Insight into GEMS

Central Ground Water Board

Topic of Discussion

- Background
- Software & Hardware Requirements
- About the contract
- GEMS – Overview
  - Data Entry
  - Validation
  - Data Processing & Analysis

Background

National Water Policy-India

Background

Envisages

- A well-developed standardized National Information System comprising network of databanks and databases.
- Improving the quality of data and processing capabilities.
- Promoting free exchange of data among the various user agencies

Background

- To Achieve the above objectives envisaged in the NWP,
  - The Concept of building a

    Hydrological Information System (HIS)

    mooted under World Bank Aided Hydrology Project.

HIS GW

Background

- Data Entry
- Management of historical data.
- Standardization, Validation, exchange, processing and analysis of data
- Data storage

- Data Collection
- Strengthening of Monitoring Network
- Optimization of network
- Institutional and human resource development

Background

A need for developing a Dedicated Software for Ground Water Data Processing Centers felt

Software & Hardware Requirements

Turn Key solution to the following items

- Development of Dedicated Software for Ground Water Data Processing Centers.
- Supply of compatible Database tool, GIS Tools, Query and Reports generation tools and all the run time modules and software tools required by the software.

Software & Hardware Requirements

- Supply of Hardware, Operating System, Communication and maintenance tools required for the Data Processing Centers
- Installation and implementation of the supplied items and software
- Training of End User and Staff and full Documentation and manuals for all the supply items.

- Maintenance and support of the supplied items for 4 years after the expiry of the warrantee of the pilot, based on satisfactory performance

Dedicated Software -Requirements

Software & Hardware Requirements

- Modular Software adjustable to the requirement at the level of office
- Various module to be customized as per client requirement to form integrated software
  - Basic
  - Groundwater Assessment Module
  - GIS Module
  - Advanced GIS Module

Capabilities of the Software shall include

- Data Entry/editing
- Entry Checks/validation
- Comprehensive Data Processing
- Statistical Analysis
- Data Retrieval
- Reporting
- Graphic/map Outputs
- Data Transfer & Dissemination
- Data Security and Backup facility

About the Contract

Development of Dedicated Software

About the Development of SW

- The contract for development of the dedicated software for Data Processing Centers has been awarded to M/S Tata Infotech Limited (TIL)
- The dedicated software developed for DPC is named as Groundwater Estimation and Management System (GEMS)

About the Development of SW

- GEMS is a GIS based database management software for
  - Data entry, validation, Data Processing, Statistical Analysis, Data Retrieval, Reporting tool capable of producing output in form of text/Graph /map, Data Transfer and dissemination, Data Security and Backup facility.

In respect of non-spatial, spatial/time series data of following attributes

- Water Level,
- Water Quality,
- Hydromet,
- Geophysics,
- Exploratory Details
- Other details

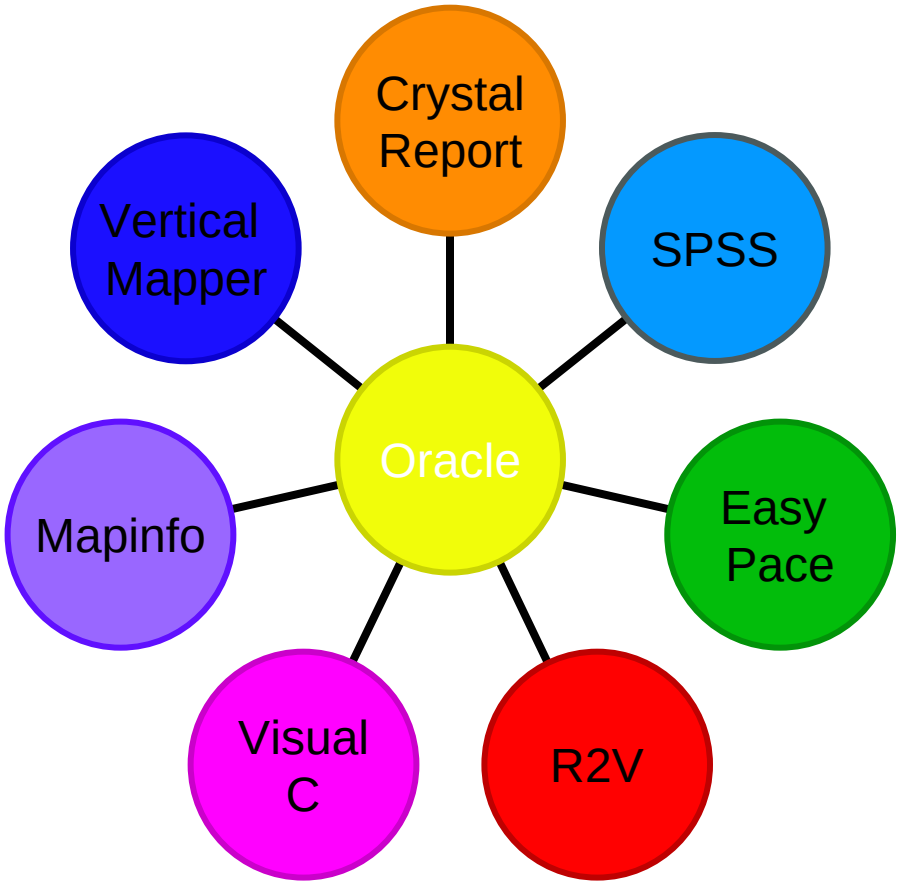
Development Team

About the Development of SW

- Software development Team from M/S Tata Infotech Limited
  - Domain Specialist
  - Database Experts
  - GIS Experts
- Working Group/User Group
  - State Ground Water Agencies
  - DHV Delft Consultants
  - National Informatic Center
  - Central Ground Water Board
- Overall Guidance was provided by the High Level Technical Group drawing member from:
  - Nodal Officers of State Ground Water Departments
  - National Informatic Center
  - National Institute of Hydrology
  - PCS, MOWR
  - Central Ground Water Board

