THE STUDY ON
ON SUSTAINABLE GROUNDWATER DEVELOPMENT
FOR BOGOTA PLAIN
IN THE REPUBLIC OF COLOMBIA

FINAL REPORT
SUPPORTING REPORT

PART 12

GIS DATABASE

Final Report
(Supporting Report)

Part 12 GIS Database

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PART - 12 GIS DATABASE

CHAPTER 1 Geographic Information System

1.1 Installation of GIS and production of database

GIS has a task to support the development of database and application for the sustainable groundwater resource development in BOGOTA plain. GIS and database closely relates to each activities in the survey as shown in Figure-1.1, so survey results is reflected to contents of application and database directly. Database relating to grand water development in Colombia the use of database is limited among agencies, so it is necessary to arrange and to edit data sources for database production that make affection against the quality of the application. It is expected that database in the study will contribute to Spatial Data Infrastructure in Colombia.

GIS System and Database among Survey Activities

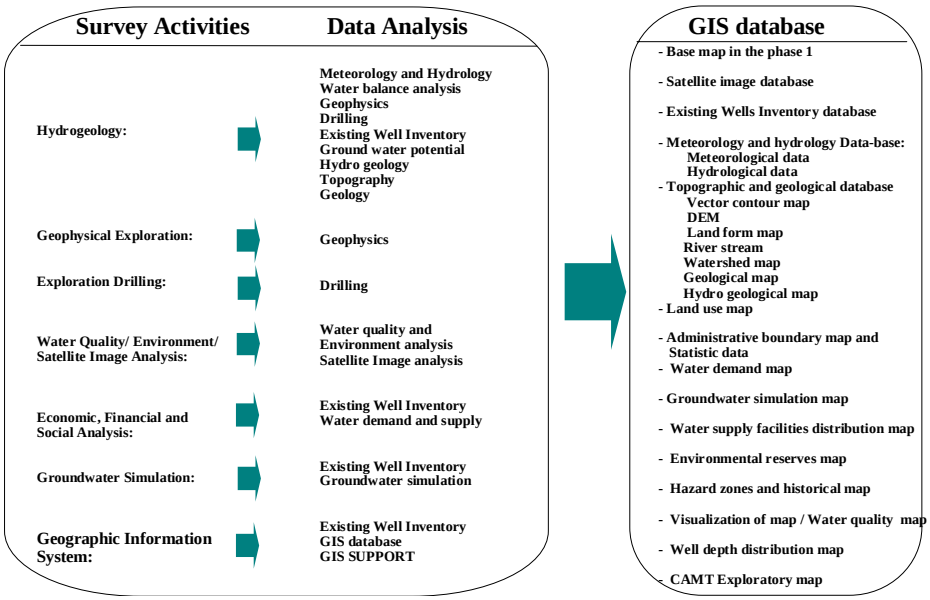

Figure-1.1 GIS System and Database in theSstudy

1.2 System configuration of GIS

Two sets of PC to support GIS and ground water simulation and relevant equipments were installed for GIS system. The system configuration is shown in Figure-1.2.

The software was installed as follows: ArcView3.2 (ESRI Corporation) and Spatial analyst of extension module for grid data processing for GIS and Visual Modflow(DHI Software Corporation) for the ground water simulation;

ArcView is the GIS software which provides overall function of map data management and map printing including display of map, reference of data, query, spatial analysis, tabulation, printing of map. Extension module of ArcView provides the following modules: the surface module for interpolation from point data, for map algebra of grid data, for tabulation and for data conversion between vector and grid. Visual Modflow is the software to support the simulation of ground water flow model based on grid cell.

GIS system was connected to LAN so called Local Area Network in EAAB and the network constituted with the following output device: A0 size of color plotter, A3/A4 size of monochrome printer, A4 monochrome laser printer, A3 color scanner, CD-RW drive.

Software of Microsoft Excel97 and Microsoft Access97 were used for database development.

