APPENDIX 4

GUIDELINE FOR GIS OPERATION

JUNE 2001

Guidelines for GIS Operation

SGD

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June 2001

1   GUIDELINES FOR DATA/INFORMATION IN THE GIS DATABASE

1.1   GIS Manual

This section only refers to the important aspects that were considered in the period of training. The other details concerning the utilisation of Arc View are explained in the manuals "Using ArcView GIS" in detail.

1.1.1   Introduction

ArcView, is a powerful, easy-to-use tool that allows the access of geographic information by computer. ArcView gives you the power to visualise, explore, query and analyse data spatially.
ArcView is produced by the Environmental Systems Research Institute (ESRI), the makers of ARC/INFO, the leading geographic information system (GIS) software in the world.

1.1.2   Working with Project

A project is the file that stores work done with ArcView. A project typically contains all the view, tables, charts, layouts, and scripts that are necessary to use a particular ArcView application. This enables the storage of the work in one convenient place. The next time the need to work on this application arises, simply open this project file in ArcView to access all the components required. Project files have an [.apr] extension.

a.   Creating a project

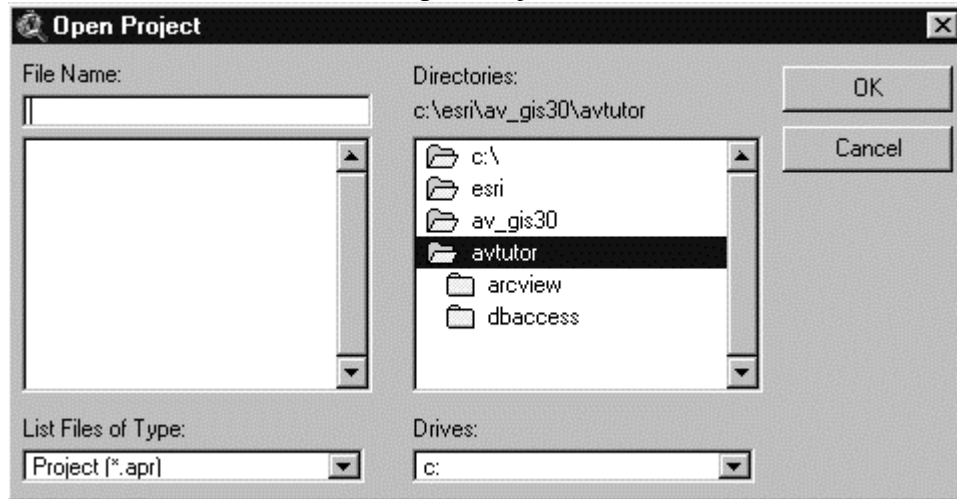   1. Start ArcView and from the File menu, choose New Project

    2. ArcView creates a new project called Untitled and opens the project window.

1.1.3   Management of a Project

a.   Opening an existing project

1.   From the File menu, choose Open Project.

2.   ArcView displays the Open Project dialog box where you specify the name and location of the project you want to open.

b.   Copying a project

1.   From the File menu, choose Save Project As. ArcView displays a dialog box in which you give the active project a different name and save it.

c.   Renaming or deleting a project

1.   Close the project. In a multi-user environment, confirm that all users have closed the project.
2.   Use your system's file management application, desktop editing technique or the appropriate rename or delete command to work with the ArcView [.apr] file. If you are renaming the project, the new name can be up to eight characters long but can't contain spaces.

1.1.4   Creating and Using Maps

a.   What's a view and theme

A view is an interactive map that lets you display, explore, query and analyse geographic data in ArcView. Views are saved in the ArcView project you are currently working with. A view defines the geographic data that will be used and how it will be displayed, but it doesn't contain the geographic data files themselves. Instead, a view references these source data files. This means that a view is dynamic, because it reflects the current status of the source data. If the source data changes, a view that uses this data will automatically reflect the change the next time the view is drawn.

A view is actually a collection of themes. A theme represents a distinct set of geographic features in a particular geographic data source. For example, a view

showing a country might have one theme representing cities, one theme representing roads, one representing rivers, etc.

b.   Creating a new view and adding a theme to a view

1. On the Project window, click the Views button and then press the New button. A new, empty view will appear in your project.

2. Add themes to the view for each spatial data source you want to display. You can also add themes based on tabular data such as street addresses or XY coordinates. Click on the add button.
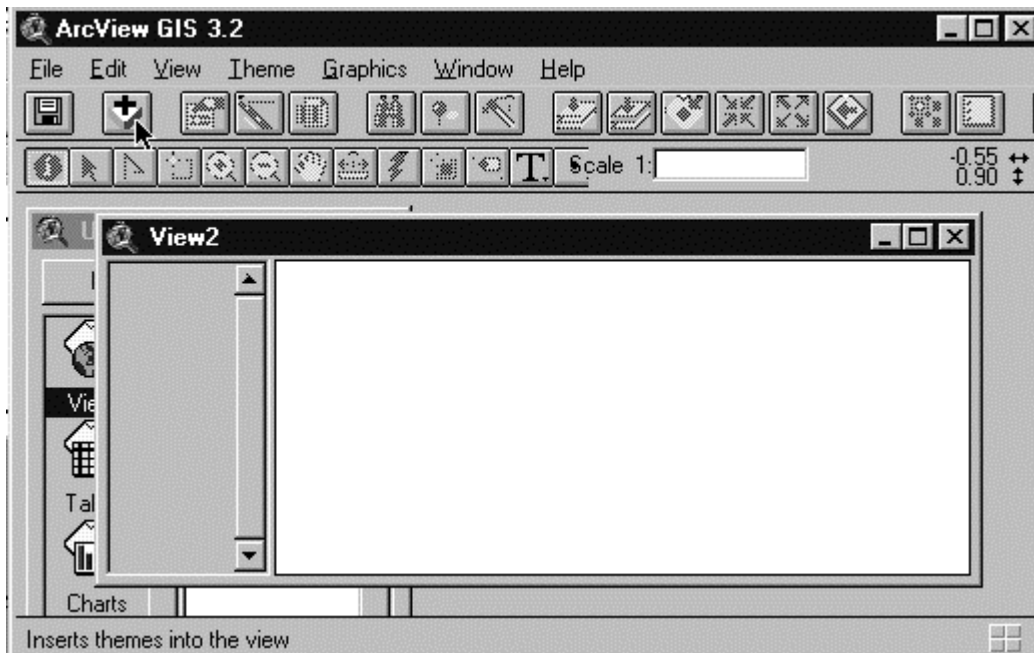
3. ArcView displays the ***Add theme*** dialog box where you specify the name and location of the theme you want to add.

4

4. Click check boxes of the theme names to be drawn into your view. These check boxes let you toggle themes on and off in the view.
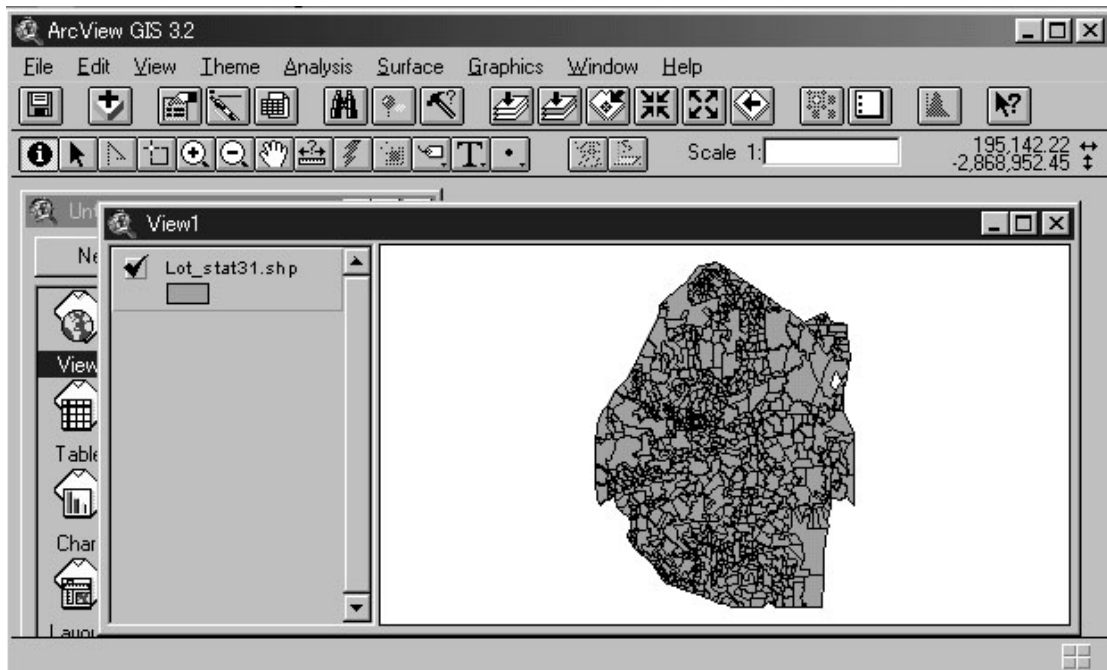
## 1.1.5 Laying out and Printing Maps

a. Creating a layout

A layout is a map that lets you display views, charts, tables, imported graphics, and graphic primitives. The layout is used to prepare these graphics for output from ArcView. The layout defines what data will be used for output and how they will be displayed. The layout can be dynamic because it allows you to make specific graphics live. When a graphic is live, it reflects the current status of the data. For example, if the data in a view changes, the layout automatically reflects the change.
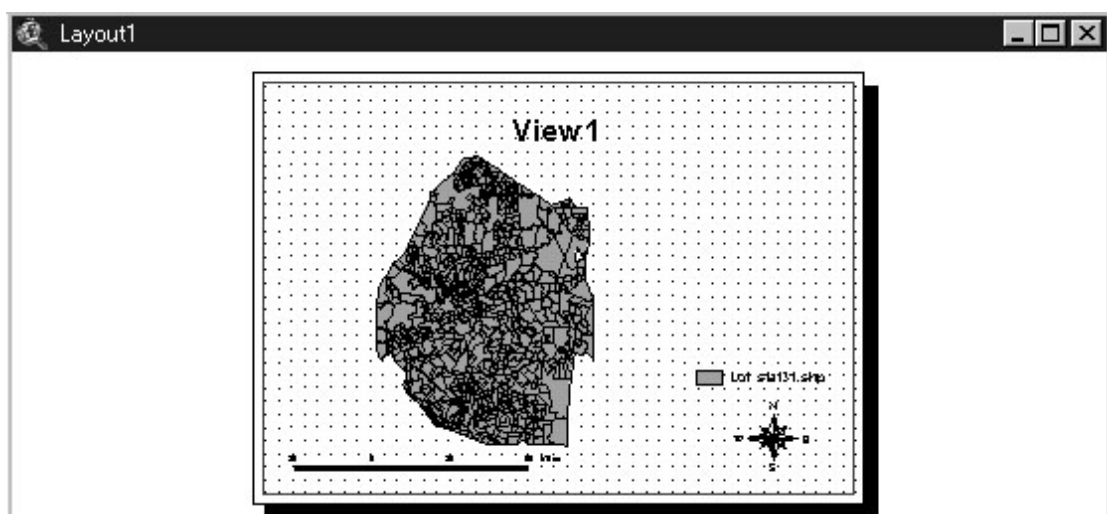
1. From the file menu select *Layout*.