GEMS - Database Tools, GIS Tools, Query and Reports

About the Development of SW



Hardware, OS, Communication and Maintenance Tools

- 4 types of Packages A, B, C & D have been installed
- Operating System -Windows 2000 and Windows 2000 Server have been installed
- Communication equipments Hubs, Routers, switches, etc. have been installed

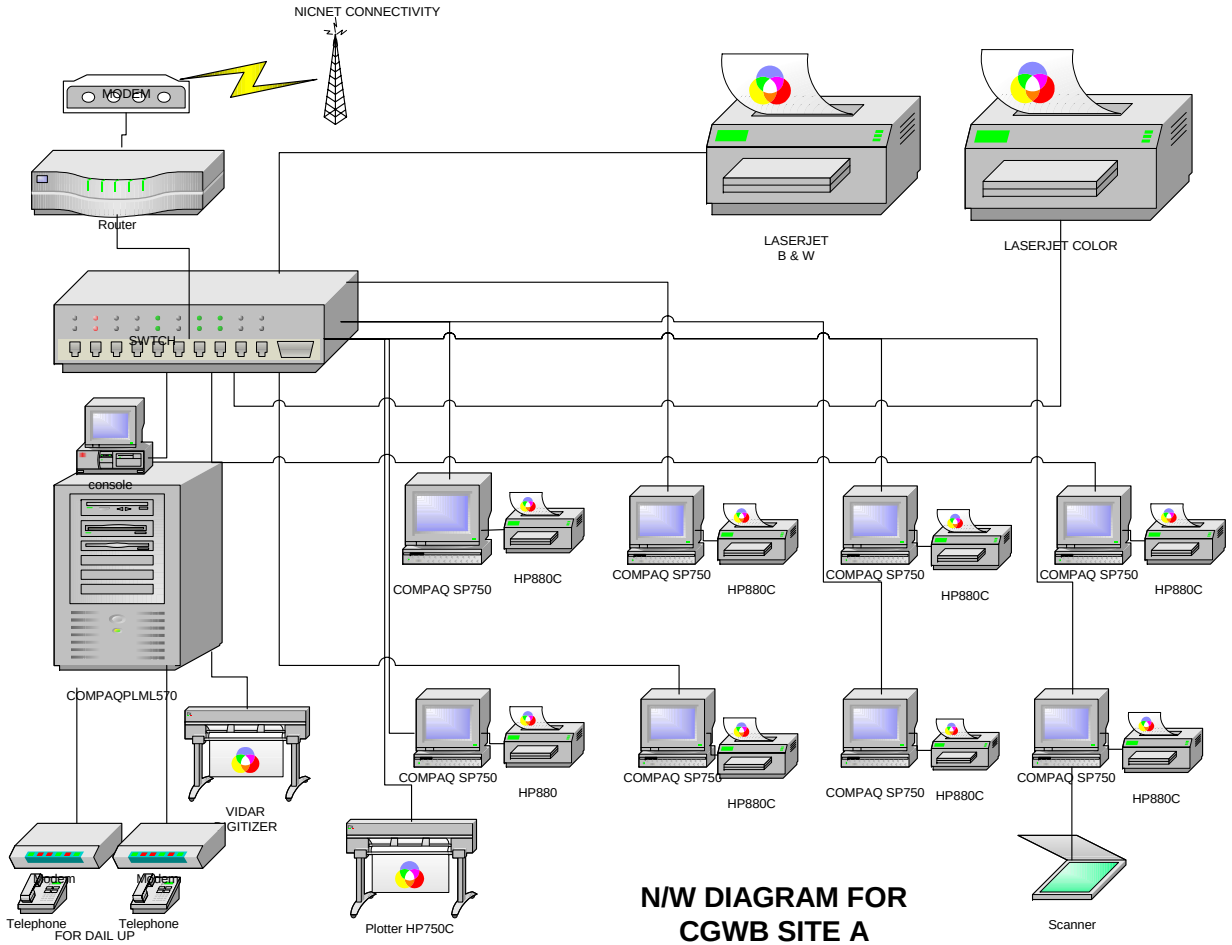
Details of Package

About the Development of SW

- Package A : (8 Nodes Network) - National Data Centre
- Package B : (5 Nodes Network)
  - Regional Data Centers of CGWB &
  - State Ground Water Data Centers
- Package C : (2 Nodes)
  - National Data Centers &
  - National Institute of Hydrology
- Package D : (2 Nodes) - District and Unit offices

