WEB BASED WATER RESOURCES INFORMATION SYSTEM (INDIA-WRIS)

Manish Rathore,
Dy. Director,
NWA Pune

1.1 *India-WARIS* VISION

The National Water Policy (2012) recognizes that development and management of water resources need to be governed by national perspectives and aims to develop and conserve the scarce water resources in an integrated and environmentally sound basis. The National Water Policy 2002 Para 14.0 on Information System reads as -

All hydrological data, other than those classified on national security consideration, should be in public domain. However, a periodic review for further declassification of data may be carried out. A National Water Informatics Center should be established to collect, collate and process hydrologic data regularly from all over the country, conduct the preliminary processing, and maintain in open and transparent manner on a GIS platform.

In view of the likely climate change, much more data about snow and glaciers, evaporation, tidal hydrology and hydraulics, river geometry changes, erosion, sedimentation, etc. needs to be collected. A programme of such data collection needs to be developed and implemented.

All water related data, like rainfall, snowfall, geo-morphological, climatic, geological, surface water, ground water, water quality, ecological, water extraction and use, irrigated area, glaciers, etc., should be integrated with well defined procedures and formats to ensure online updation and transfer of data to facilitate development of database for informed decision making in the management of water.

The proposed India-Water Resources Information System (*India-WRIS*) is envisaged with following vision –

THE VISION

India–WARIS aims to provide a
'Single Window solution' for all water resources
data and information in a
standardized national GIS framework.

It will allow users to
Search, Access, Visualize, Understand and Analyze
comprehensive and contextual water resources data
for assessment, monitoring, planning, development and finally IWRM.

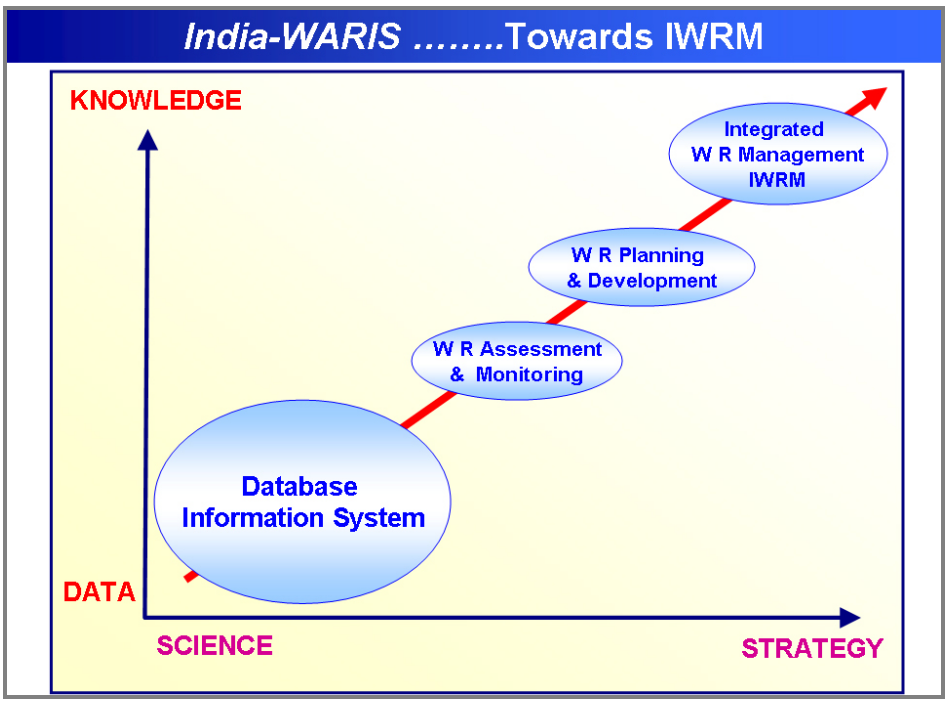
1.2 *India-WARIS* OBJECTIVES

1. To **collate** available data from varied sources, **generate** new databases of country's water resources, **organize** in standardized GIS format and **provide** a thin client scalable web-enabled information system.