Table-1.1 List of GIS equipment

List of software :	Number of set
ArcView3.2 and extension module of Spatial analyst module For development of GIS databases and GIS application	1 set
SURFER V.7.0.2 For surface model and visualization tool	1 set
VISUAL MODFLOW For ground water simulation	1 set
Microsoft office97 MSExcel, MSAccess For Database handling software	1 set
List of hardware:	
Personal Computer for GIS data processing and ground water simulation for GIS data processing and ground water simulation	2 sets
PC for GIS data processing supported by WindowsNT4.0	
PC for ground water simulation supported by Windows98	
A0 size color plotter	1 set
A4 size color laser printer	1 set
A3/A4 size monochrome printer and copy	1 set
A3 size color scanner	1 set

GIS System Configuration for Water Resources Development

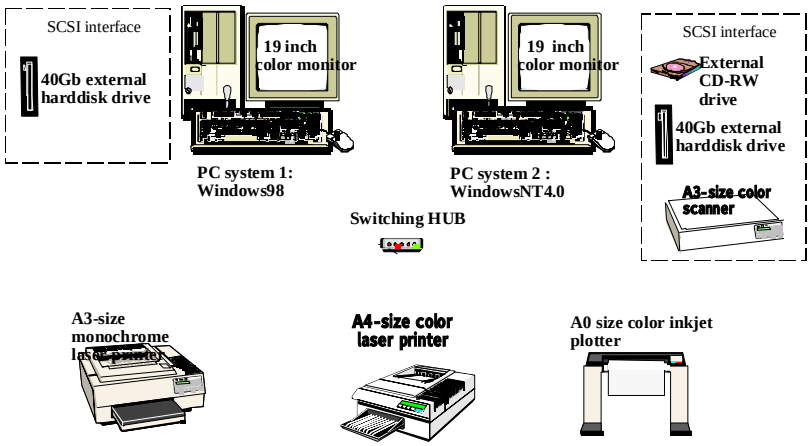

Figure-1.2 System Configuration of GIS equipment

1.3 ArcView and GIS database

ArcView supports the following data format:

- Vector data that is data feature of point, line, polygon and text;
- Raster data that is grid cell data of satellite image data, graphic data and grid data in ArcView;
- Non spatial database that is a tabular data such as census, data of water quality analysis, the meteorological observation data and etc.

The standard format in ArcView is supported by Shape format and a database of Shape file is supported by dBASE format, so GIS database in the JICA Study followed these standard formats. Importing observation data and another else data without figure data as the external data in ArcView, ODBC(Open Data Base Connectivity) in the menu of SQL connection is available for data importing.

To import these data to ArcView in the study, the Microsoft ACCESS format and EXCEL format data was used for data management with taking consideration with the compatibility and the easy operability of database. If these data have fields to show map location, these are plotted in the view of ArcView directly, maps were produced as follows:

- Existing well inventory data
- Meteorological observation data
- Hydrological observation data
- Water quality analysis data

Also by using the interpolation calculation in spatial analyst module of ArcView, thematic maps will be produced from these point maps to surface map.

GIS database in the JICA Study is mainly supported by the data format ArcView supports as shown in Table-1.2.

Table-1.2 Available data format of GIS system in ARCVIEW3

Software	Data format
ARCVIEW:	Shape file(SHP), GRID file(GRID), MapInfo Inter exchange File (MIF file of MapInfo)
ARC/INFO:	Arc/Info Coverage file, Export file(E00), GRID file(GRID), Shape(SHP), Generate file, Ungenerate file
Raster data:	ERDAS Imagine file(IMG), EARDS LAN file, ERDAS GIS file, Geotiff, BIL, BIP, and other raster format with world file such as JPG, BMP,TIFF and etc. Arc/Info raster file
Computer Assisted Design File:	AutoCAD file (DWG, DXF), MicroStation Design file (DGN)
Database:	DBASE file(DBF), MSAccess97(MDB), TEXT Other database file through ODBC driver

CHAPTER 2 Production of GIS database

2.1 Definition of GIS database

It is important for GIS system to consider the setup of map projection of database and the range of data production. GIS database was defined as data specification shown in Table-2.1, which considered with distributions of the study area and the index map of topographic map from IGAC, the origin coordinates on map of vector data and raster data, the resolution of grid cell. The study area is shown in Figure-2.1. DEM data uses for grid data analysis in ArcView and the ground water simulation in Visual Modflow. Considered map scale of 1:100,000 and the contour interval in map the maximum resolution of DEM was decided to 100 meters.