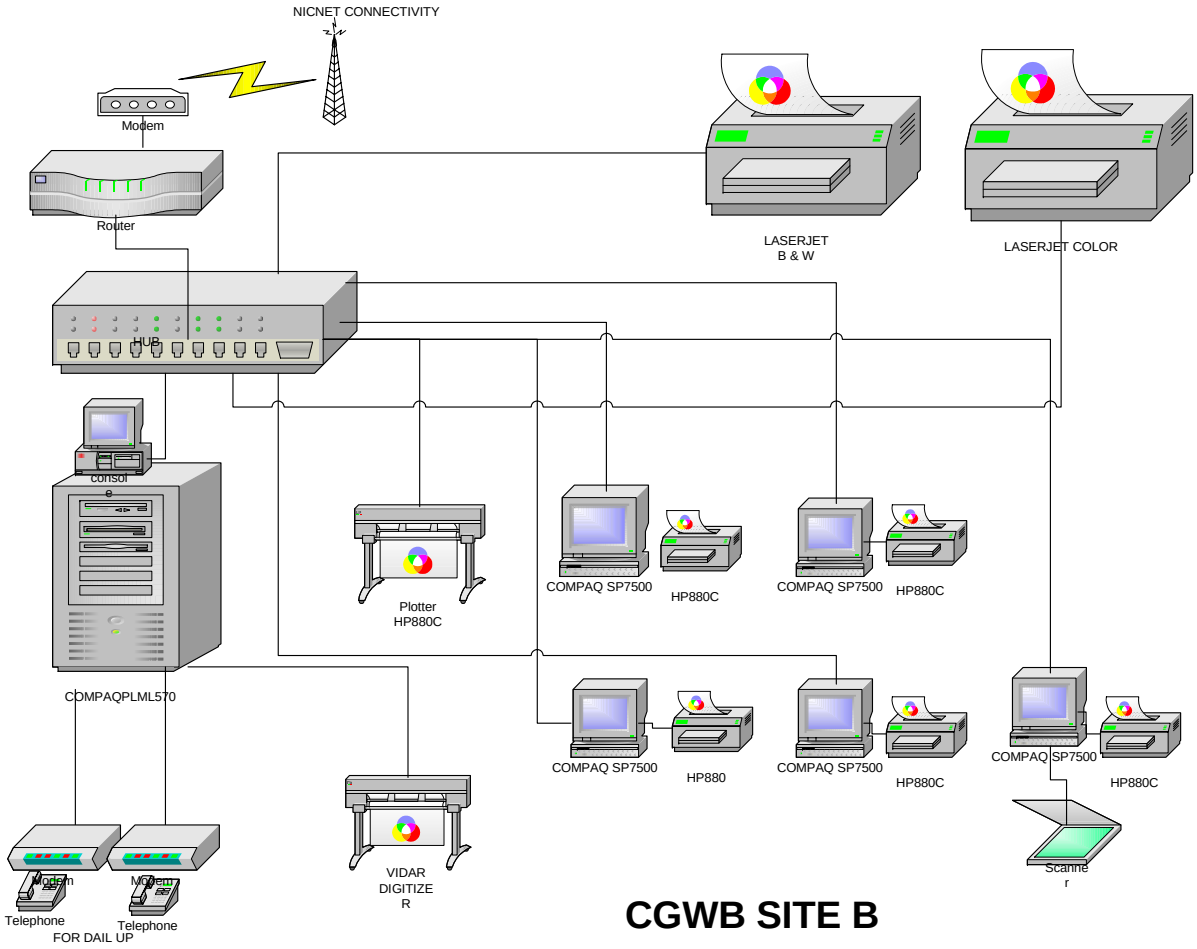
Network Diagram ‘A’ Package

About the Development of SW



Network Diagram ‘B’ Package

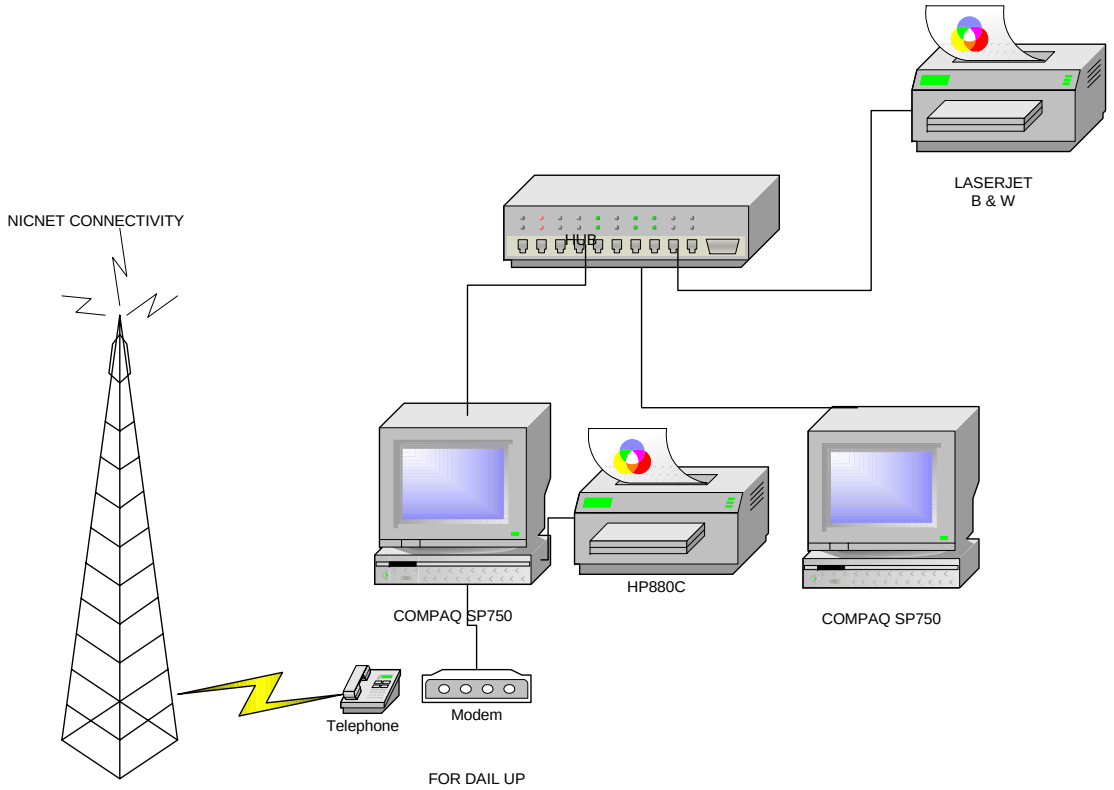
About the Development of SW



CGWB SITE B

Network Diagram ‘C-D’ Package

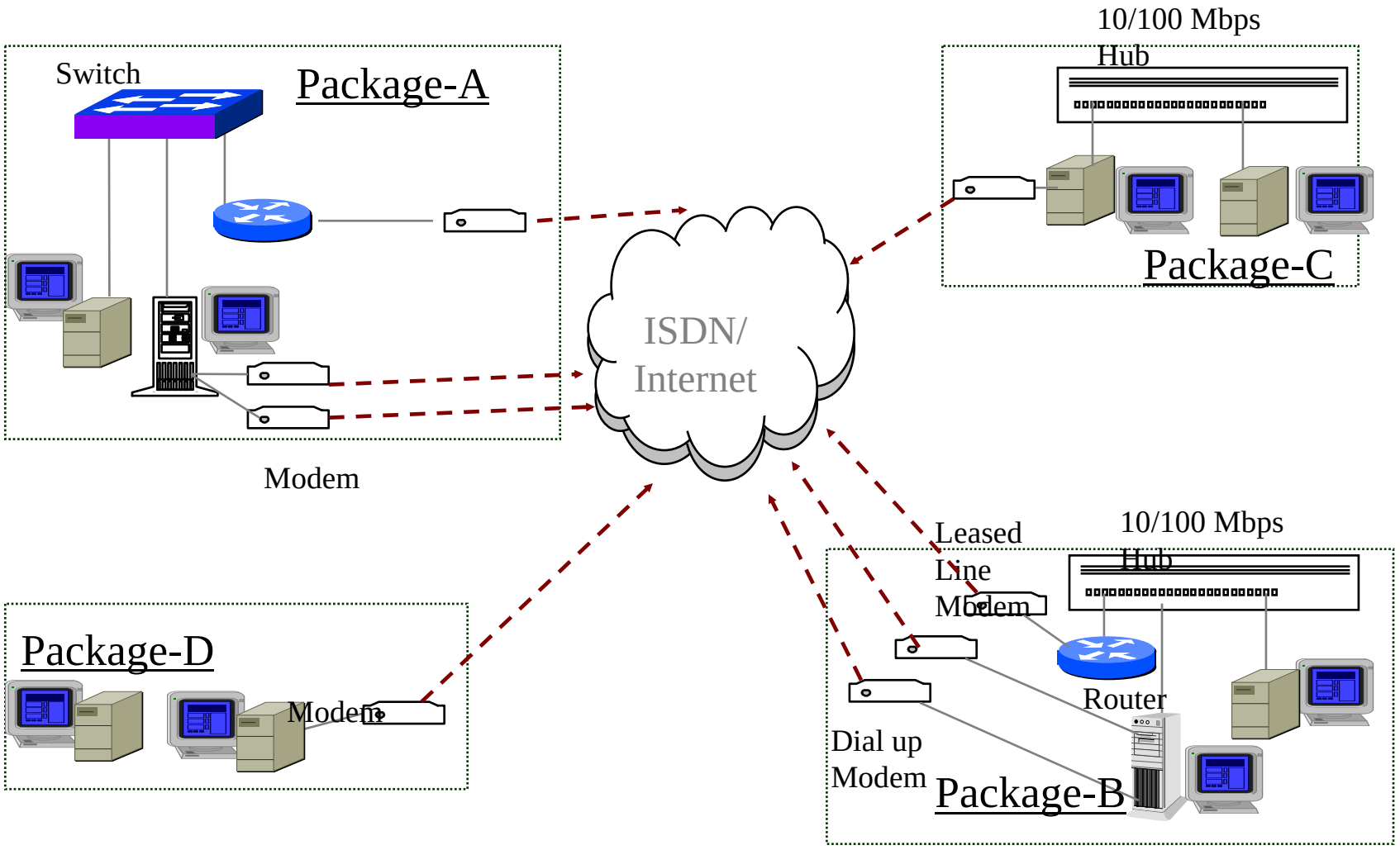
About the Development of SW



N/W DIAGRAM FOR
CGWB SITE C & D

Logical Diagram of HIS A-B-C-D Packages

About the Development of SW



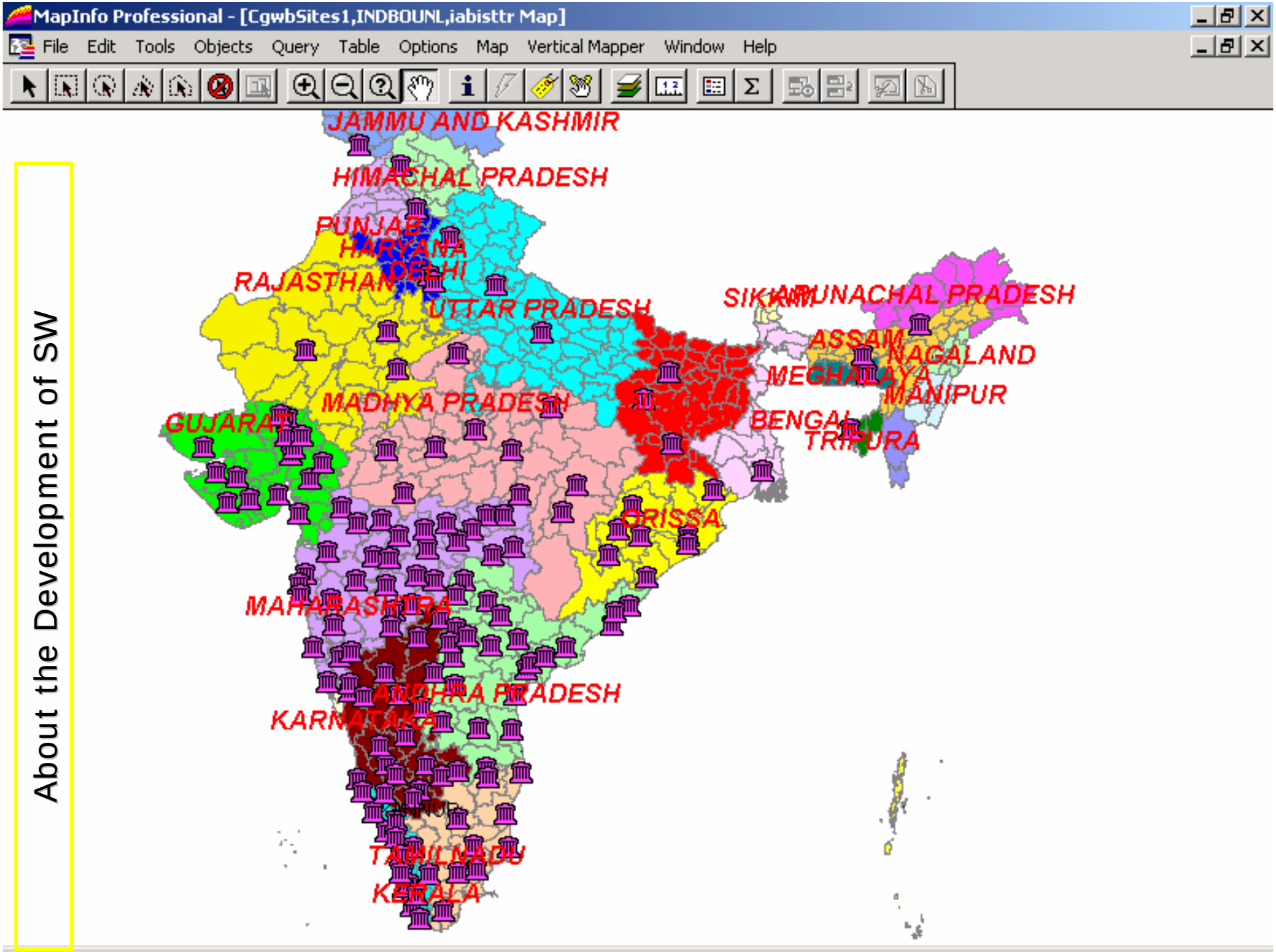
Extent of Implementation

About the Development of SW

- 191 sites through out India
  - 175 (163 States+12 CGWB) in 9 peninsular states