2. Select the paper size, orientation and then Click on the *ok* button.
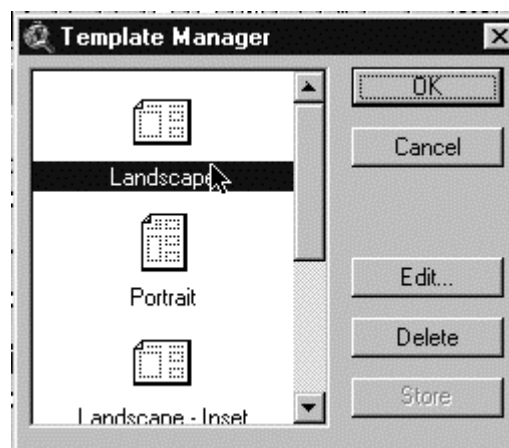
3. Add legend, scale bar, title and graphic, and when you are finally satisfied with your layout you can send it to a printer.



b.   Exporting a layout

6

You can export a layout to a file in any of a number of supported output formats. ArcView exports to the following formats:

- Placeable Windows Metafile
- Windows Metafile
- Windows Bitmap
- Encapsulated PostScript - New
- Encapsulated PostScript - Old
- Adobe Illustrator
- CGM Binary
- CGM Character
- CGM Clear Text
- JPEG

1. Select the layout you want to export
2. From the file menu select *Export*.
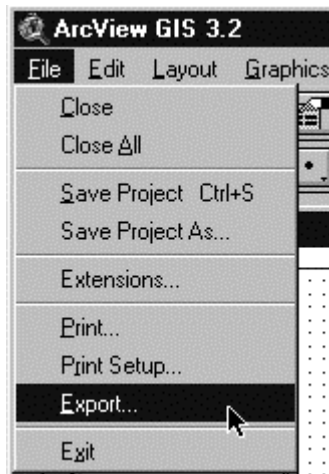
3. ArcView displays the *Export* dialog box where you specify the name and location of the layout to export and select a file format from the *List Files of Type*.

7
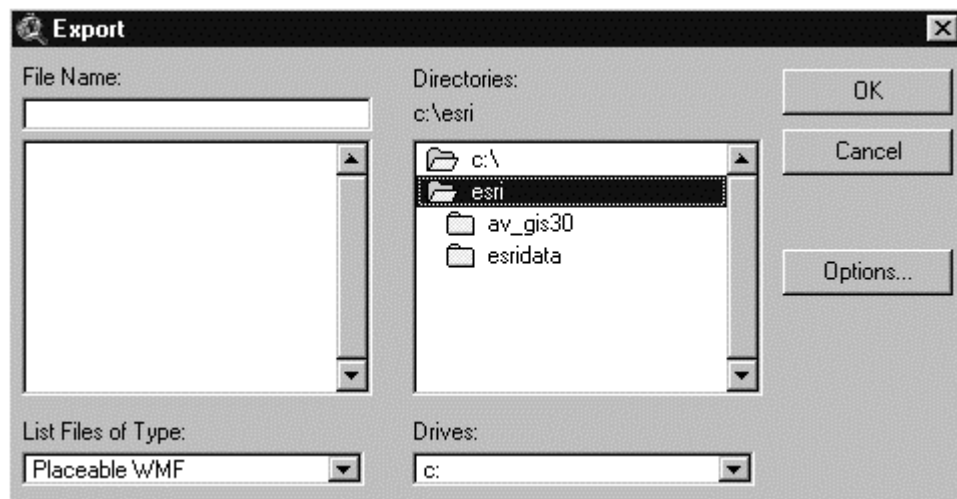
1.1.6   Working with Tabular Data

a.   What's is a table?

A table lets you work with data from a tabular data source in ArcView. You can bring data from almost any tabular data source in your organisation into ArcView as tables. Then you can add data from these tables to maps, and symbolise, query and analyse this data geographically.

An ArcView table references the tabular data source it represents, but doesn't contain the tabular data itself. This means that tables are dynamic, because they reflect the current status of the source data they are based on. If the source data changes, a table based on this data will automatically reflect the change the next time you open the project containing this table. You can also choose Refresh from the Table menu to refresh the table at any time to see the current state of your source data. The definitions of tables you add to ArcView are saved in the project file you are currently working on.

You can create new tables in ArcView and type data values into them directly. You can also edit some tables, depending on the type of tabular data source they represent and whether you have write permission. See editing the values in a table.

You can add dBASE, INFO, tab or a comma, and delimited text files into ArcView as tables. These data sources can contain any data that you wish to work with in ArcView. For example, these tables might contain additional information about the features displayed on a view.

From ArcView, you can connect to a database server, such as Oracle or Sybase, and run an SQL query to retrieve records from the server as a table. ArcView stores the definition of the SQL query used, not the records themselves. See Connecting to a Database to create a table.

b.   Management of a Table

b.1   Opening a theme's table
1. Open the view containing the theme.
2. Click on the theme to make it active and Click the *Open Theme Table* button in the View button bar.
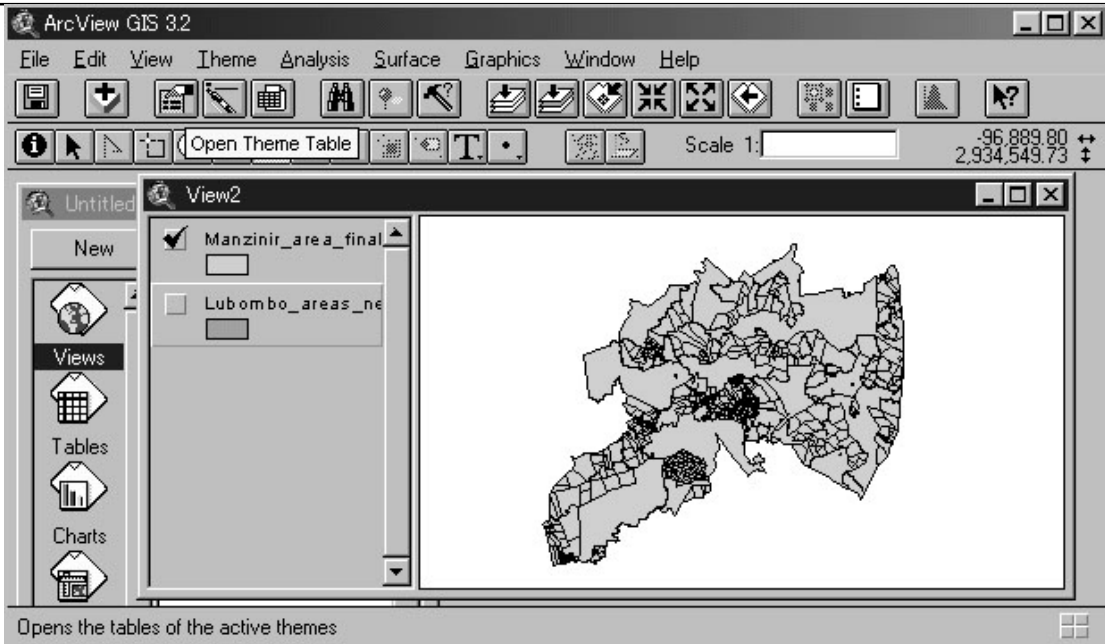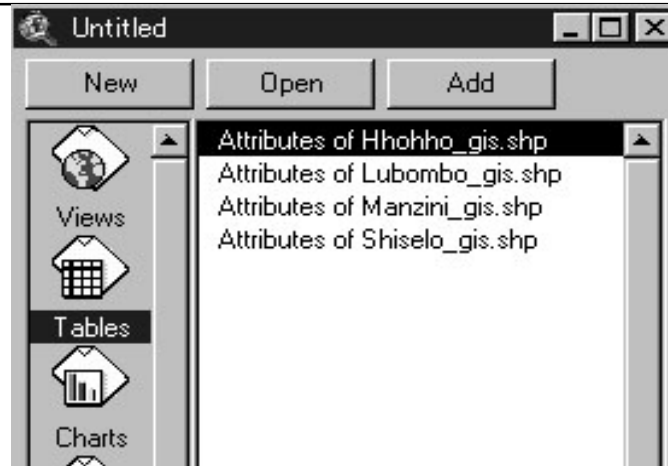
3. When you open a theme's table, it will appear in the list of tables in the Project window in which case it can also be opened using the Open button on the Project window.

b.2   Adding a table into a project

1. Select the table icon in the project windows and click the "Add" button.

2. ArcView displays the [Add Table] dialog box where you specify the name, type and location of the file to add a dBASE, INFO or delimited text file as a table in your project.
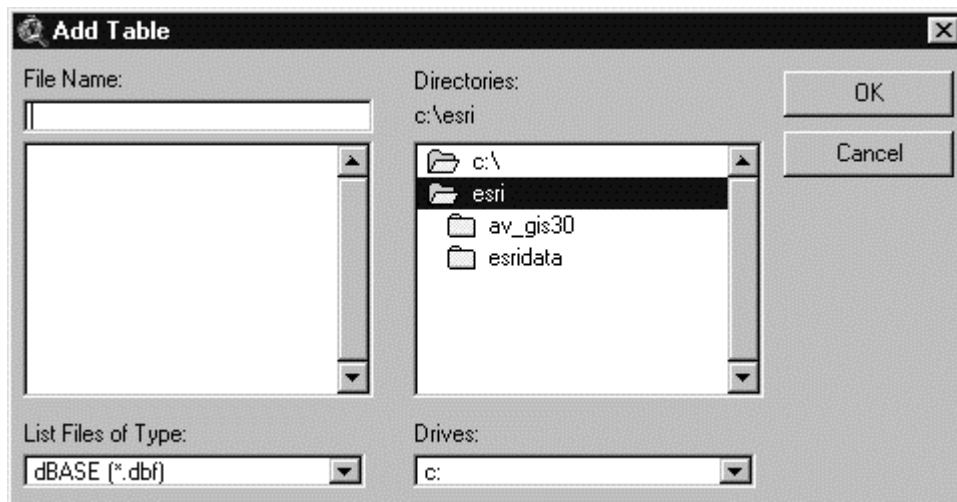
b.3   Creating a new table

