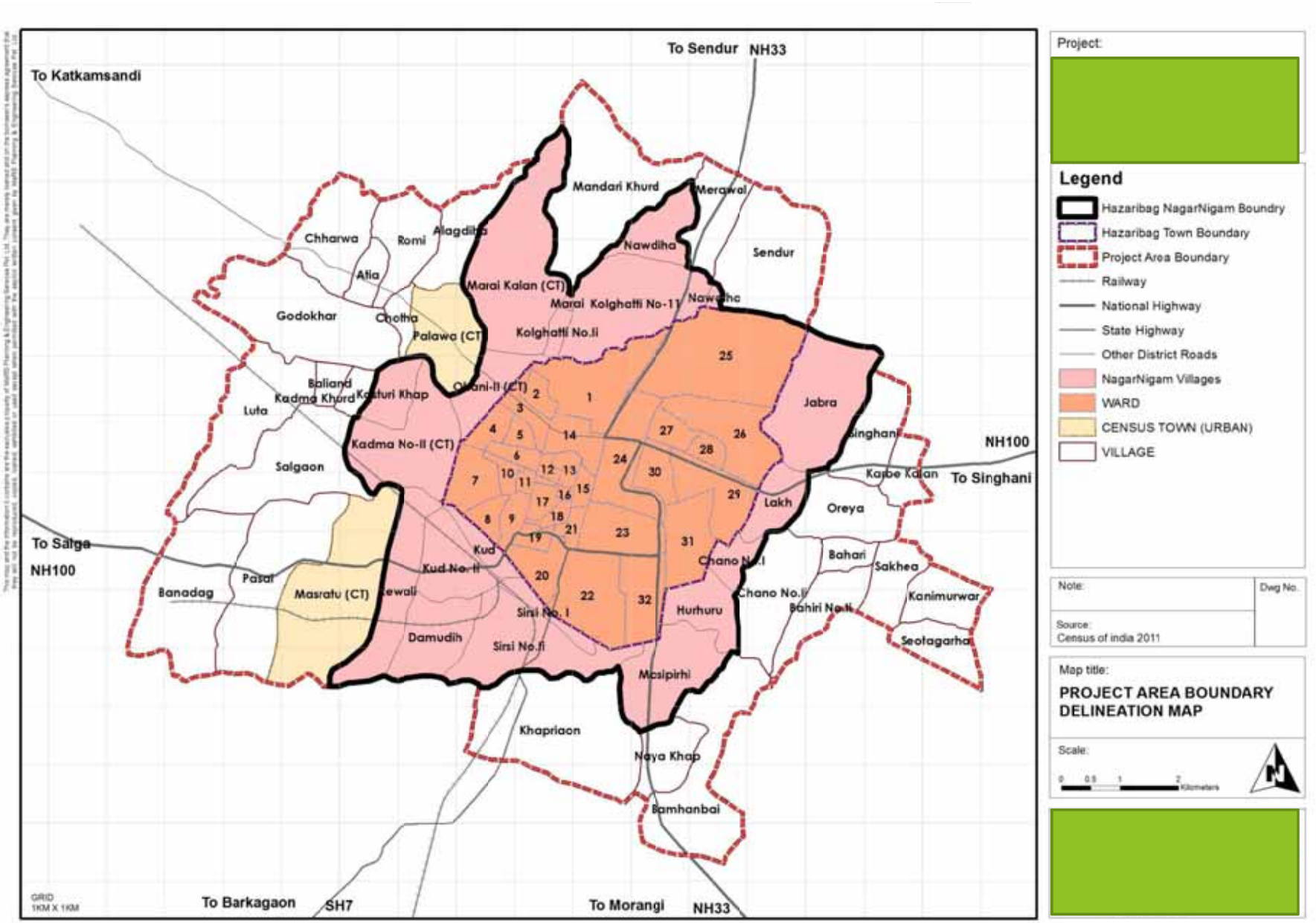
Map Title:

REGIONAL CONNECTIVITY

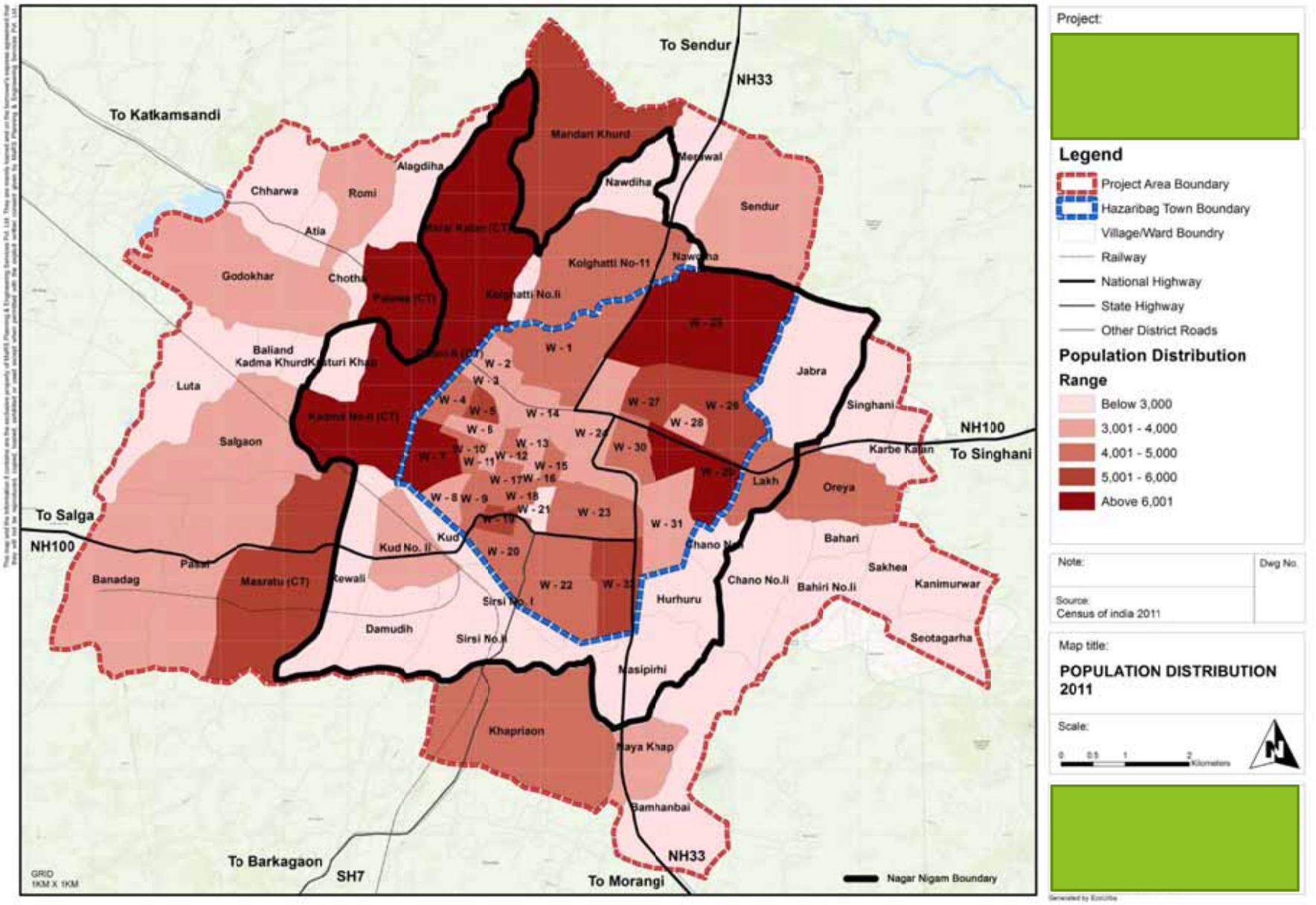
Scale:

30 27 Kilometers

Delineation Map



Population Distribution



Project:

Legend

- Project Area Boundary
- Hazaribag Town Boundary
- Village/Ward Boundry
- Railway
- National Highway
- State Highway
- Other District Roads

Population Distribution

Range

- Below 3,000
- 3,001 - 4,000
- 4,001 - 5,000
- 5,001 - 6,000
- Above 6,001

Note:

Dwg No.

Source:
Census of india 2011

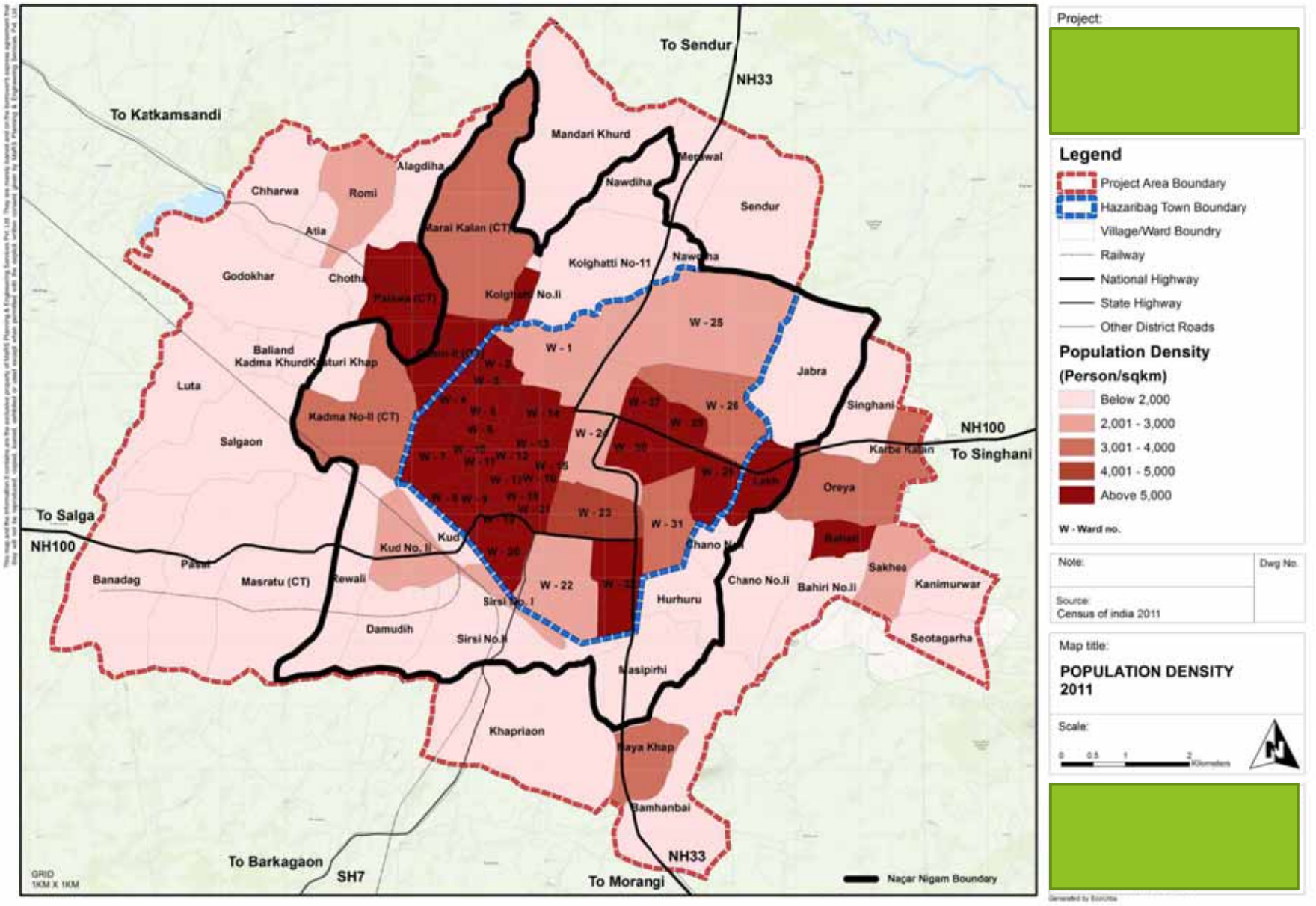
Map title:

POPULATION DISTRIBUTION 2011

Scale:

0 0.5 1 2 Kilometers

Population Density



Project:

Legend

- Project Area Boundary
- Hazaribag Town Boundary
- Village/Ward Boundry
- Railway
- National Highway
- State Highway
- Other District Roads

Population Density (Person/sqkm)

- Below 2,000
- 2,001 - 3,000
- 3,001 - 4,000
- 4,001 - 5,000
- Above 5,000

W - Ward no.

Note:

Dwg No.

Source: Census of india 2011

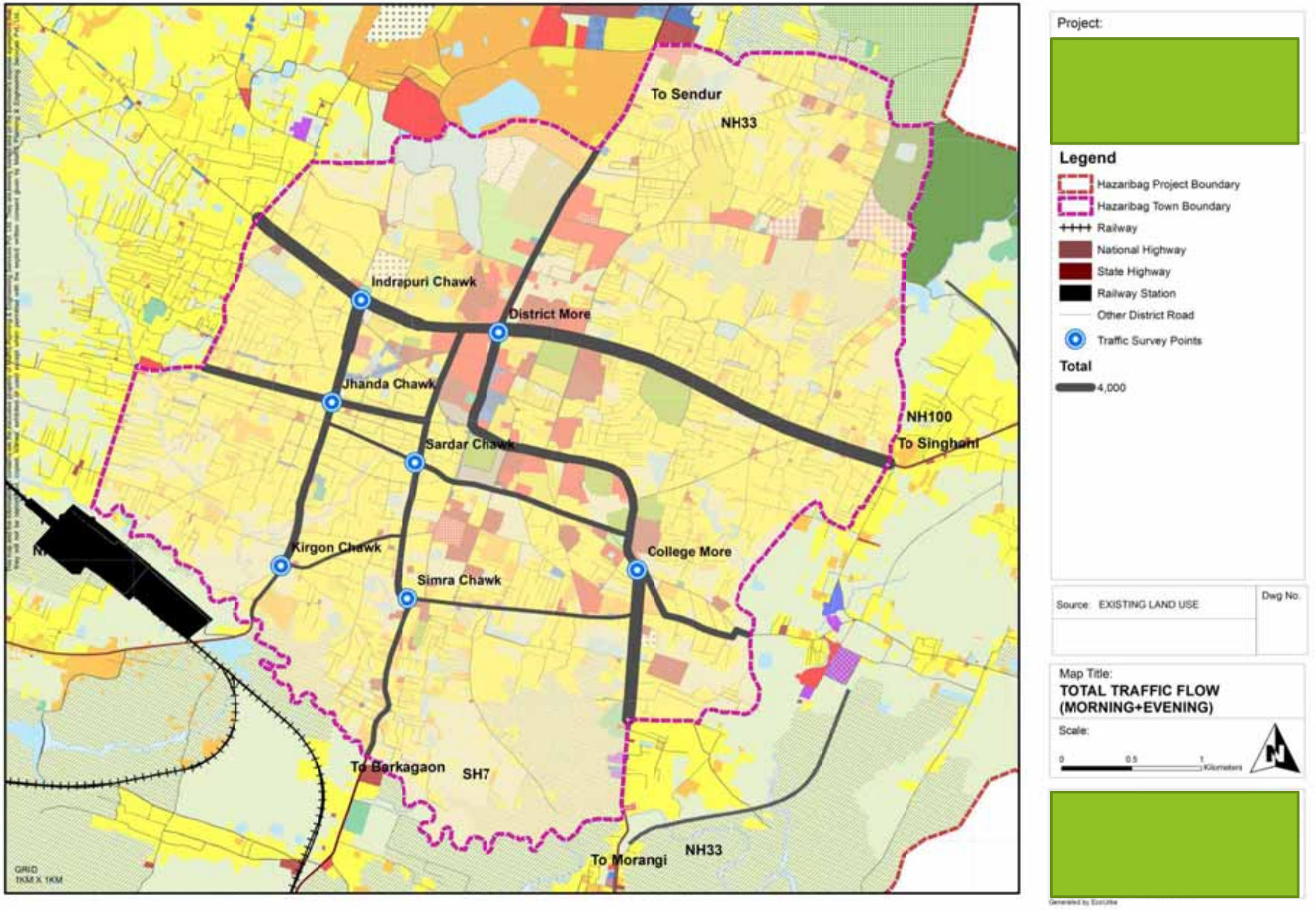
Map title:

POPULATION DENSITY 2011

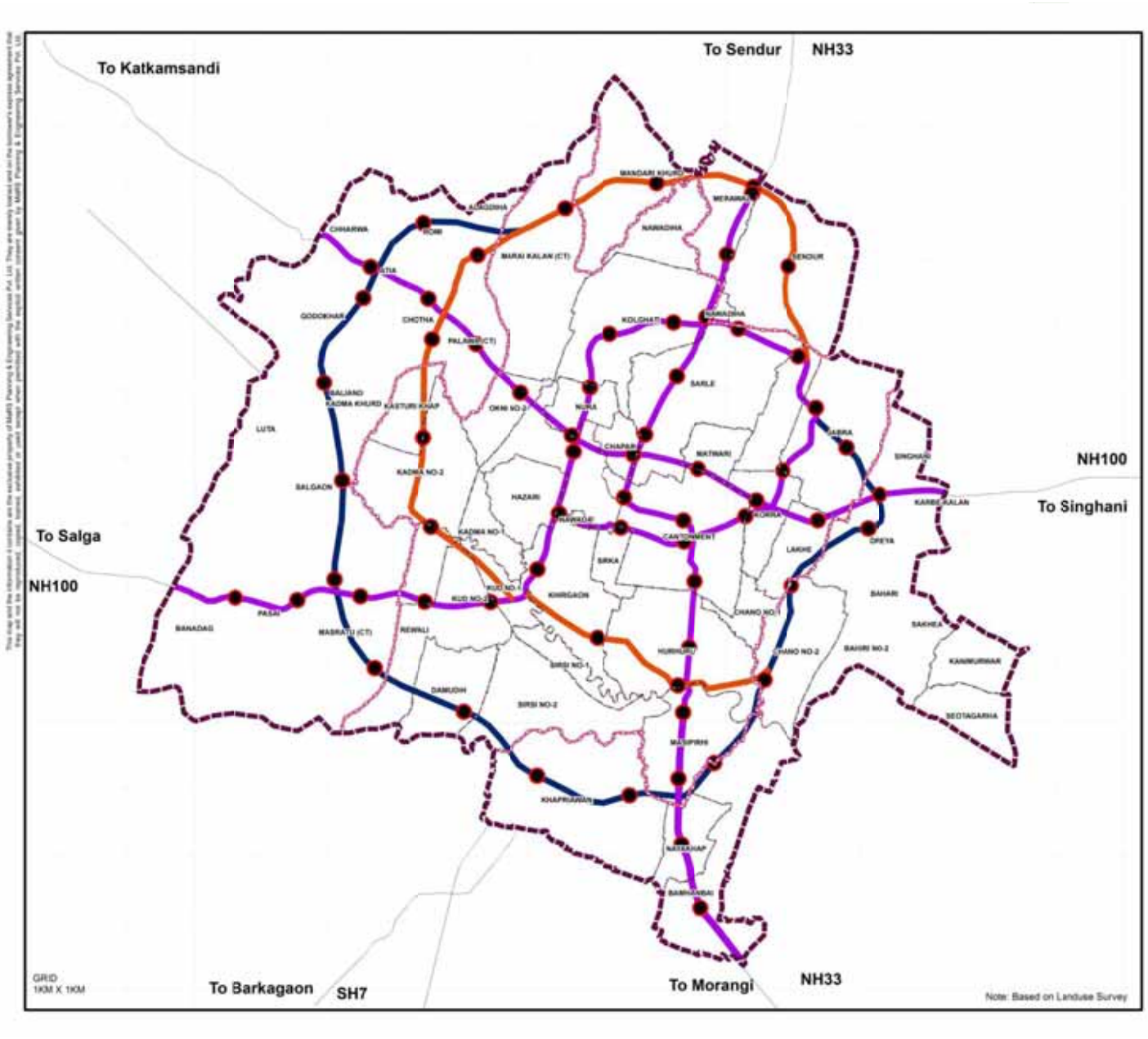
Scale:

0 0.5 1 2 Kilometers

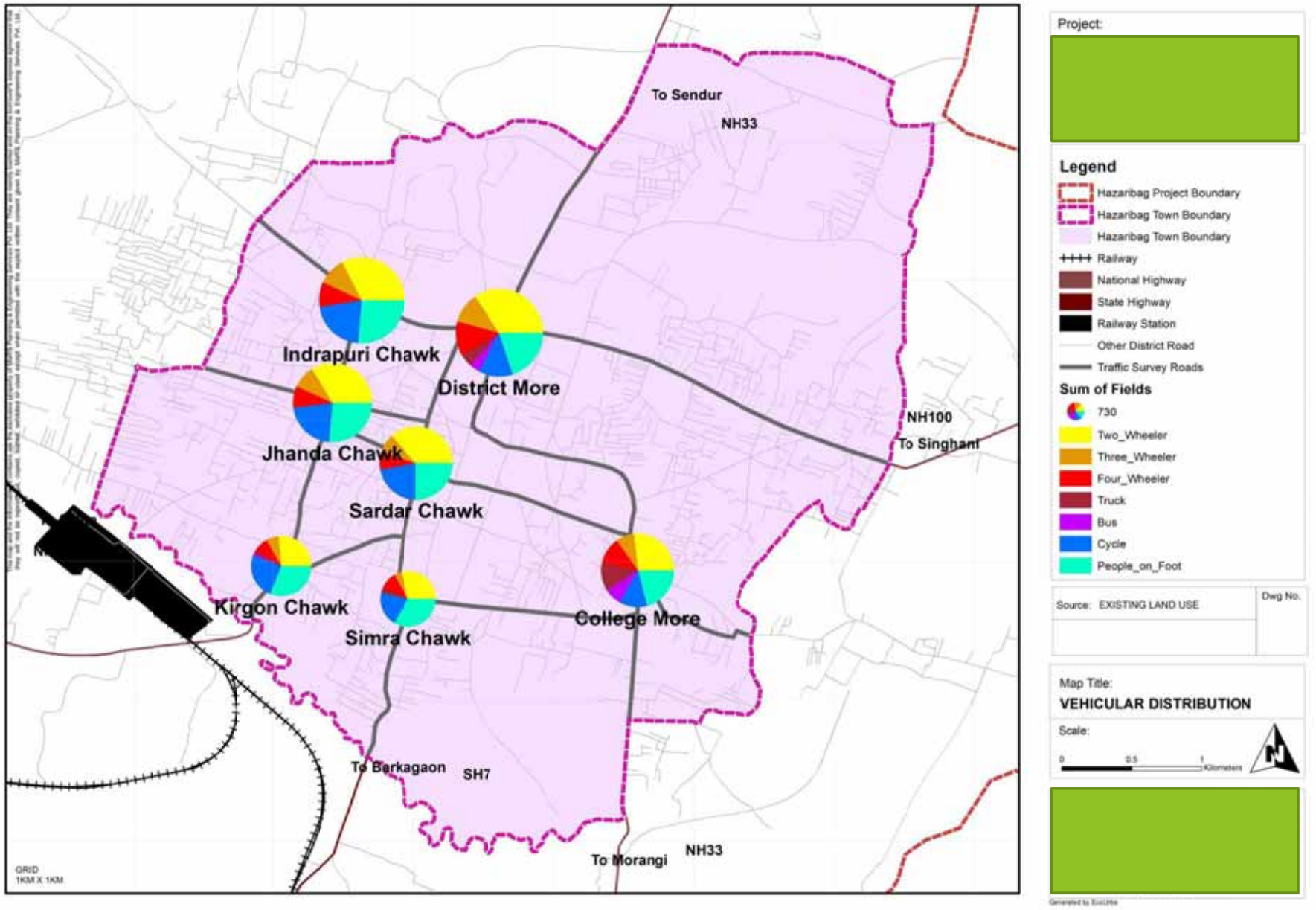
Traffic Flow



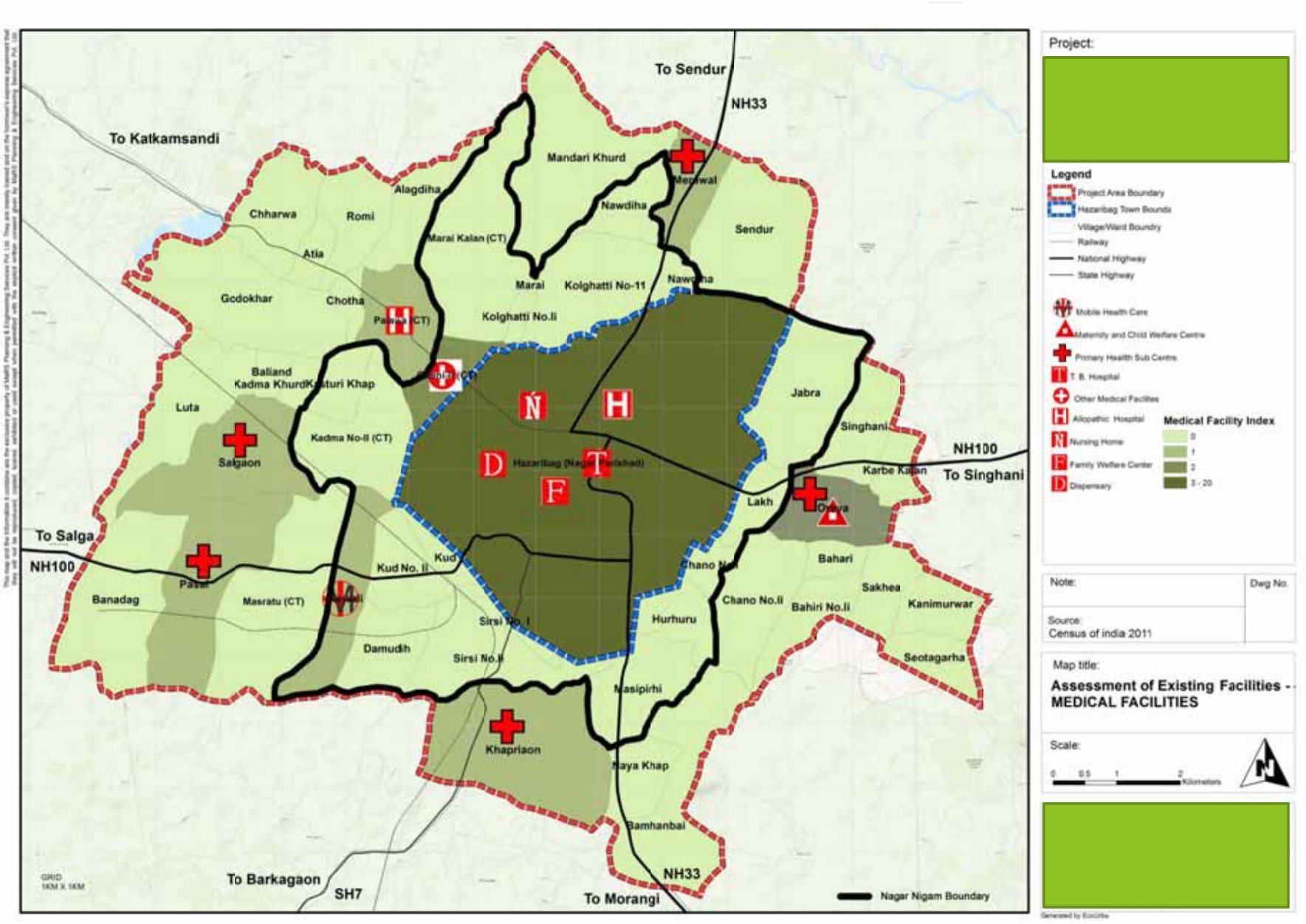
BRTS Route & Bus Stops