  - 16 sites of CGWB are out of Project area i.e. Non-Peninsular states

➔ ***Implementation at***

⇨***CGWB***	***122***	***28***
⇨***Andhra Pradesh***	***69***	***04 + 29***
⇨***Gujarat***	***38***	***16***
⇨***Maharashtra***	***79***	***38***
⇨***Orissa***	***21***	***09***
⇨***MP***	***27***	***12***
⇨***Kerala***	***37***	***17***
⇨***Tamil Nadu***	***31***	***14***
⇨***Karnataka***	***47***	***22***
⇨***NIH, Roorkee***	***4***	***02***
⇨***Total***	***475***	***162 + 29 = 191***


MapInfo Professional - [CgwbSites1,INDBOUNL,iabisttr Map]
File Edit Tools Objects Query Table Options Map Vertical Mapper Window Help
JAMMU AND KASHMIR
HIMACHAL PRADESH
PUNJAB
HARYANA
DELHI
RAJASTHAN
UTTAR PRADESH
SIKKIM
ARUNACHAL PRADESH
ASSAM
NAGALAND
MEGHALAYA
MANIPUR
TRIPURA
BENGAL
MADHYA PRADESH
GUJARAT
ORISSA
MAHARASHTRA
ANDHRA PRADESH
KARNATAKA
TAMILNADU
KERALA
About the Development of SW

Training of End User and Staff

About the Development of SW

- 508 end user have been trained for operation and maintenance of the GEMS software and hardware
- 1 - TOT course for 30 persons have been conducted
- Second TOT course is under going presently at NDC, Faridabad
- Documentation and manuals for all the supply items provided.
- Manual for GEMS software has been finalized for distribution.