1. With the Tables icon selected, click the New button at the top of the Project window.
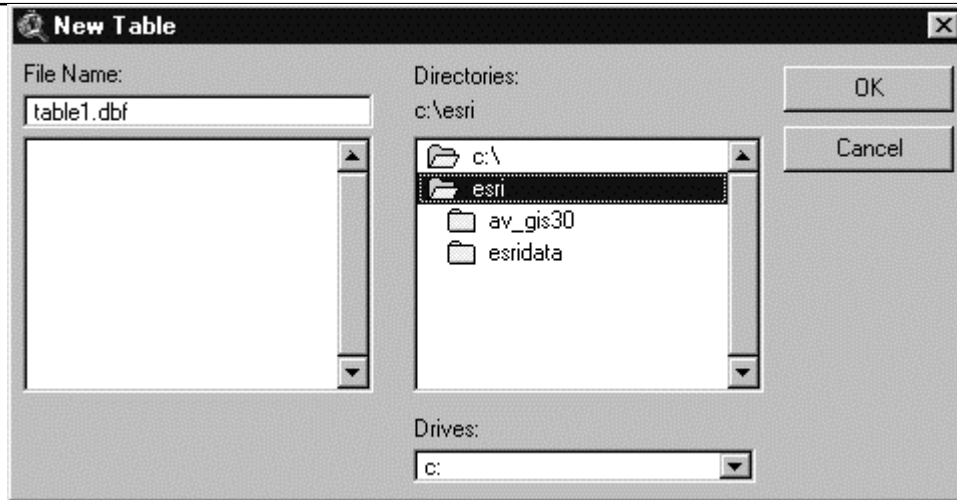
2. Enter a name and a disk location for the dBASE file that ArcView will create to store the source data for the table. ArcView creates a new table and its name will appear in the list of tables in the project. ArcView names new tables in numerical order: Table1, Table2, Table3, etc.

b.4   Editing a table

1. Open the table you want to edit.
2. From the Table menu, choose Start Editing. If you have write access to the data source, you will be allowed to edit the table. You can add or delete fields and records and edit the values in the table.
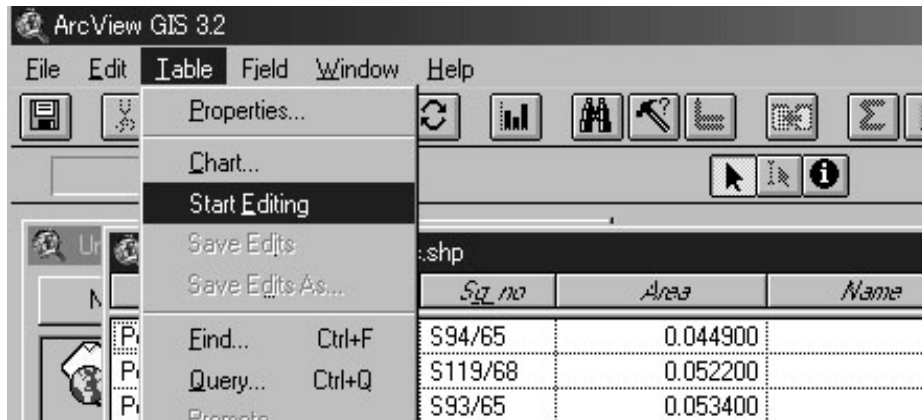
b.5   Closing a table

1. From the File menu, choose Close, or click the close control on the table's window.

b.6   Deleting a table

11

Click once on the table in the list in the Project window and choose Delete from the Project menu. You will be prompted to confirm deleting the table. Deleting a table removes it from the project, but does not affect the tabular data source that the table is based on.

b.7   Exporting a table

1. Open the table you want to export.
2. From the File menu, choose [Export]

3. ArcView displays the [Export Table] dialog box where you specify the export format and then click the [OK] button.
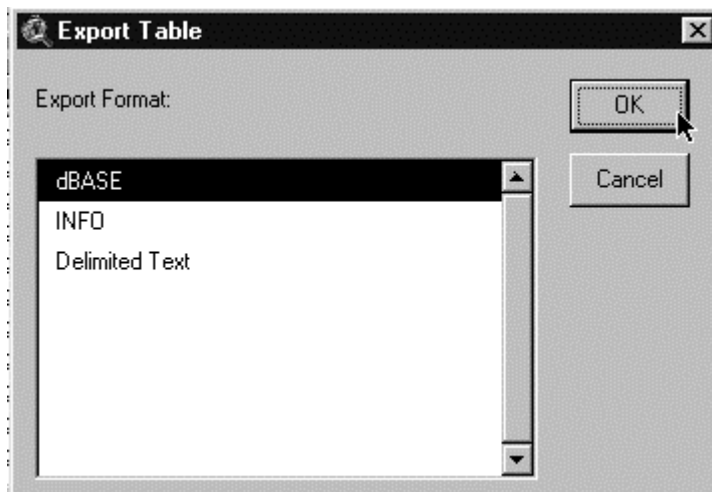
c.   Join tables

You can join a table to the active table based on the values of a common field found in both tables. Join establishes a one-to-one or many-to-one relationship between the destination table (the active table) and the source table (the table you are joining into the active table). Typically, the source table contains descriptive attributes of features that you wish to join into a theme's table so that you can symbolise, label, query and analyse the features in the theme using the data from your source table.

c.1   Joining two tables

1.   Open the tables you wish to join.
2.   For example, joining cadastral information with the attribute of cadastral boundary table.
3.   Make the source table active (cadastral information). Click the name of the common field you wish to use, in this case (PID).

Attributes of Hhohho_gis.shp			hhohho_pid		
Pid	*Area*	*F*	*Mslink*	*PID*	*SG_NO*
1/1074	11263.287550		803	1/1074	S127/62
1/1112	145488.920800		94	1/1112	S65/65
1/1140	867989.105500		328	1/1140	S199/71
1/1205	896337.272250		269	1/1205	S25/71
1/1210	857597.664150		241	1/1210	S18/72
1/1212	879505.808850		370	1/1212	S166/71
1/1214	861348.706450		177	1/1214	S91/72
1/1266	1030866.875000		460	1/1266	S89/83
1/190	4432080.901844		401	1/190	S158/57
1/239	1330766.282050		675	1/239	S29/75
1/352	289472.076300		61	1/352	S31/21

4.   Make the destination table (attribute of cadastral boundary). Click the name of the common field you wish to use (PID).

Attributes of Hhohho_gis.shp			hhohho_pid			
Pid	*Area*	*F*	*Mslink*	*PID*	*SG_NO*	*AREA*
1/1074	11263.287550		803	1/1074	S127/62	3.128600
1/1112	145488.920800		94	1/1112	S65/65	14.551200
1/1140	867989.105500		328	1/1140	S199/71	86.798300
1/1205	896337.272250		269	1/1205	S25/71	89.633700
1/1210	857597.664150		241	1/1210	S18/72	85.760800
1/1212	879505.808850		370	1/1212	S166/71	86.811200
1/1214	861348.706450		177	1/1214	S91/72	86.349100
1/1266	1030866.875000		460	1/1266	S89/83	100.778600
1/190	4432080.901844		401	1/190	S158/57	444.635700
1/239	1330766.282050		675	1/239	S29/75	135.572200
1/352	289472.076300		61	1/352	S31/21	29.069300

Destination table — Join — Source table

ArcView GIS 3.2

0 of   820 selected

5.   From the Table menu choose Join, or click the Join button. Now you have a table of cadastral boundary with cadastral information.

13

Tables are joined based on a field that is found in both tables. The name of the field does not have to be the same in both tables, but the data type has to be the same. You can join;

- Numbers to numbers
- Strings to strings
- Booleans to Booleans
- Dates to dates.

Any field can be chosen as the basis for a join, not just ones that uniquely identify geographic features.

c.2   Why is the join option dimmed out when I try to join tables

1. The problem may be because the source table already contains a join. For example, if you join table A to table B and then try to join table B to table C, the join option will appear dimmed out. To see if your source table already contains a join, make it active and look at the Remove All Joins option in the Table menu. If Remove All Joins is not dimmed out, your source table does contain one or more joins.

   To perform a join in this situation you can either choose Remove All Joins to remove any existing join(s) from your source table and then perform the join or export the source table into a new table, add that table into your project, then do the join. The latter option is more useful than the first because it ensures that all the data in your original table is joined to the destination table.

   To perform a join in this situation you can either choose Remove All Joins to remove any existing join(s) from your source table and then perform the join or export the source table into a new table, add that table into your project, then do the join. The latter option is more useful than the first because it ensures that all the data in your original table is joined to the destination table.

   The destination table (the table that is active when you choose Join) can contain existing joins.

2. Join will also be dimmed out if the data types of the fields that you are joining are different, for example, trying to join tables on a zip code field that is under type number in one table and type string in another. The string field is left

justified while the number field is right justified. To resolve this issue, add a field to one of the tables that is of the appropriate type and use the calculator to add zip codes from the original field.

3. Joins are also not possible if the source table is in edit mode.

c.3   Editing joined data

When editing a joined table, you can only edit the fields in the destination table. Edits to the fields from source tables must be performed directly on those tables. You can then use Refresh from the Table menu to show the changes in the joined table.

c.4   How are joins saved

When you save a project containing a join, ArcView saves the definition of the join rather than saving the joined data itself. The next time you open the project, ArcView rejoins any joined tables by reading their files from disk or re-executing the SQL queries they are based on. In this way, any changes to the source or destination tables that have taken place since they were last joined are automatically included in the project, and reflected in any views, tables, charts or layouts based on the joined data.

Because joining tables has no effect on their physical files on disk, you don't need to have write permission to files to be able to join them in ArcView.

If you want to make a new table on disk to permanently store the joined data, you choose Export from the Table menu. You would do this, for example, if you want to use the table in another application.

To remove joined fields from a table you are working on, choose Remove All Joins from the Table menu.

d.   Spatial joins

If you join two theme attribute tables together using their Shape field as the common field, ArcView automatically bases the join on the spatial relationship between the features in the two themes.

d.1   Performing a spatial join

This can be carried out if for example you have a land use theme and district boundary theme, and if you want to know the land use type per each district.