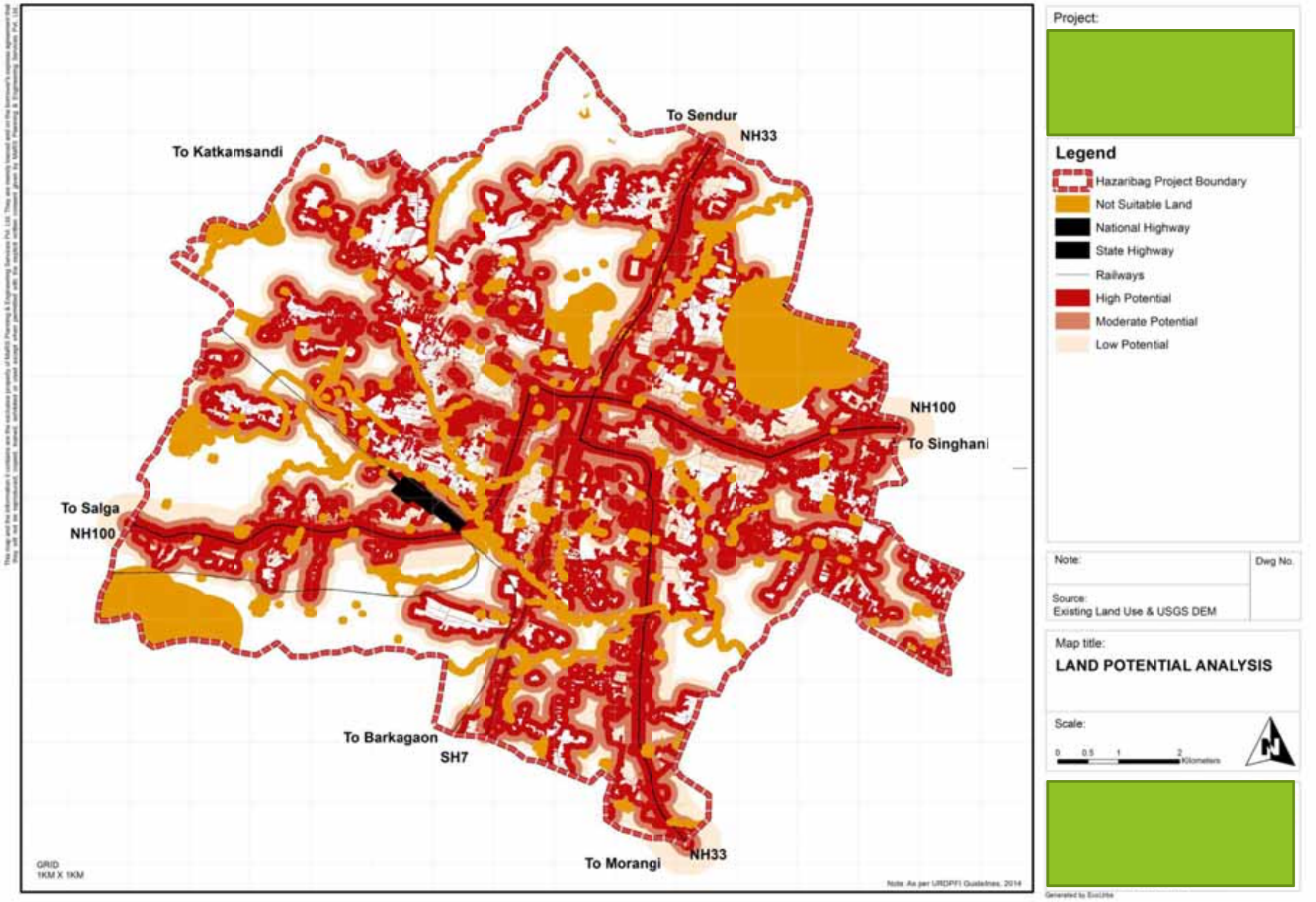
Vehicular Distribution



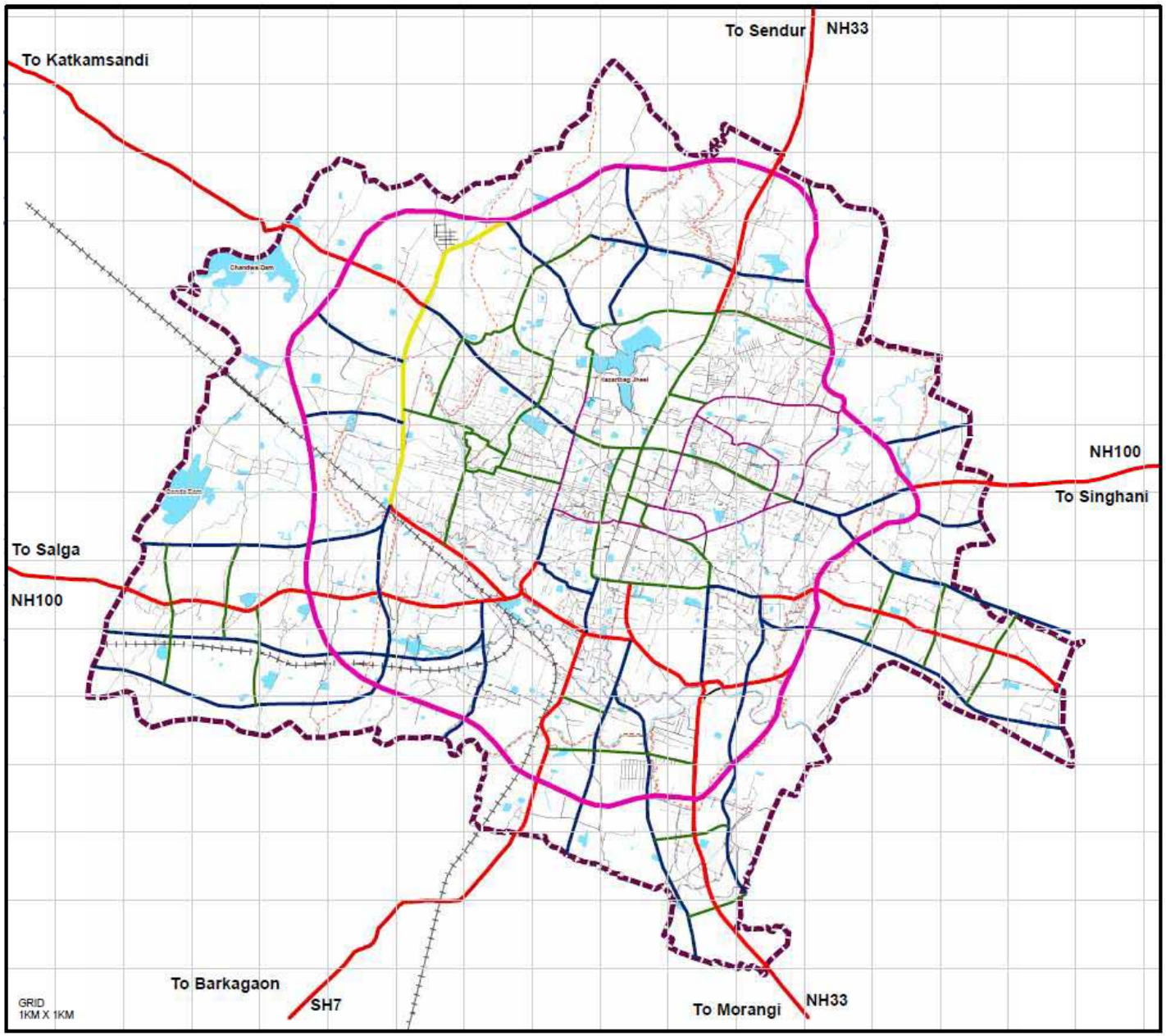
Social Infra Distribution