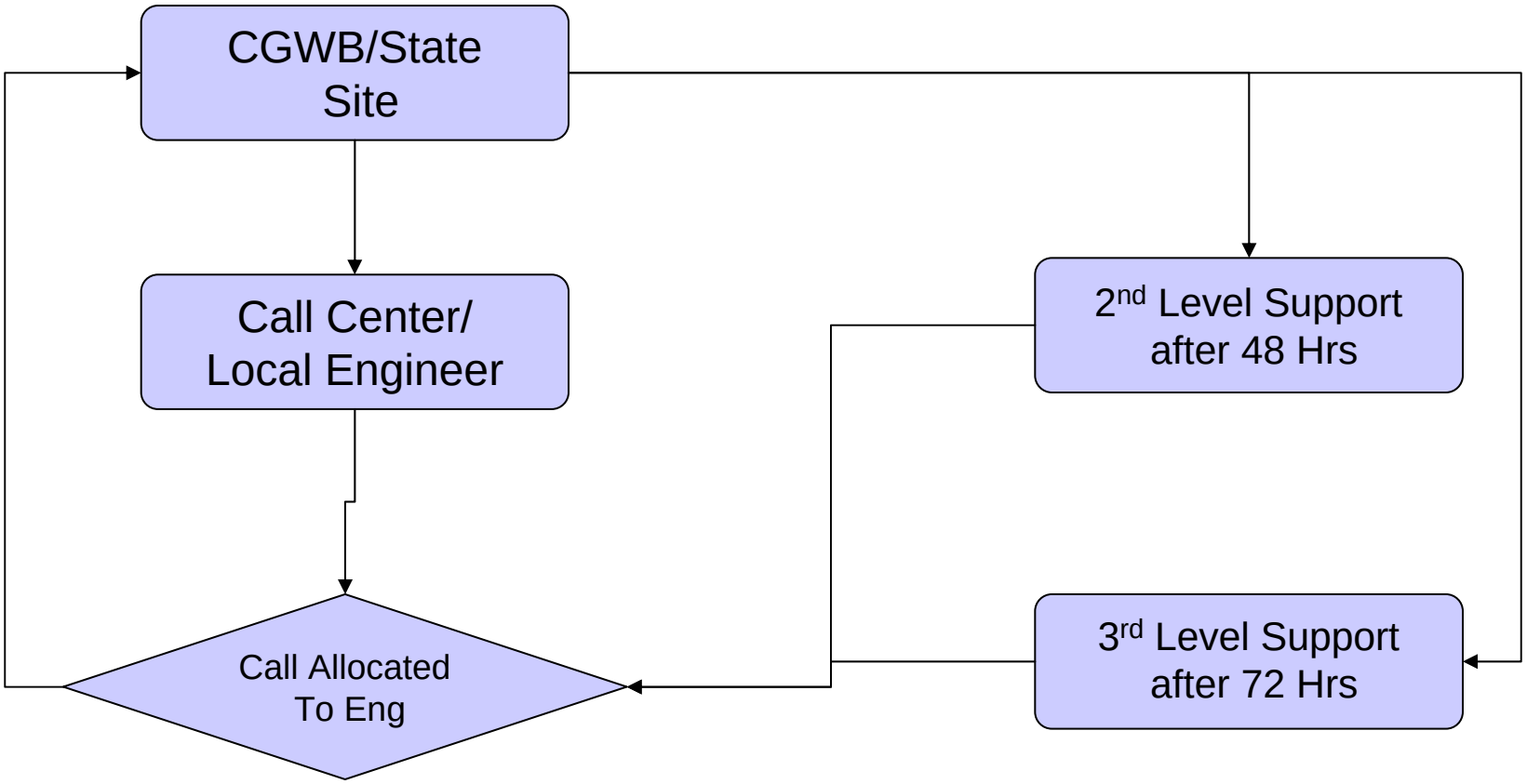
Maintenance and Support

About the Development of SW

- 2 officers per B-site have been nominated for monthly review meeting with M/S Tata Infotech Limited (TIL) for evaluation of maintenance and support.
- Regular meetings are being held in the 1st week of every month at all the B-Sites
- At NDC level all calls made during the month are reviewed by a committee every month in the 2nd /3rd week
- Web Based helpdesk site has been registered with the domain name www.cgwbgems.org and is under construction.
- In addition to the above the maintenance is through the toll free number at Mumbai, Email to CGWB & M/S TIL is in operation.