2. To provide **easier and faster access** and **sharing** of nationally consistent and authentic water resources data **through a centralized database** and application server to all water resources departments, organizations, professionals and other stake holders for IWRM.

3. To **provide tools** to create value added maps by way of multi-layer stacking of GIS databases so as to **provide integrated view** to the water resources issues.

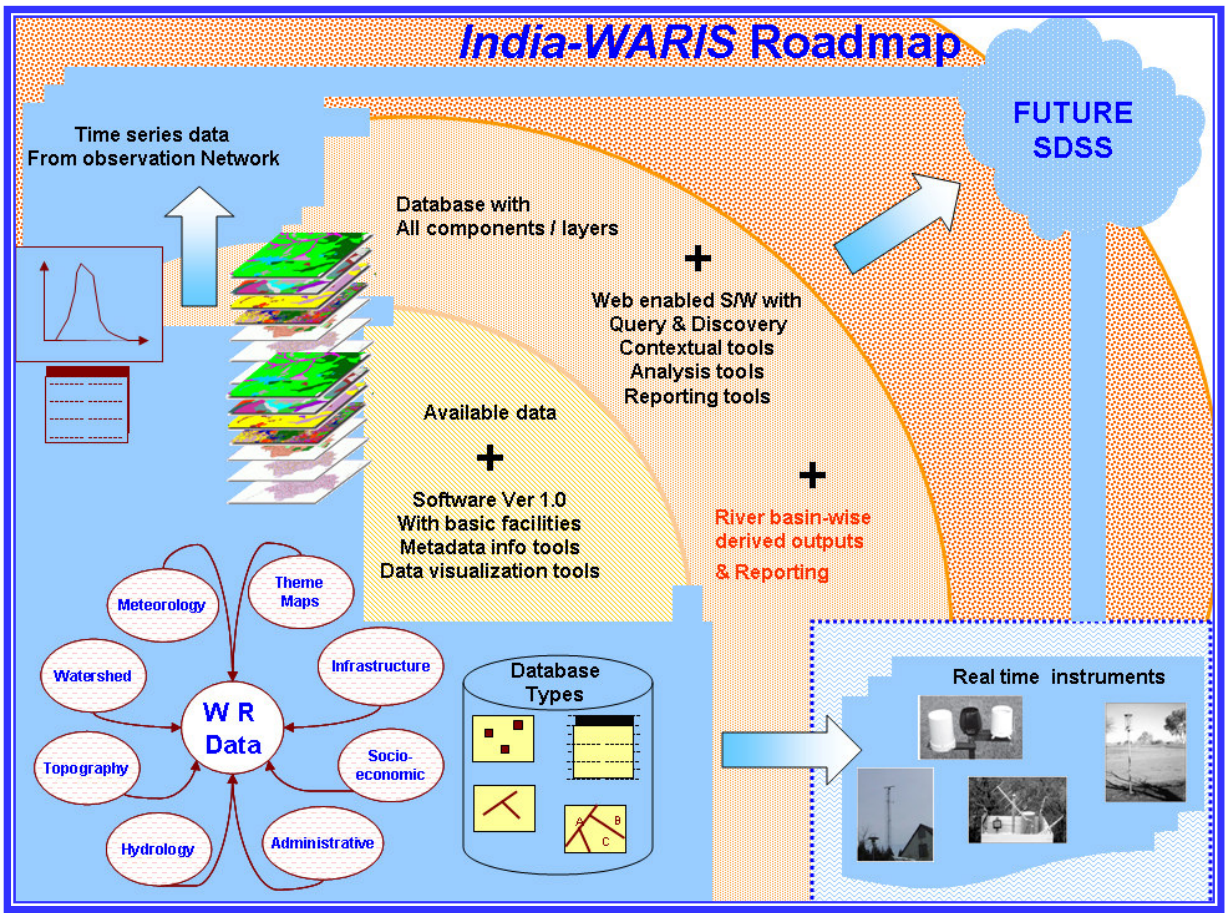
4. To provide **foundation** for advanced modeling purposes and future SDSS including automated data collection system.