1. From the view, open the attribute tables of the themes you wish to join. In this case land use themes and district boundary themes.
2. Make the source table active (District boundary); this is the table you wish to join to the other table. Click the Shape field's name.
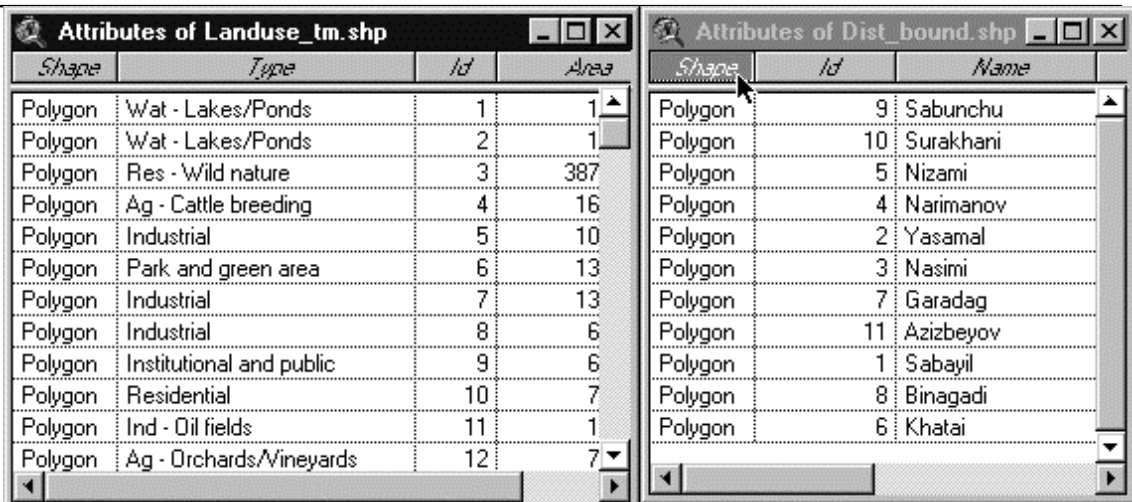
3. Make the destination table active (Land use); this is the table you wish to receive the values of the source table. Click the Shape field's name.
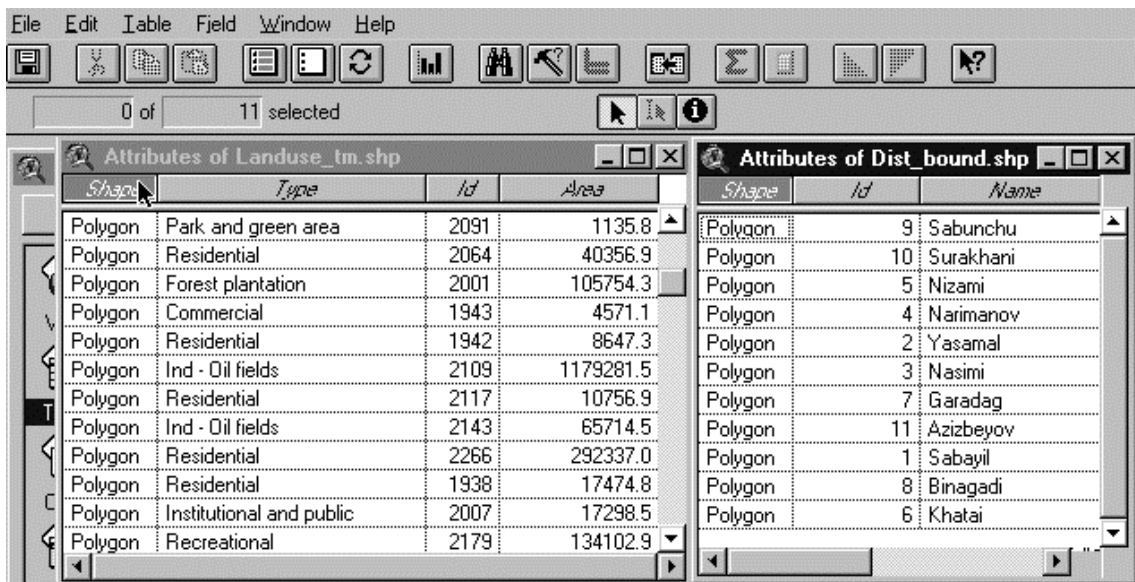
4. From the Table menu choose Join, or click the Join button. The source table is joined to the destination table. The source table is closed automatically.

A spatial join is similar to an attribute join; however it is based on the spatial relationship between the features in the two themes. For each feature represented in the destination table, ArcView determines if any of the following spatial relationships exist with any feature represented in the source table, and if so, that feature's record from the source table is joined into the destination table:

Shapes	Point	Line	Polygon
Point	Nearest	Nearest	Inside
Line	Nearest	Part of	Inside
Polygon	n/a	n/a	Inside

16

When the spatial join is based on the 'nearest' relationship (i.e., neither of the two themes involved contains polygons and one of them contains points), ArcView adds a Distance field to the destination table. This field is automatically calculated by ArcView and contains the distance to the nearest feature represented in the source table for each feature represented in the destination table. The distance is calculated in the view's map units.

When the spatial join is based on the 'part of' relationship (i.e., both themes involved contain line features), the line features represented in the destination table have to be substrings of the line features represented in the source table to satisfy the spatial join. In other words, the lines in one theme are part of the lines in the other theme.

e.   Link two tables

Join establishes a one-to-one or many-to-one relationship between the destination table and the source table. However in some situations you may want to establish a one-to-many relationship between the destination table and the source table.

An example of a one-to-many relationship is a table on type of land use and the table on land use in the entire district. One type of land use may be predominant (many) in the entire district. You may want to select a specific type of land use in the entire district.

1. From the view, open the attribute tables of the themes you wish to join. In this case *type of land use* themes and *land use of the district* themes.
2. Make the source table active (land use of the district); this is the table you wish to link to the other table (type of land use). Click the field's name to link (type).
3. From the [Table] menu select [Link]

4. Select open space in the type of land use table, and all open space will be selected for the land use of the district.

17
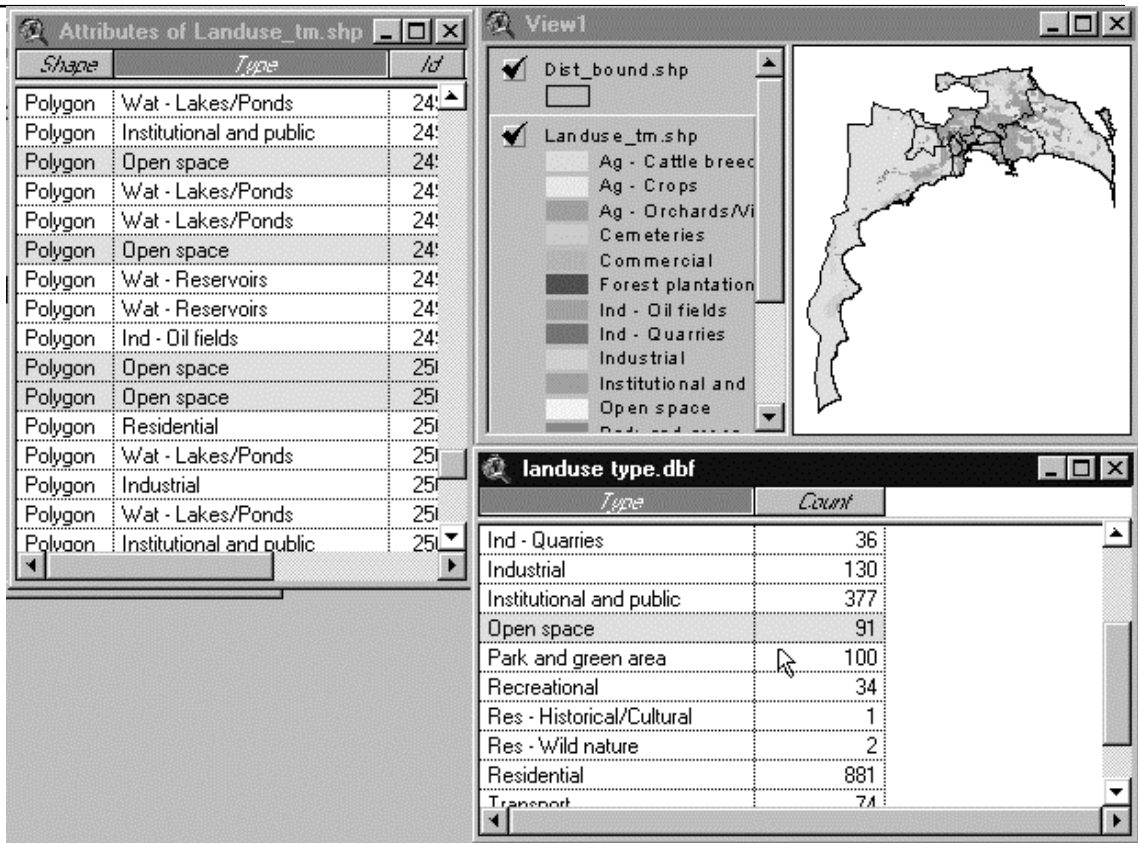
f.   Calculating features

f.1   Calculating area of polygon themes

1. Open the attribute tables of the themes you wish to calculate the area. In this
    example Cadastral boundary themes.
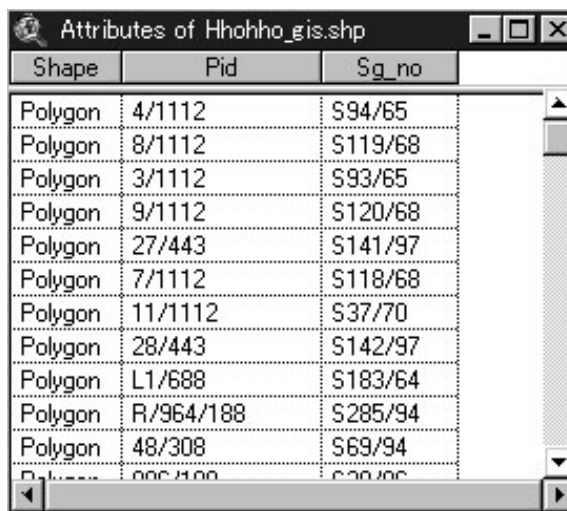
2. Make the source table active and from the [Table] menu select [Start Editing].
    The table will enable to make changes.

3. From the [Edit] menu, select [Add Fields]. Input the name, type, width and decimal places of the fields, and then click the [OK] button.
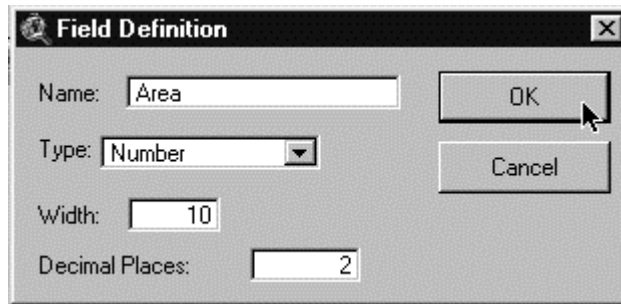
4.   Now you have a table with the new fields to calculate the area of the polygons.