Support Methodology

About the Development of SW



GEMS
- an Overview

First Screen of GEMS

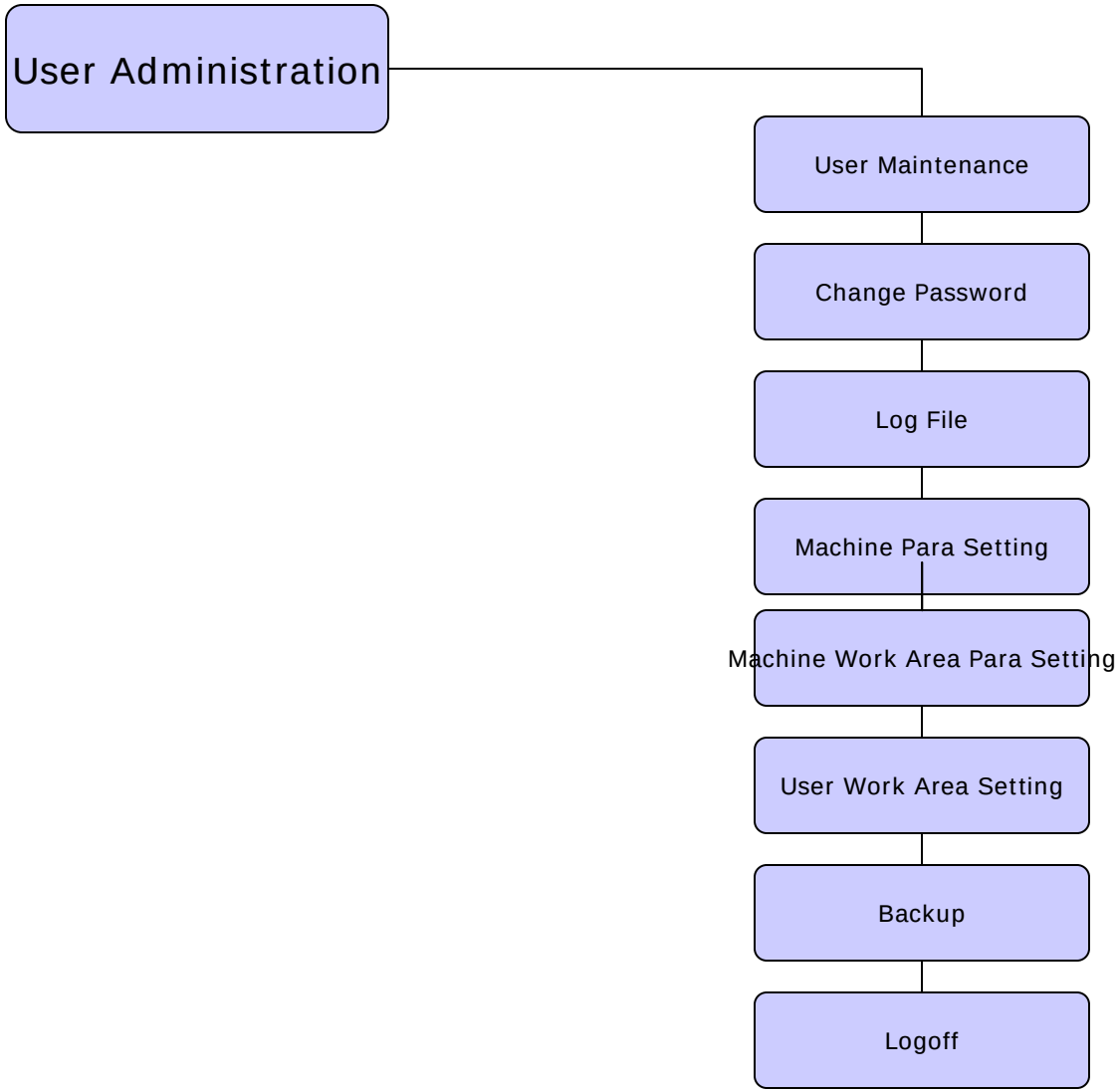
GEMS - Overview

GEMS - Modules

GEMS - Overview

User Administration

GEMS - Overview



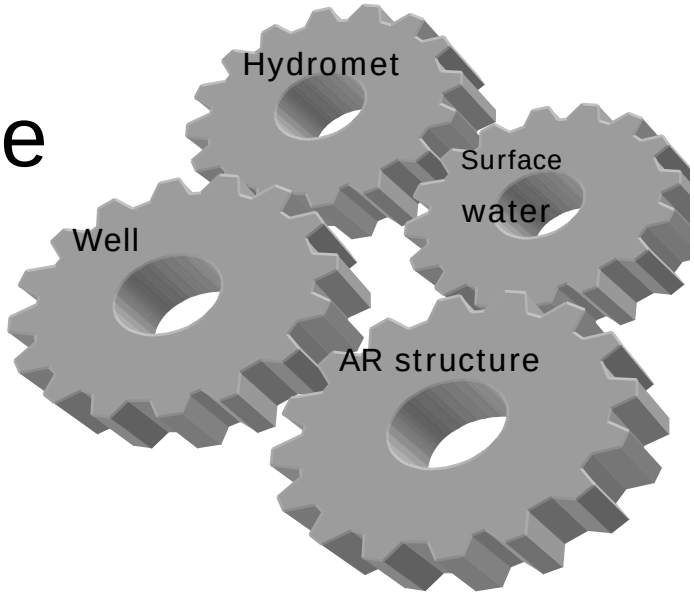
Master

- To Standardize & Minimize Data Entry Errors.
- Masters have been broadly classified into three categories
  - General
    - Relating to Admin/Hydrological boundaries
  - Groundwater Assessment
    - Canal seepage
    - Lithology/infiltration factor/well unit draft Master
    - Return flow
  - Water Quality
    - Method of analysis
    - Labs/agencies
    - Ion/elements/container/Parameter
    - Standards etc