Spatial Decision Support Systems specially targeted towards near real time problem solving demands require large amount of dynamic data at higher scale, which becomes increasingly complex in the initial stage. However, once the all the resources are pulled together and a centralized data repository is established the initial information system could be slowly further developed towards SDSS with application specific models. Hence, efforts right now will be to put Web Enabled Information System in place with centralized server.

The system will be primarily aimed at organizing the varied databases on common platform with standards defined for each of the database layer and further providing the user friendly interface to Geo-Visualize the diversified data. The system will employ Geo-visualization strategy to view data at user specified scale and also in automated fashion to match the View as per the scale requirements. As the viewing scale changes the viewer contents will also change as per scale. The system will allow to stack multiple GIS layers and will provide

flexible switching operations to the user for desired layer selection. System will provide ways to generate value added maps and will allow to have insight into the databases. Information system hence will allow to aesthetic display, layer stacking, query, pan/zoom operations and

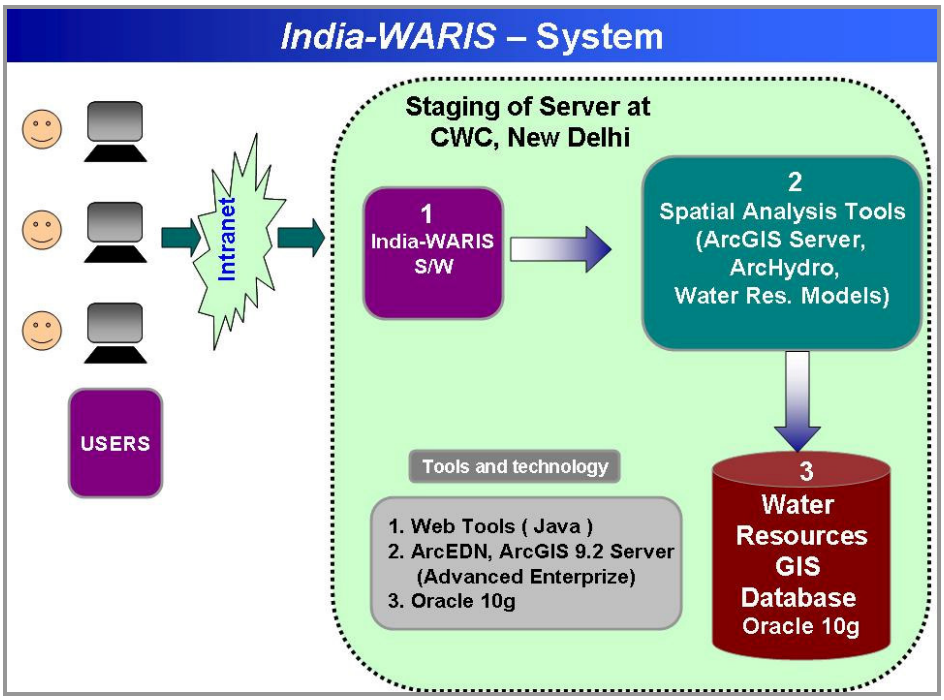


area of interest operations, basic report generation, printing etc.