5. From the [Field] menu, select [Calculate].
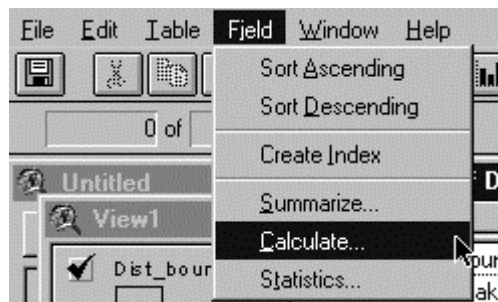
6. In the [Field Calculator] dialog box, type [Shape].ReturnArea and then click on the [OK] button.

19
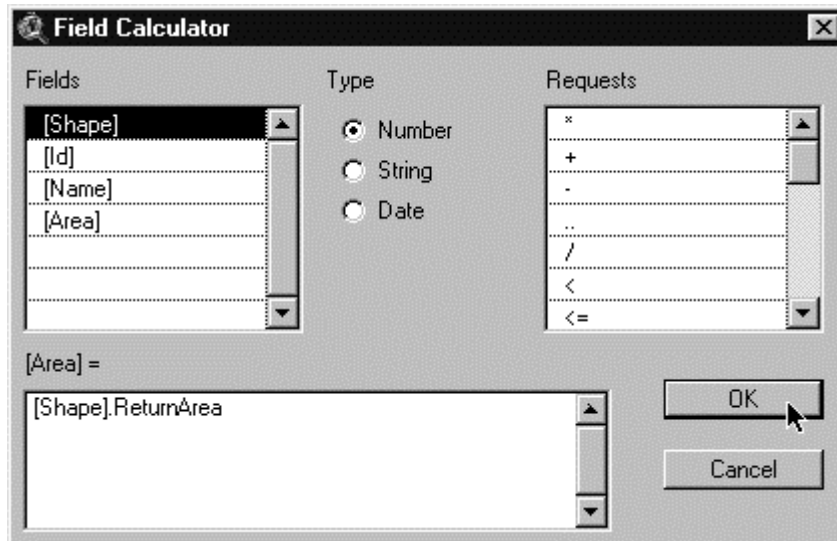
7. ArcView calculates the area of each polygon in the table. To save the changes in the table select [Stop editing] from the [Table] menu.

f.2   Calculating the length of line themes

1. Same as calculating the area, open the attribute tables of the themes you wish to calculate the area. In this example District boundary themes.
2. In the [Field Calculator] dialog box, type [Shape].Returnlength and then click on the [OK] button.
3. ArcView calculates the length of the shape in the table. In the case of the polygons, it calculates the length of perimeters, and the length of the line for polyline.

g.   Getting the X and Y coordinate from point themes

1. Follow the same step to edit and add fields.
2. In this example the X and Y coordinates are calculated for the location of industries .
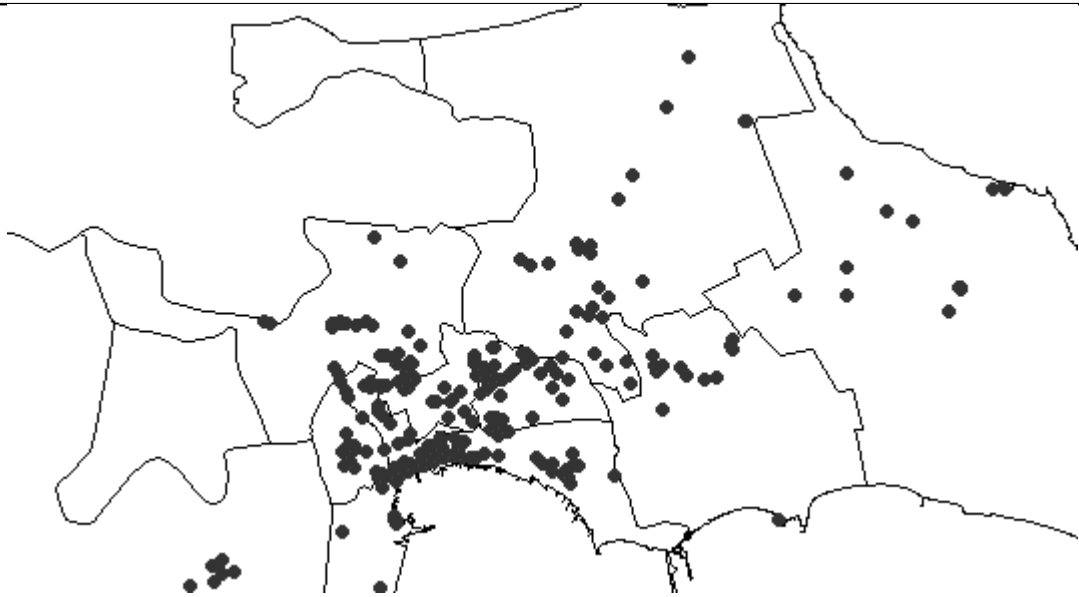
3. Open the table of industries themes
4. Add new fields to calculate the X and Y coordinates.
5. Select the new fields X.
6. In the [Field Calculator] dialog box, type [Shape].GetX and then click on the [OK] button.
7. ArcView calculates the X coordinate of the point shape in the table.
8. Select the new fields Y.
9. In the [Field Calculator] dialog box, type [Shape].GetY and then click on the [OK] button.
10. ArcView calculates the Y coordinate of the point shape in the table. You can get a table for each industry with the X and Y coordinate.

1.1.7 GeoProcessing

GeoProcessing is a way to create new data based on themes in your view. In most cases you will alter the geometric properties of the features in a dataset while controlling some aspects of how its attribute data is handled.

a.   Starting GeoProcessing

1. From the [File] menu select [Extensions].

2. In the [Extensions] dialog box select [Geoprocessing].
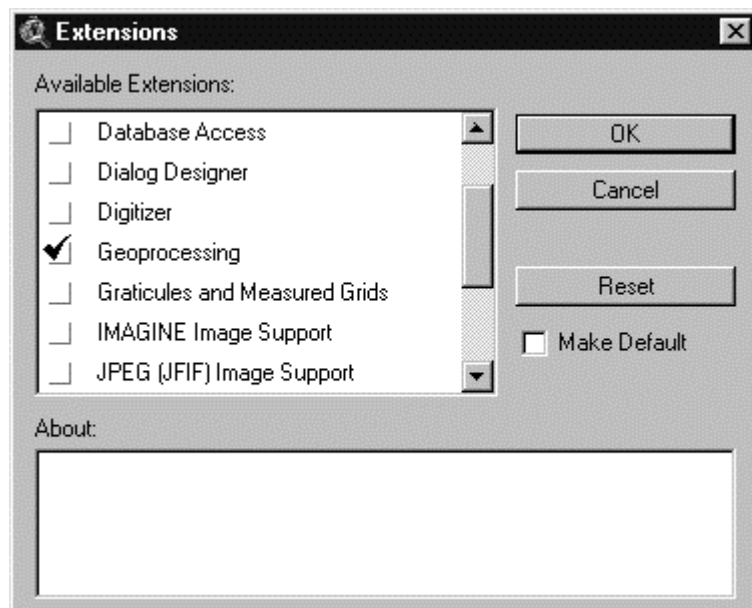
3. Now you can select [Geoprocessing Wizard] from the [View] menu.

4. This will prompt the Geoprocessing dialog box.
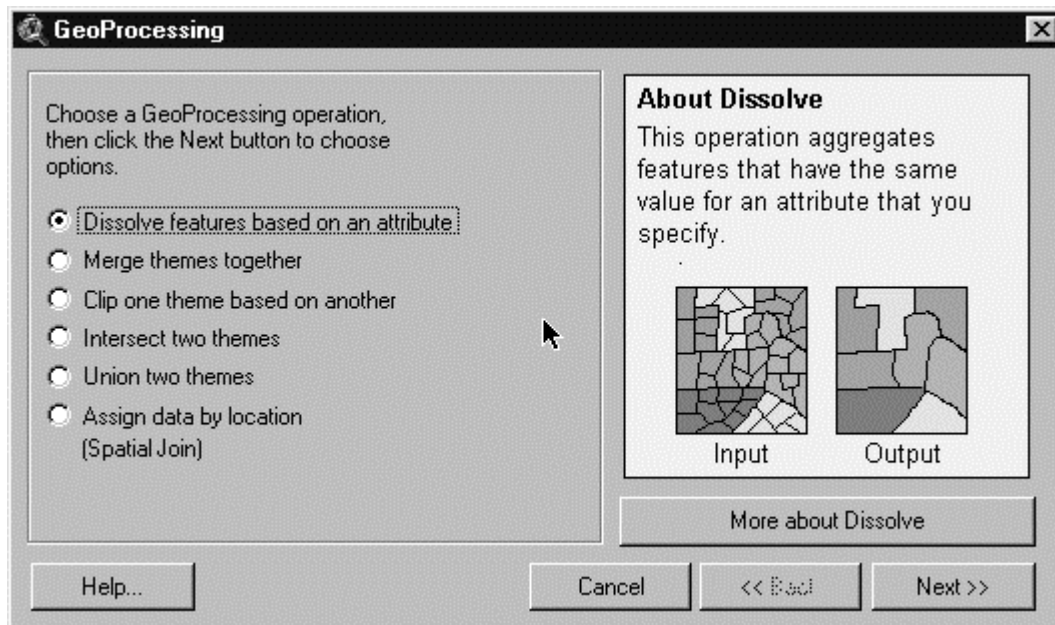
b.   Intersecting two themes

This process is similar to clipping a theme, except for the fact that it preserves only those features falling within the spatial extent common to both themes. The features of the input theme are intersected or sliced by the intersect theme. The attribute data from both themes are included in the new theme's attribute table.

The Intersect process computes the geometric intersection of the two themes and adds it to your view as a new theme. The input theme can be a line or polygon theme. The overlay theme must be a polygon theme. The overlay theme's features will split the input theme. Any features in the input theme that are not overlaid by features in the overlay theme will not be added to the new theme. The output shapefile's features will be of the same type as the input theme features. When intersecting features of the input theme with the polygons of the overlay theme, the attribute tables are also updated. The attribute table for the output shapefile includes the attributes from the input and overlay theme.

Use the Intersect process when you want to integrate two spatial data sets while preserving only those features falling within the spatial extent common to both themes. For example you have land use themes and district boundary themes, and you will want to know the exact area of land use type by each district you had to intersect those two themes.