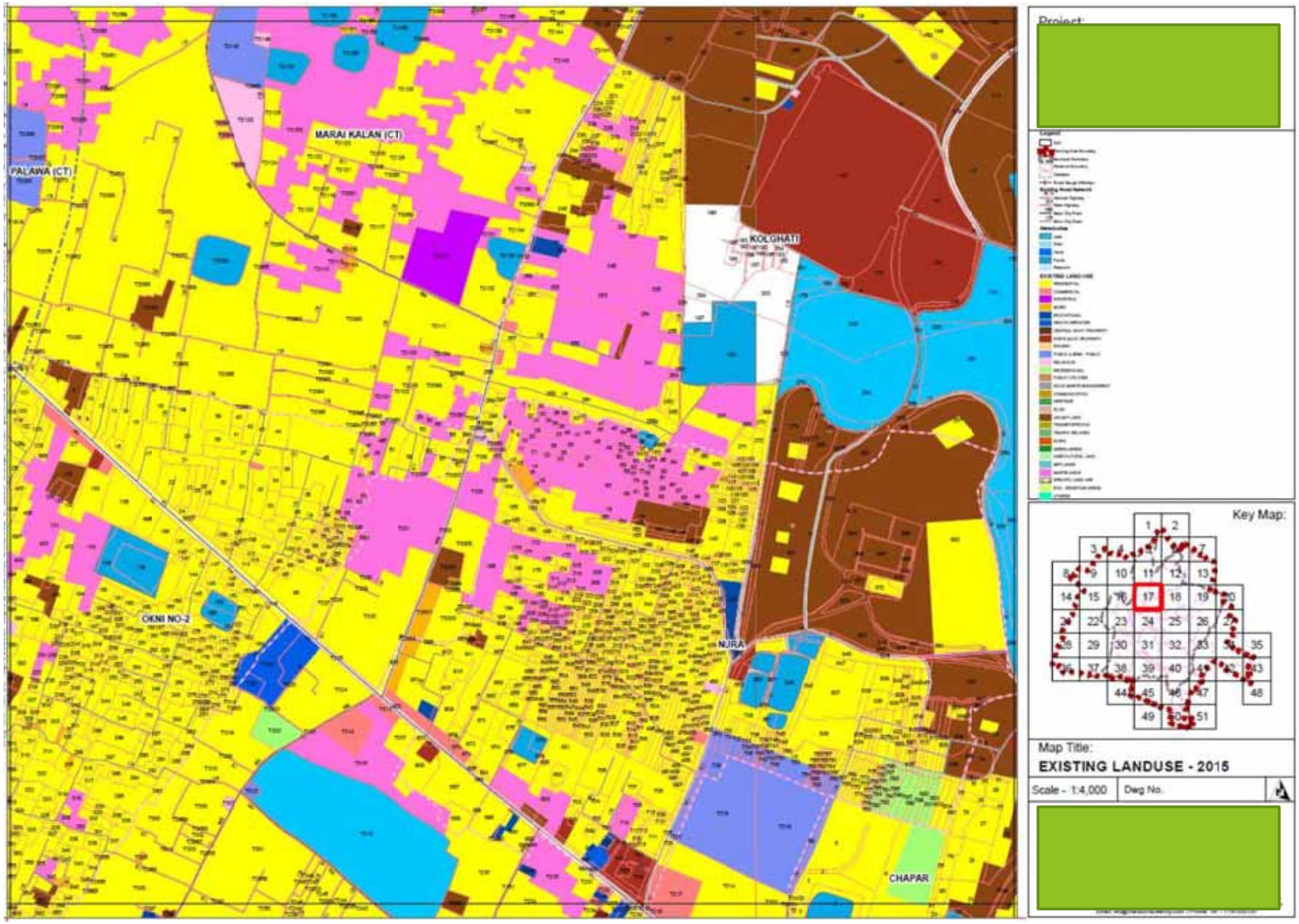
Land Potential Analysis



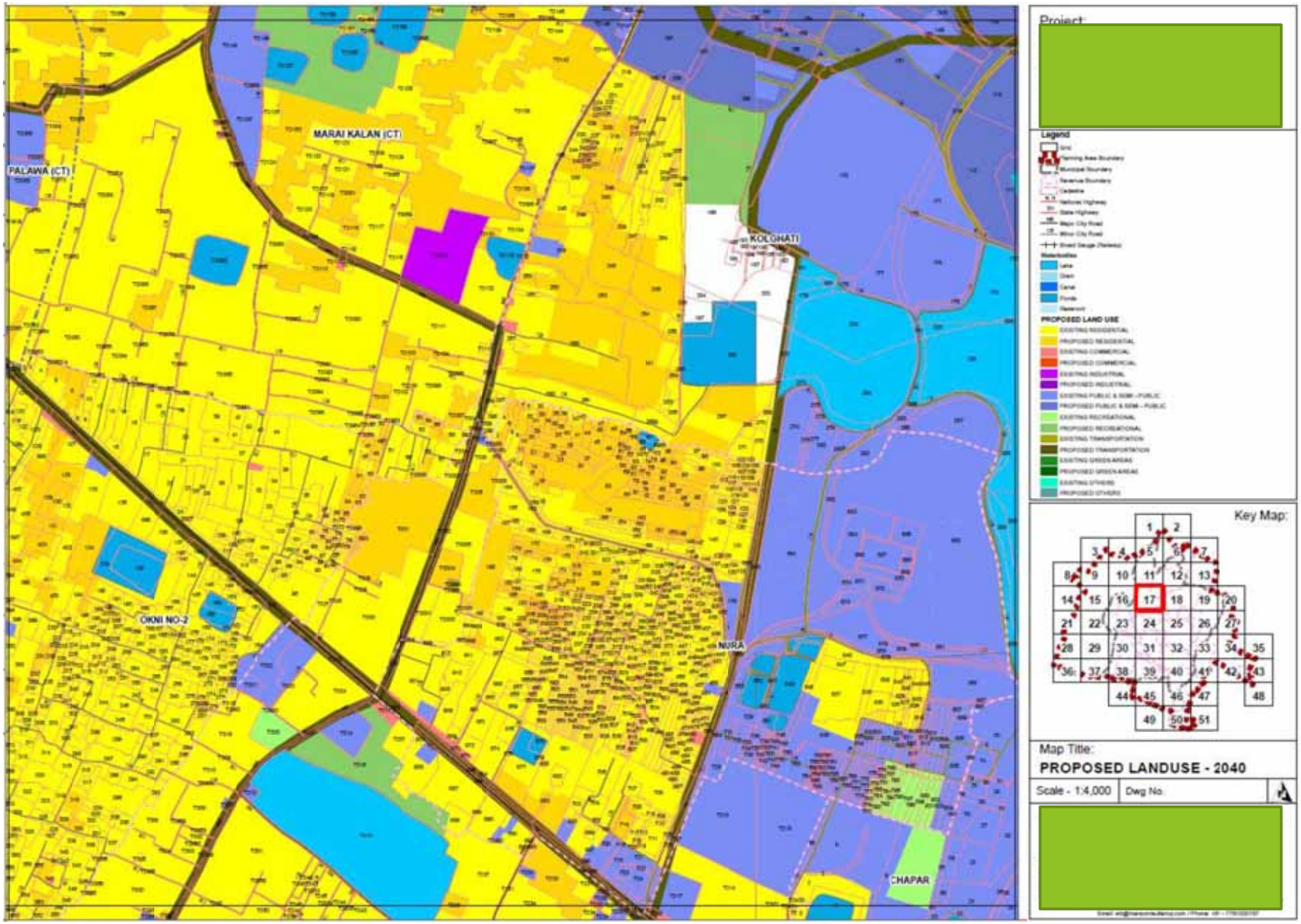
Proposed Road Network