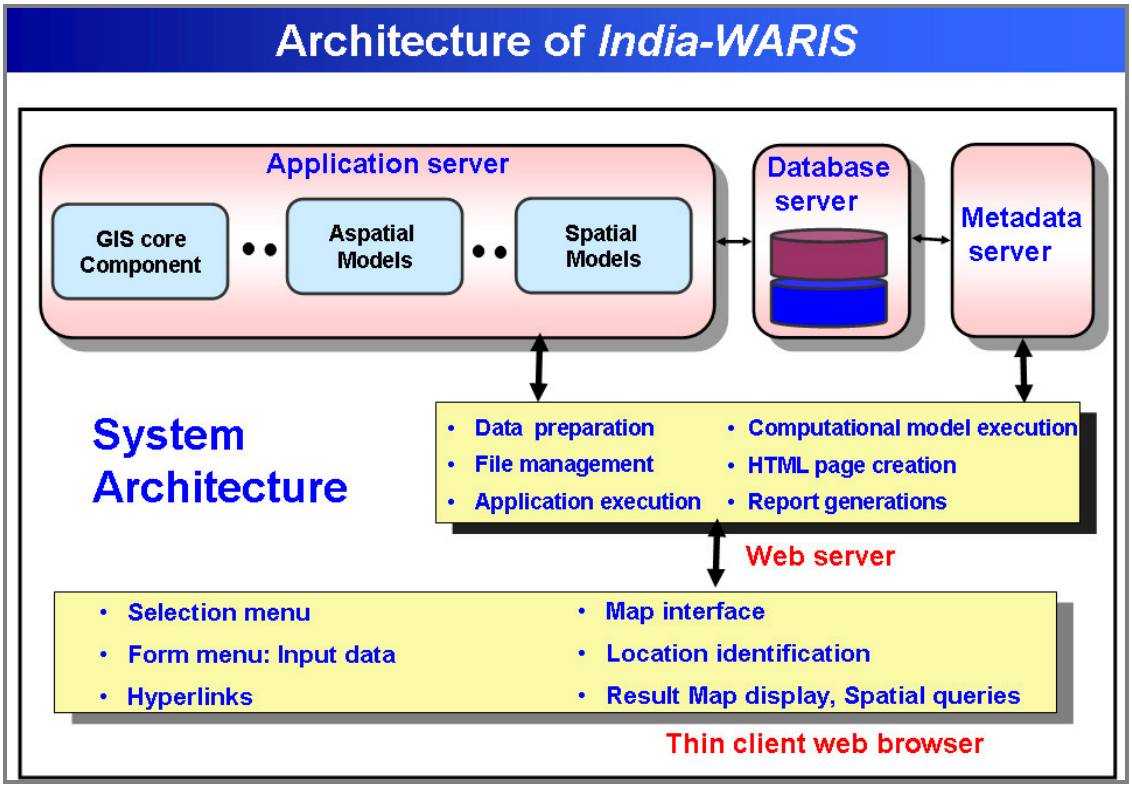
1.3 SYSTEM ARHITECTURE OF *India-WARIS*

As decided by CWC, *India-WARIS* will be a client server system with server side processing. The server-side approach uses a thin client and most of the processing, including spatial data access and manipulation is performed on the server side. The resulting information and image objects are then sent to the clients to be rendered. The server-side Web enabled information system requires only a browser installed on the client machine to carryout tasks. However, every user action requires communication between the client and the server.

The server side environment typically will include a web server (Apache, IIS etc.) and a map server (ArcGIS Server) that will provide GIS services. The map server software establishes a common platform for the exchange of web-enabled GIS data and services. The web server transfers spatial and non-spatial data between the client side (Web browser) and the map server through sockets. The client side user interface will be developed using Industry Standard Languages and web technologies provided by ArcGIS server Application Development Framework (ADF).



ArcGIS Server is an open, flexible, and scalable technology that runs on industry-standard IT infrastructure and supports geospatial Service-Oriented Architecture (SOA) initiatives. ArcGIS Desktop software complements ArcGIS Server by acting as a means of authoring, configuring, and maintaining data, models, and applications. This authored content can be published via ArcGIS Server, which provides the technology foundation for organizations to build and implement GIS-based Web services.



1.4 SCOPE OF THE PROJECT

The project envisages 30 Major spatial layers (Annexure – I) grouped under 5 heads & the report generation.