1. Open the themes to intersect
2. In the [Geoprocessing] dialog box select [Intersect two themes].
3. Select the input theme, the overlay theme and the location of the output file, and then click on the [Finish] button.
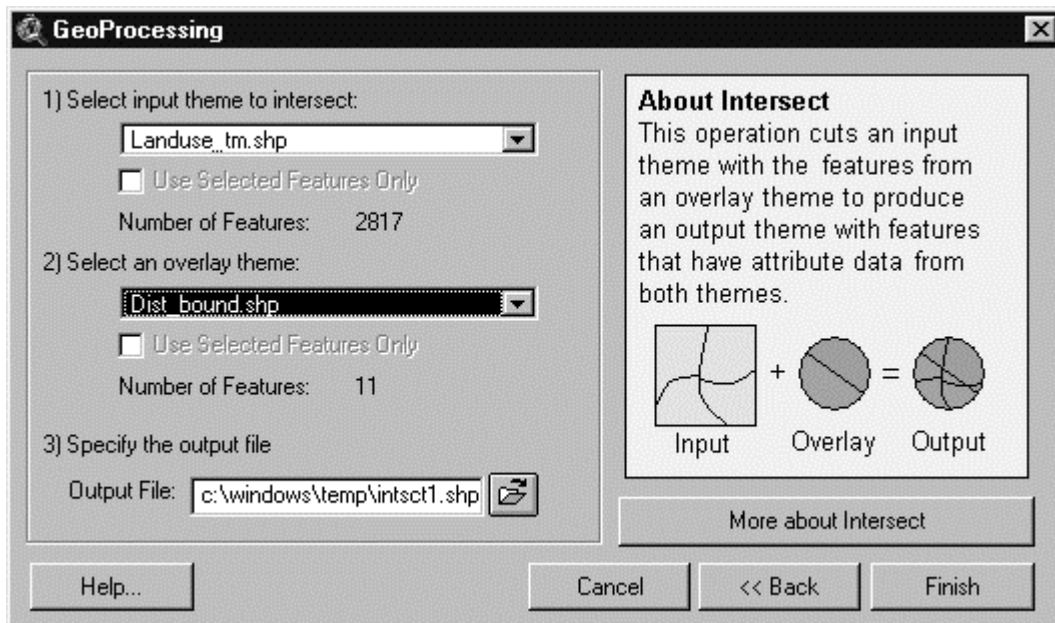
4. ArcView will process the intersection and create the new theme.

c.   Merging features

Use the Merge process when you want to create a new theme containing two or more adjacent themes of the same shapefile type. For example, you may want to merge or append highway data delivered as a series of tiles. Merge allows you to append the data while maintaining the attributes contained in whichever shapefile you select.
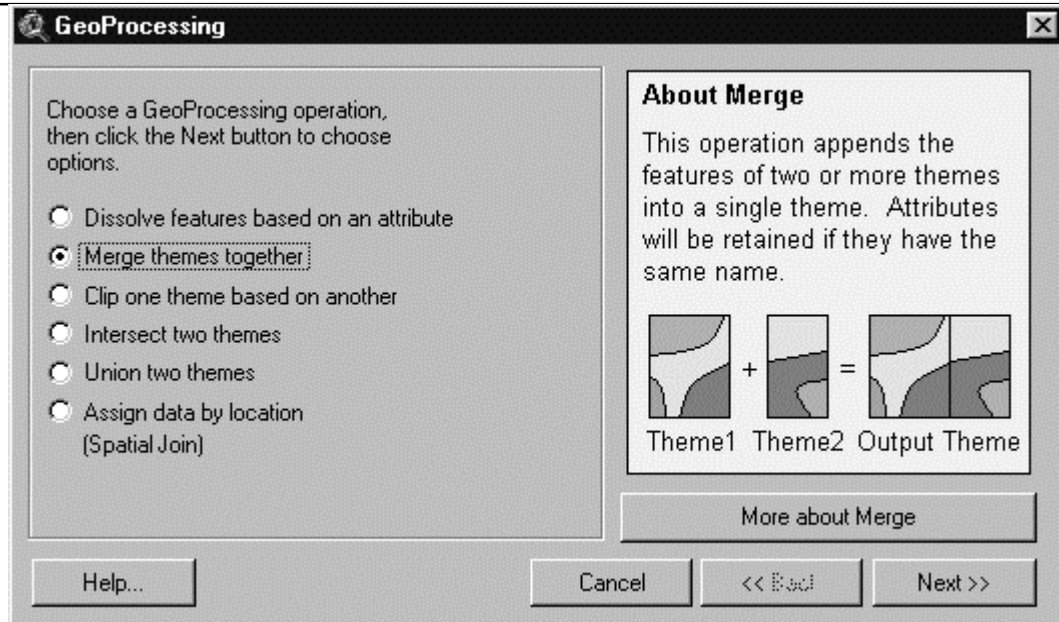
Select themes to merge: Choose two or more themes that are of the same geometry type. The Finish button will not be enabled until you have selected two or more themes of the same type. You can use the Control and Shift keys in conjunction with your mouse click to select more than one or a range of themes.

Use Fields from: Choose the theme that contains the attributes you want to use in the theme that will result from this merge operation. If each of the other chosen themes have the same fields, then all cells in the attribute table of the merged theme will be populated. If any of the other input themes have additional fields, that data will not be included. If any of the other input themes are missing the fields, then no data will be added to those fields for the features of the selected theme.

Note: The dropdown list of available themes will not be activated until two or more themes of the same shapefile type have been selected for merging. To select more than one theme, you need to hold down the Shift key.
Specify the output file: Browse for or enter the shapefile name that will be used to store the results of the merge operation.

d.   Clipping features

Use the clip operation when you want to cut out a piece of one theme using another theme as a "cookie cutter". For example, you may want to select a county boundary from your counties theme to extract the roads from your roads theme to create a new theme containing a smaller number of roads.

For this process you can use the Clip option in the GeoProcessing Wizard, but remember to first select the county polygons defining the clip area before starting the Clip wizard. Enter the roads data as the input theme and the county boundaries as the polygon overlay theme. The clipping theme is used as the "cookie cutter" to clip the roads. Then, check the "Use selected feature only" box to use the selected features as your clipping area. Then specify the output theme name or use the default name, clip1.shp.
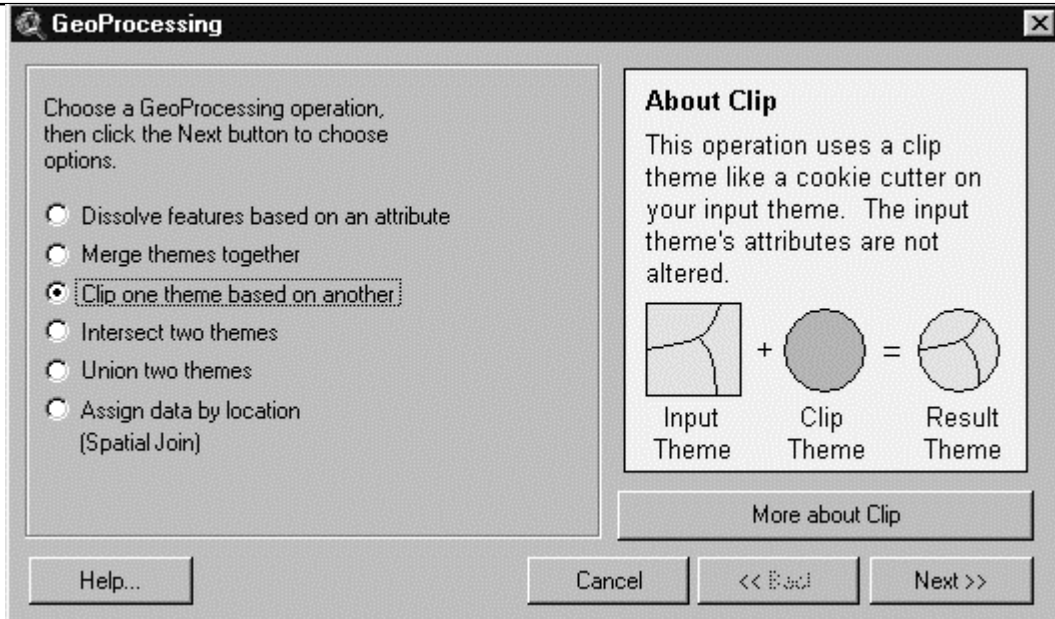
e.   Union two themes

Use the Union process when you want to produce a new theme containing the features and attributes of two polygon themes. Let's look at using Union to provide the basis for performing an erosion analysis of soils during a flood. Some combinations of slope and soil type represent high risk for erosion, and knowing where these conditions are enables risk assessment of crops. For instance, rocky or sandy soil on a relatively steep slope could represent flash-flooding dangers to either crop or grazing agricultural activities during rainstorms.
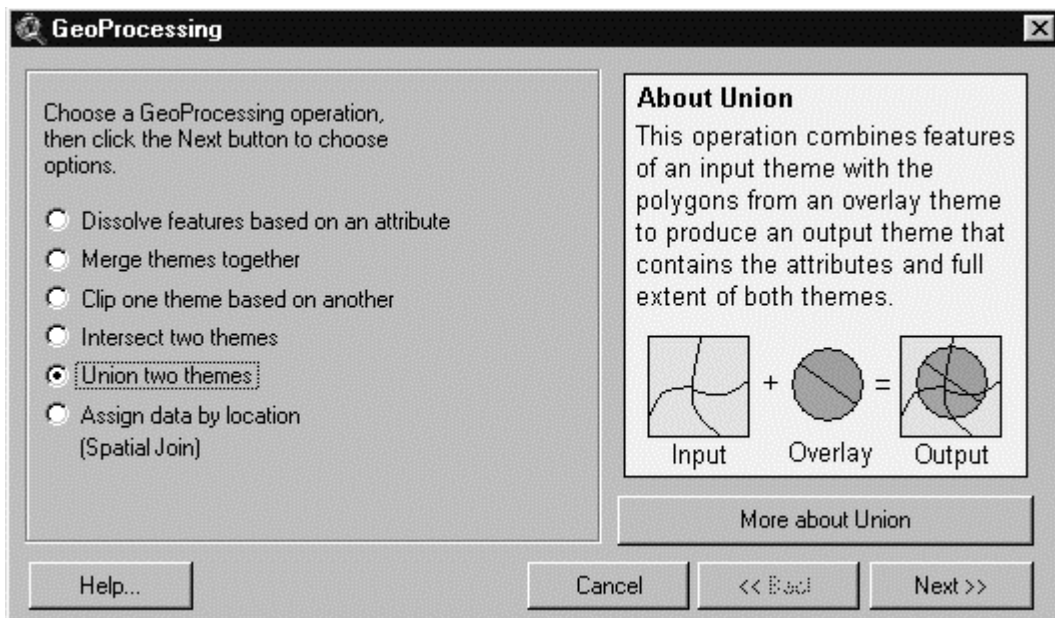
f.   Assigning data by location

Use Assign data by location when you want to use a spatial relationship to join data from the attribute table of one theme to the attribute table of another theme.

Depending on the type of data you have, the join will be one of three types of spatial relationships: 'nearest', 'inside', or 'part of'.