Site

All the groundwater related structures have been grouped under 4 site categories

- Well
- Hydromet
- Artificial Recharge Structure
- Surface water site



DATA ENTRY

Data Entry

- Data Entry of all the sites is being done through uniform data entry screens
  - Static - Location, General, Topographic, Hydrology, Hydro-geology etc
  - Dynamic – GW Level, WQ Parameters, Rainfall Depths etc

Static – General Information

- Static details are being entered through uniform data entry screens
  - Location, General, Topographic, Hydrology, Hydro-geology
- These screen allows
  - Selection of Well, Add / Modify Well Details

Static-Well Specific Details

The data entry forms are as per the structure type

- Dug Well
- Bore Well
- Dug Cum Bore Well
- Tube Well
- Slim Hole
- Spring
- Observation Well

Static - Other well related data

- Pumping Test Data
  - Aquifer Performance Test
  - Step Drawdown Test
  - Zone Test
- Grain Size Analysis
- Geophysical Logging Data
- DWLR Details

Static - Hydromet

- Rainfall and other Hydromet data/ Normal Rainfall Data
  - Add / Modify / Delete
  - Location Details

Static - Artificial Recharge Structures

Type of structures

- Percolation Tank
- Cement Plug
- Nallah Bund
- Injection Well (Bore & Tube)
- Recharge Shaft
- Infiltration Test
- Spillway Details

Static – Geophysical Data

- Data entry of Geophysical Sounding / Profiling
- Add /Modify Sounding / Profiling

Dynamic Data

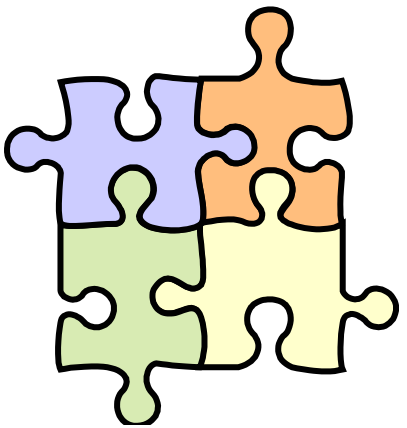
- Water level (Add / Modify / Delete)
  - Manual
  - Automatic / DWLR Data Upload
- Water Quality
    - Date wise
    - Parameter wise
- Rainfall
    - Daily/Monthly

Dynamic Data

- Groundwater Resource Assessment & Balance
  - Selection of Assessment unit
  - Assessment Unit
    - Add
    - Modify
    - Delete
  - Draft Data
  - Canal Reach, Surface Water Irrigation, Cropping Pattern, Tanks and Ponds, Water Conservation Structures, Additional Potential Recharge structures, Rainfall Infiltration Factor, Static Resources info, Future Domestic and Industrial Uses info

DATA VALIDATION

- Online Validation : Field level primary online data entry checks(limits) inbuilt in software.
- Offline Validation :
  - Primary – Check for completeness of data, well type related dimension etc.
  - Secondary – statistical , time series, spatial
  - Map based validation



DATA PROCESSSING

&

ANALYSIS

Reports, Maps & Queries can be prepared on

- Administrative Boundaries
- Hydrological Boundaries
- Or Both

Water level / Water Quality data

- Spatial domain
  - Contouring
  - Interpolation
  - Attribute maps
  - Thematic
  - Cross Section
  - Fence Diagram
- Time domain
  - Long Trend Analysis
  - Hydrograph Analysis
  - Spectral/Harmonic Analysis
- Non-spatial Data processing
  - Lithological log
  - Geophysical Log
  - Grain Size Analysis

Other Specific Analysis

- Hydrograph Analysis
- Comprehensive Logs Display
- Grain Size Analysis
- Hydrogeological Map
- Morphometric Analysis
- Event Analysis (Change Analysis)

Water Quality

- Suitability Table
- Water Quality Plots
- Diagrams
- Parameter Distribution Maps

Groundwater Assessment

- Groundwater Draft
- Groundwater Recharge
- Recharge from Rainfall
- Recharge from Other Sources
- Additional Potential Recharge
- Overall Assessment
- Ground Water Balance
- Sensitivity Analysis

Statistical Analysis

- Hypothesis Testing
- Univariate Analysis
- Multivariate Analysis
- Time Series Analysis
- Lag time Analysis

Miscellaneous Utilities

- Query & Report
- Master Data Maintenance
- Export & Import
- Database Maintenance
- On -line Help

Integration of GIS Layers

Software has been integrated with 14 layers

- Administrative boundaries up to blocks,
- Hydrologic boundary up to water shed, Settlement up to village,
- Drainage Transport net work
- Transport net work (Railway Lines),
- Elevation contours,
- Elevation point height,
- Landuse/Cover,
- Soil,
- Geology Lithology/rock type)
- Geology structure,
- Geomorphology,
- Command area/non-command area/hilly area map.

GIS Functionalities

- Automatic data pickup from GIS layers at the time of data entry.
- Database and maps synchronization when maps are updated.
- Advanced GIS analysis
  - Union,
  - Identity
  - Overlay Analysis
- Standard Interpolations
- Fence and Cross-Section

Thank You

Save Water

Save Life