1. Watershed atlas (Basin maps – Basin, sub-basin, catchment, Watershed, River network, Digital Elevation Map)

2. **Administrative layers (**International, State, District, Tehsil / taluk, Village Boundary, Town / Villages location and extent, Infrastructure layers, Major Tourist Stations on River banks, Major water sanctuaries, Major Waterfalls & other environmental issues)

3. **Water resources projects (**Location of Major & Medium, Location of Hydroelectric projects, Location of Multipurpose projects, Major and medium Irrigation project command boundaries, Canal network, Waterlogged and salt affected area, soil sample)

4. **Thematic layers** (Water bodies, Landuse landcover, snow cover area, Groundwater well and its analyses, litholog data, land degradation, wasteland map, Drought prone area, Flood inundation map, Interbasin transfer links, inland navigation)

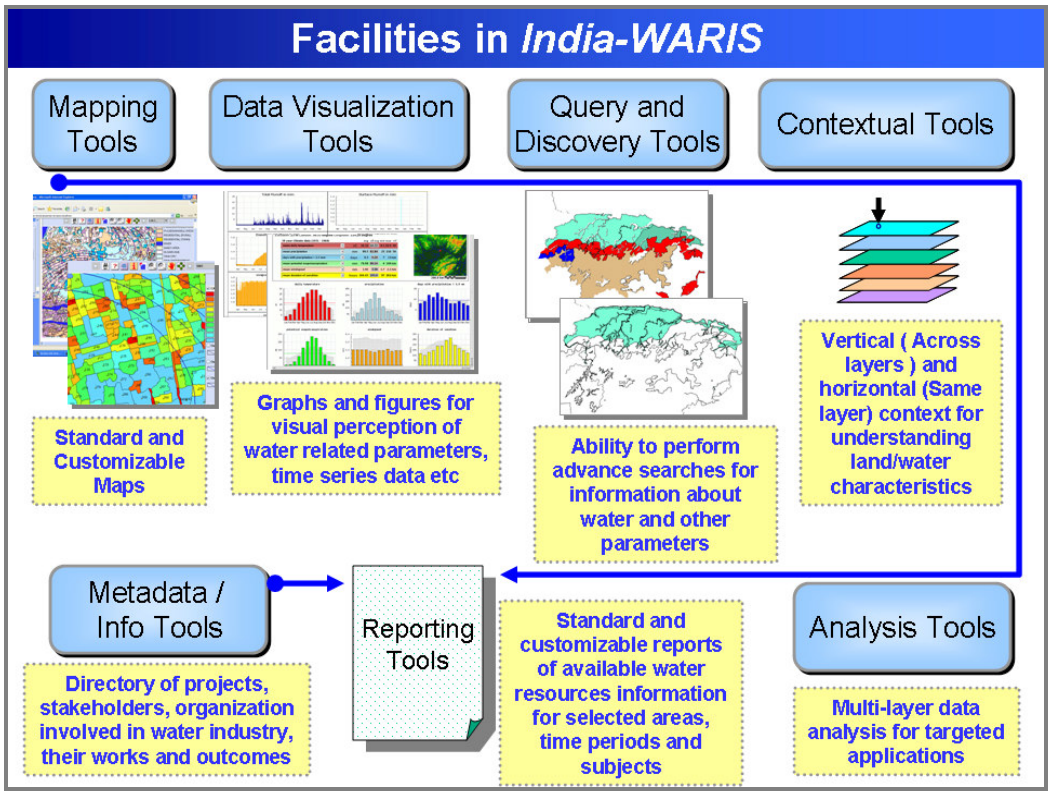
5. **Environment data** (Rainfall station, G&D station, Water quality station, climatic layer)

1.5 WEB ENABLED *India-WARIS* – PROPOSED FACILITIES

The user requirements, data types and required tools for decision support have been arrived through discussions and as of now, following facilities are proposed in India-WARIS:

Table 4: Facilities in *India-WARIS*

S N	Broad level facilities
1.	Mapping tools
	• Rendering of static styled maps with roaming, zoom-in and zoon-out facilities. Map tips to get information about any spatial unit on display on available database fields. • Multi-layer visual overlays for value added maps generation • Annotation on the maps through a database field and as graphic tools for map creation.
2.	Data visualization tools
	• Non-spatial data visualization for viewing spatial patterns • Visualization of non-spatial data in various ways to create environment for visual analysis of data and trigger decisions. • Generation of bar chart / pie chart from tabular data for data
3.	Query and discovery tools
	• Aim and shoot query to provide user required results through a single or stack of layers on the display. • Logical query through 'software provided forms' on thematic and other layers • Provide querying on single database layer • Stacking of query outputs with for visual analysis • Provide ways to discover the data
4.	Contextual tools
	• Vertical context by multi-layer stacking and identification tools and with layer transparency management
5.	Analysis tools
	• Multi-layer logical queries and unit-wise area / length statistics generation • Tools to facilitate analysis in other suitable packages providing open format inputs. • Multi-theme based analysis based on intra-theme and inter-theme weight-ages as desired by CWC
6.	Metadata / info tools
	• Metadata for the all the available data in central server • Information on projects / works of the stakeholders as provided by CEC
7.	Reporting tools
	• Generation of printable maps using standard map layout with various map elements. • Creation of area statistics report.



1.6 DATABASE STANDARDS

The Database Standards for Spatial and Non-Spatial Data: Standards are fundamental requirement for the GIS based information system. These standards enable technologies – imaging, GIS, GPS and applications – thematic mapping, services and outputs etc to work together. Standards are important not only to facilitate data sharing and increase interoperability, as is understood from many international efforts, but also to bring a systematization and "automation" into the total process of mapping and GIS itself. ISRO / DOS has put enormous amount of efforts and prepared the NNRMS standards for most of the thematic data. However all the new elements, which are not covered in earlier standards, will be standardized on the same guidelines as NNRMS standards. With regard to non-spatial data, this project will have enormous amount of such data, which will be standardized. Database table names and their linkage with corresponding spatial layer, database field type and structure of non-spatial database will be addressed by the small working level group of CWC and ISRO scientists.

Metadata Standards: The Metadata standards contain a set of relational tables that standardize the layer Metadata, the geographic search metadata, the access metadata etc. The NNRMS Metadata Standards will be followed for each of the database components.

Datum and projection: The project envisages WGS-84 datum and UTM projection for individual states and WGS-84 datum and LCC projection for entire country mosaic data.

Scale: All database creation under *India-WRIS* is proposed at 1:50,000 scale.

1.7 User of India-WRIS:

There could be three categories of users and three types of datasets, namely -

General user : Public domain fast track system – all users will be able to the visit website and get the snapshots of the outcome of the project on reduced scale with limited access to the database.

Premium user : This category of user will be able to get the access to the India-WRIS web application with the visualization of selected database and tools.

1.8 Status of Development of WRIS:

Central Water Commission (CWC), MoWR, initiated, the project 'Generation of Database and Implementation of Web enabled Water Resources Information System named as **India –WRIS in XI plan.** WRIS has been jointly formulated by CWC and ISRO to generate nationally consistent water resources database to be completed by December 2012. The MOU was signed with ISRO in December 2008. Hon'ble Minister for Water Resources launched the first version during December 2010. The URL of the website is www.india-wris.nrsc.gov.in. The current version is 4.0, which contains around 95 GIS layers and is on 1:250K scale (Public domain). The 1:50 K (Premium version) will be ready by May 2014.

Annexure – I

S.No	Name of GIS layer
1	Basin, sub basin, catchment, water shed
2	River network
3	Digital Elevation model
4	Administrative boundary like International, state, district & block boundary
5	Village boundary
6	Town/village location and extent
7	Road network
8	Major tourist station
9	Location of major & medium irrigation projects
10	Location of Hydroelectric project
11	Location of multipurpose projects
12	Major & medium irrigation command boundary
13	Waterlogged and salt affected area in major & medium command
14	Soil samples of major & medium irrigation project command
15	Canal network
16	Surface water bodies
17	Ground water observation well location & data
18	Litholog data with aquifer data
19	Landuse/land cover
20	Land degradation
21	Wasteland map
22	Snow cover area
23	Flood inundation map
24	Drought prone area map
25	Inland navigation waterways
26	Inter-basin transfer link as per NWDA
27	Hydro-meteorological (Gauge & Discharge) sites of CWC
28	Meteorological station of IMD & CWC
29	Climate related data
30	Pollution monitoring station/water quality station of CWC