Nearest: If you're assigning data from a point theme to another point theme OR you're assigning data from a point theme to a line theme, a 'Distance' field is automatically added to the theme you're assigning data to, along with any other data in that theme. This 'Distance' field contains the distance to the nearest feature.

Inside: If you're assigning data from a polygon theme to a point, line, or polygon theme, the data will be joined to the point, line, or polygon that is contained in each of the polygons.

Part of: If you're assigning data from a line theme to another line theme, data will be assigned from lines that are 'part of' (a sub-set of) the lines you're assigning data to.
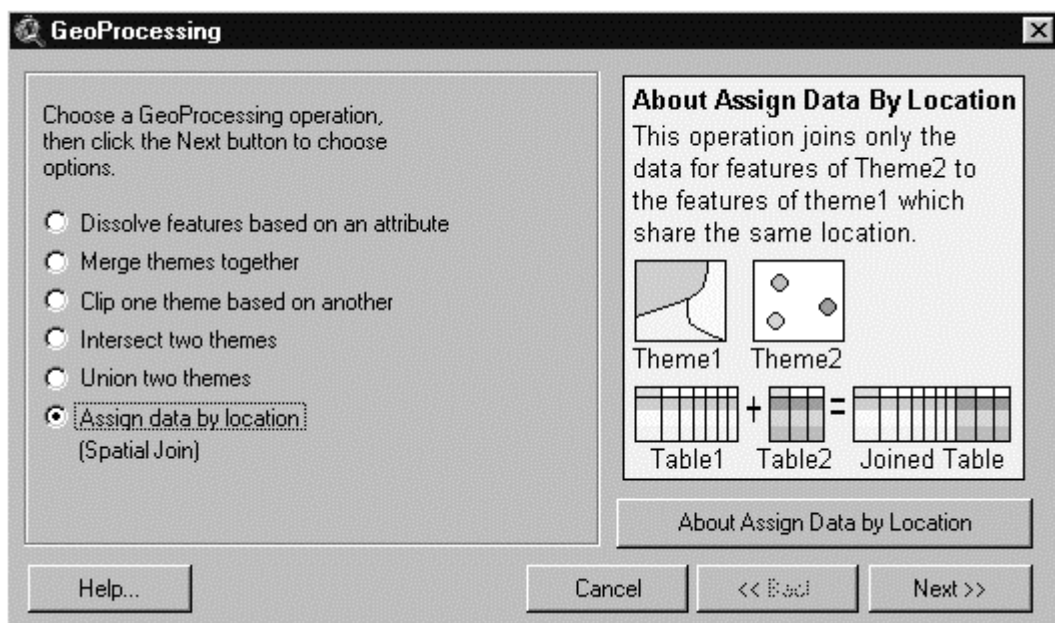
1.1.8   Management of a Table with Microsoft® Excel

To manage ArcView data into the Microsoft® Excel, you can export data from ArcView to Excel and make a report.
1. For example, when using the data of land use by district to make a report: Area of type of land use by each district.
2. Export the ArcView table data into DBF format.
3. Open the exported file in Excel. Specify the location and change the [File type] into dBase files.
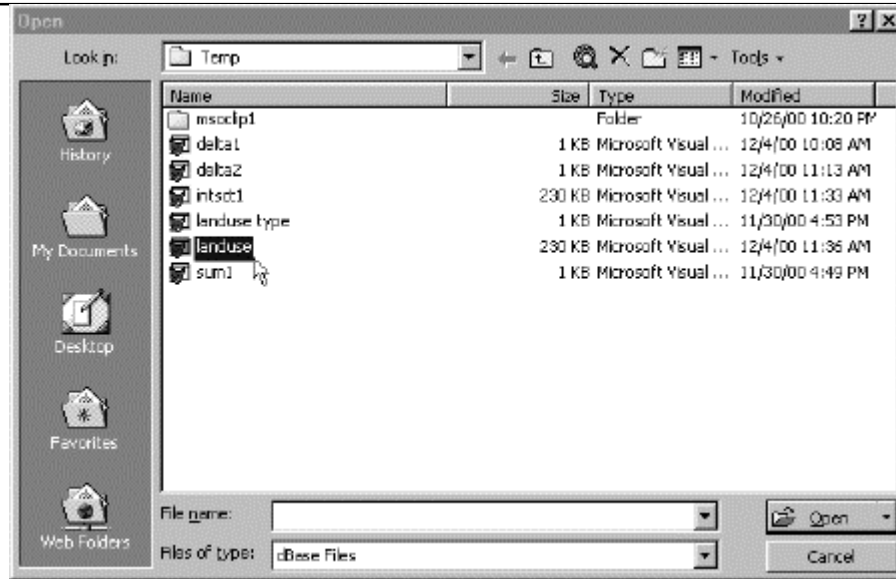
4. Now you have a data file in Excel to manage as you want.

5. From the [Data] menu select [Pivot table report and pivot chart report]
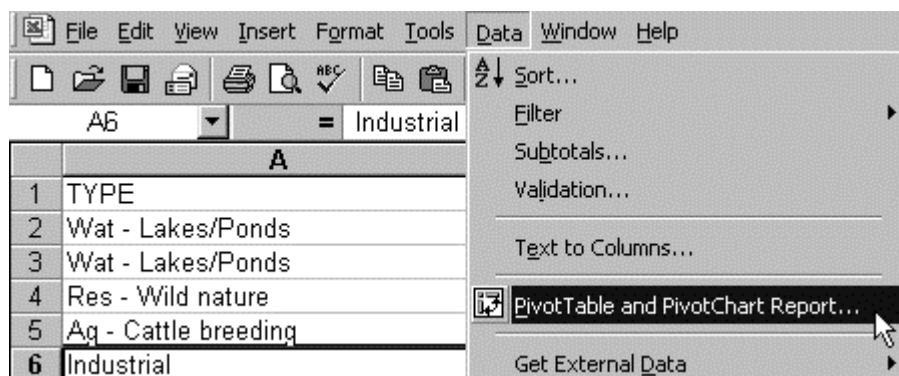
6. In the [PivotTable and PivotChart Wizard] step 1 dialog box, select the type of the data to analyse. In this case select the [Microsoft Excel list or database] and click on the [Next] button.
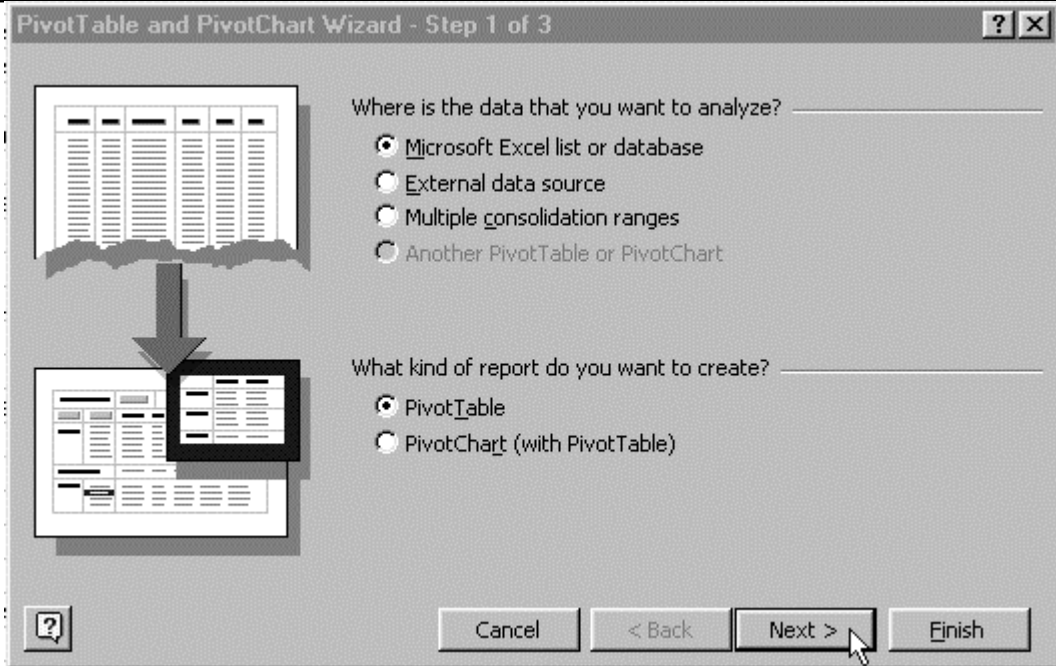
7. In this step select the range of the data. Excel automatically selects the entire database. Click on the [Next] button.

8. In this step select the location of the pivot table. You can select the entire worksheet or a new worksheet. Click the [Finish] button.

9. Excel creates the pivot table to manage the database and create any type of table.
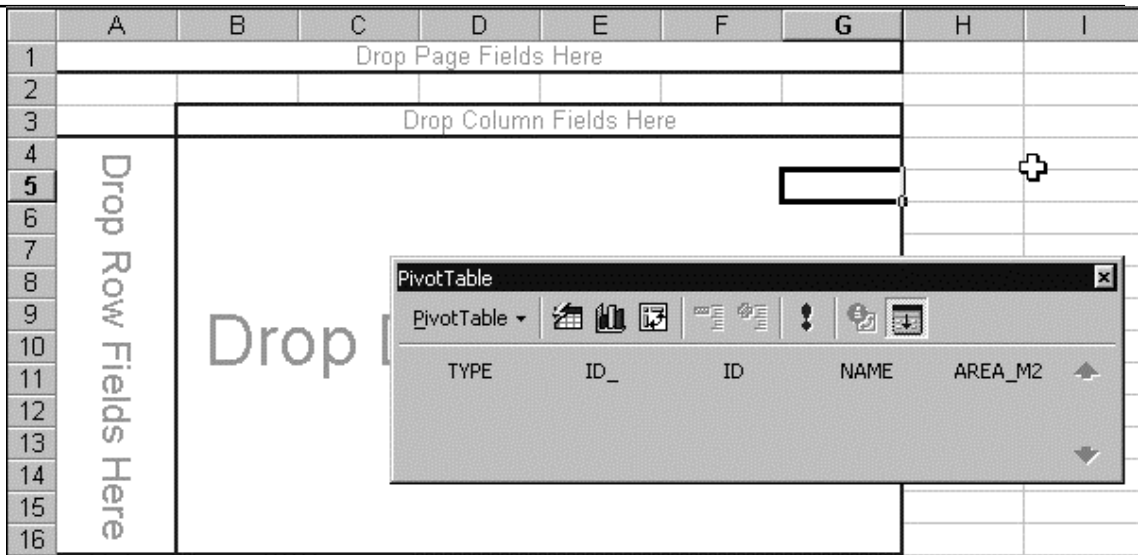
10. Drop in the row fields Type (Land use type), in the column fields name (District name) and in the center the area_m^2, to calculate the area of each type of land use by district.
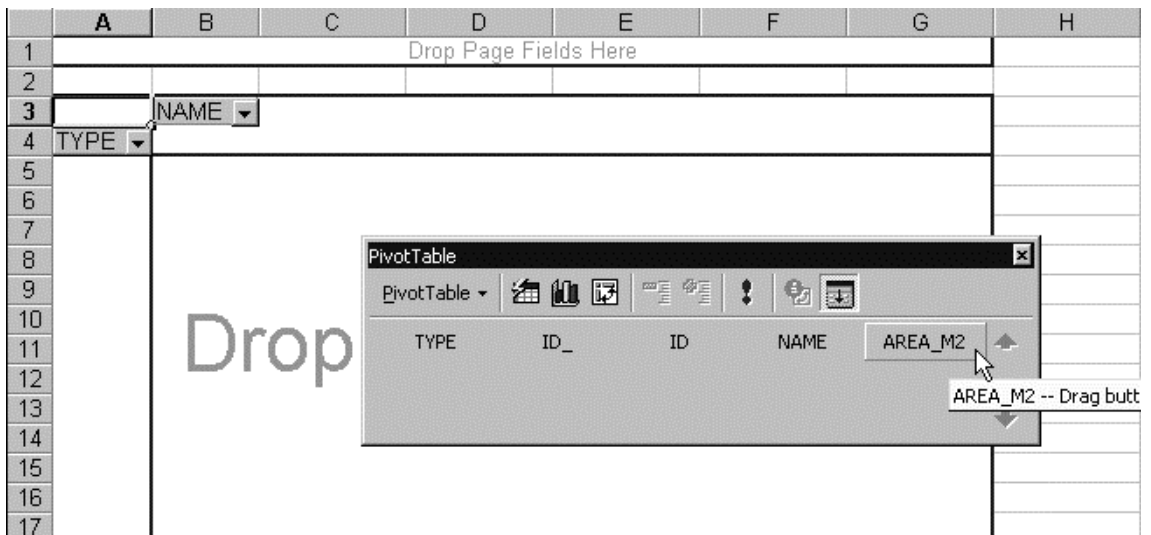
11. Finally you can obtain the following table.