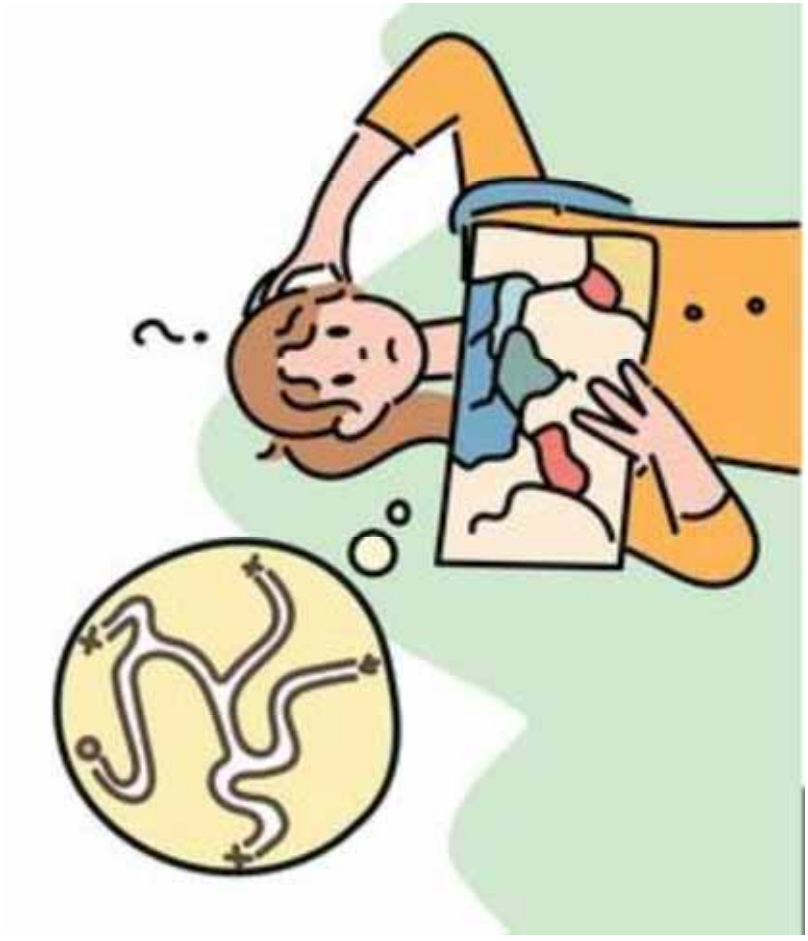


Existing Landuse



Proposed Landuse





Thank You

Sources:- Various Online / Offline & Live projects