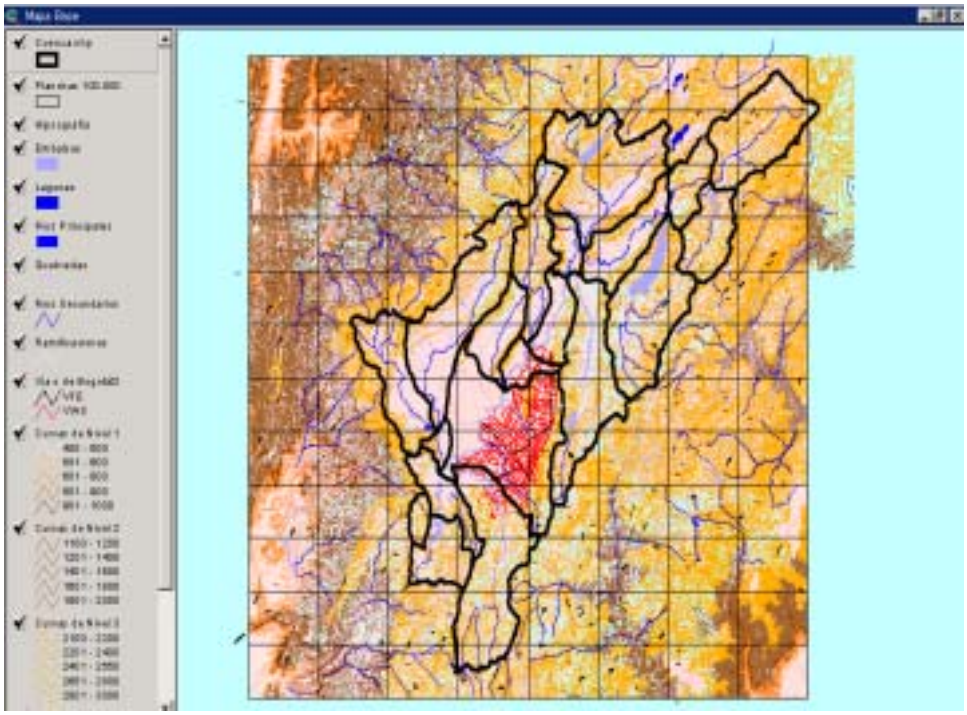

Figure-2.1 Study Area and Database Production Area

Table-2.1 Definition of GIS data

Definition of database	Contents
Range of map coordinate of X (EAST)	940,000 m - 1,070,000m
Range of map coordinate of Y (NORTH)	960,000 m - 1,080,000m
Origin of GRID CELL : (X, Y)	X = 940,000 m, Y = 1,080,000m
Resolution of DEM and GRID CELL	100m, 250m, 500m
Map projection	Gauss conformed
ESFEROID:	International
ZONE ORIGEN GEOGRAPHICAL COORDINATES:	LATITUD; NORTH 4 ° 35 ' 56.57"
	LONGITUDE; WEST 74° 04 ' 51.30 "
PLAIN COORDINATES;	1'000.000 METRERS NORTH;
	1'000.000 METRERS EAST;
VERTICAL DATUM:	MEAN LEVEL OF THE OCEAN IN BUENAVENTURA
HORIZONATAL DATUM:	BOGOTA

2.2 The priority of data production

In the production of GIS database it was necessary to collect most of data resources from POT prepared for regional planning by each municipality. The information consisted of administrative boundary, land use, environment and conservation, natural disaster about inundation, land slide and others, facility of water supply and sewerage in surrounding municipalities out of Bogota city. But POT were prepared for digital data of AutoCAD or GIS data in except Bogota city and some municipalities, others were still prepared with paper map. Also there were no POT in some municipalities. It was not expected to produce data effectively by the direct editing of collected digital data. Considered with difficulties of data collection and the limited working period in the study, the study decided three priorities for data production to develop database in the study area as follows:

- The first priority was Bogotá D.C
- The second priority was Municipalities near the Metropolitan Area of Bogotá area;

  Cajicá, Cota, Chia, Facatativá, Funza, Gachancipá, La Calera,Madrid, Mosquera, Soacha, Sopó, Tocancipá, Zipaquirá, Tabio, Tenjo
- The third priority was other municipalities in the study area