Sum of AREA_M2	NAME ▾							
TYPE ▾	Azizbeyov	Binagadi	Garadag	Khatai	Narimanov	Nasimi	Nizami	Sabayil
Ag - Cattle breeding	4,039,182.0		145,329.9					
Ag - Crops	18,606,283.1	8,523,288.3	75,083.1		353,867.7		87,684.9	
Ag - Orchards/Vineyards	27,787,841.2	2,944,307.0		1,461,869.1				
Cemeteries	1,605,979.7	87,606.0	656,204.6	114,159.5	775,876.2		173,586.5	105,695.5
Commercial	938,243.0	5,258.5	25,916.9	26,836.6	87,394.9	130,324.2	75,143.9	50,121.9
Forest plantation	1,962,782.6	5,754,367.6	1,666,632.3	933,573.9		17,987.3	221,596.4	1,813,535.8
Ind - Oil fields	20,056,371.5	40,076,389.8	34,219,836.6	2,471,945.6				6,261,053.9
Ind - Quarries	667,246.6		3,647,121.9					
Industrial	3,382,349.6	5,955,362.3	19,212,898.7	12,735,681.8	7,679,490.5	641,402.1	8,928,275.0	1,291,164.0
Institutional and public	1,039,707.2	1,798,594.0	4,212,254.6	2,086,462.7	1,878,963.5	1,454,692.2	582,366.3	1,576,429.5
Open space	221,370,886.8	16,042,585.7	940,606,696.4	3,106,722.2		59,685.9	153,551.9	6,076,604.5
Park and green area	219,791.4	377,253.2		404,812.8	639,342.7	288,208.6	1,991,004.6	953,517.4
Recreational	44,268,533.9	24,176,071.0	23,595,281.9					466,127.0
Res - Historical/Cultural								227,874.7
Res - Wild nature	3,877,913.9		23,870,130.4					
Residential	29,417,687.6	12,752,493.0	12,877,483.6	12,538,104.4	5,979,949.8	6,364,430.8	5,983,303.9	5,538,896.9
Transport	9,119,944.0	1,420,267.7	2,468,361.9	163,604.6	2,371,446.8	1,520,674.1	780,563.7	96,369.0
Wat - Lakes/Ponds	2,315,926.2	10,652,282.6	16,182,256.2	38,932.0	101,907.2			15,117.8
Wat - Reservoirs	70,844.1	44,274.1	237,634.6	202,678.7			70,238.8	
Grand Total	390,747,514.2	130,610,400.7	1,083,699,123.4	36,285,383.7	19,868,239.4	10,477,405.2	19,047,315.9	24,472,507.9

12. Format the number and the border to print. (For more details about pivot table please refer to Excel help files.)

1.1.9   Spatial analysis

a.   Creating themes from external data

In this example we will use the data of air pollution concentration. The database contains X, Y coordinates and the concentration in each point is calculated using another application (air.dbf).

1.   Add the external database.

air.dbf		
X	Y	Conc
414500	4480000	1.10829
414500	4481000	1.07449
414500	4482000	1.60870
414500	4483000	1.92998
414500	4484000	1.91666
414500	4485000	1.82779
414500	4486000	2.07464
414500	4487000	2.08374
414500	4488000	1.85481
414500	4489000	1.46609
414500	4490000	1.47818
414500	4491000	1.61304
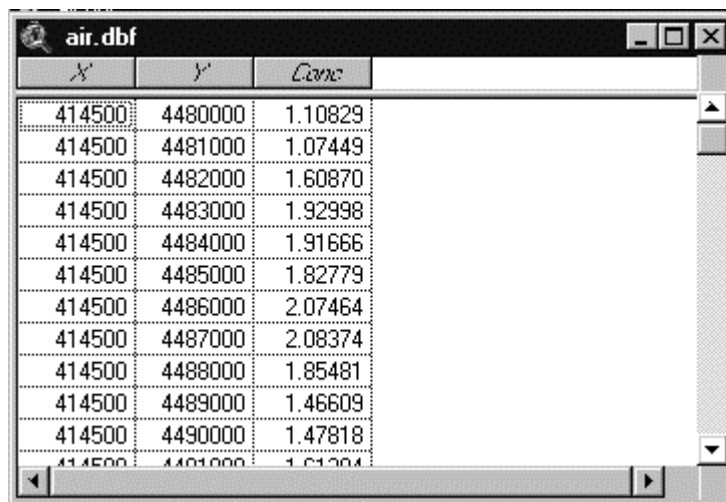
2.   From the [View] menu, select [AddEvent Theme…] to convert the database to themes file.

3. In the [Add Event Theme] dialog box, select the new table, X field (the column that contains the X coordinate) and Y field (the column that contains the Y coordinate). Click the [OK] button.
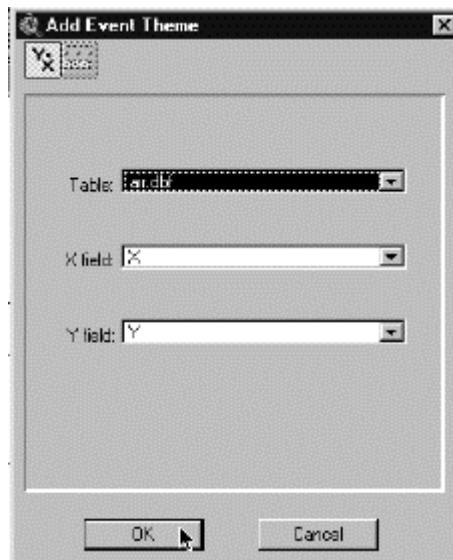
4. ArcView creates the new point theme. Activate the new theme in the view.
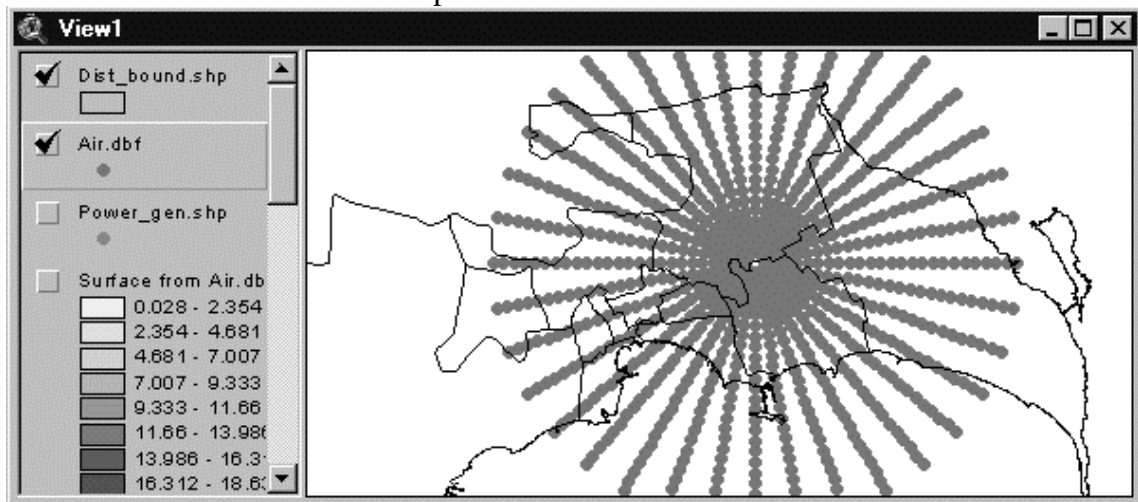
5. In this step we will create the map of air pollution concentration at each point. From the [Surface] menu, select [Interpolate Grid].

File   Edit   View   Theme   Analysis   Surface   Graphics   Window   Help

Create TIN from Features...

Add Features to TIN...

Interpolate Grid...

Create Contours...

Derive Slope

View1

✓ Dist_bound.shp
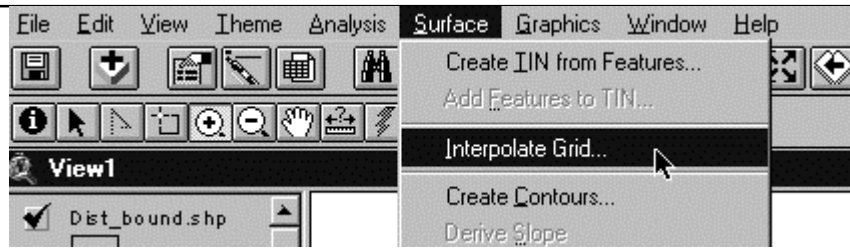
6. In the [Output Grid Specification], select as follows. For more details you can change each value in this step.

Output Grid Specification

Output Grid Extent   Same As Air.dbf

Output Grid Cell Size   As Specified Below

CellSize   216.930809   Map Units

Number of Rows   230

Number of Columns   230

OK   Cancel
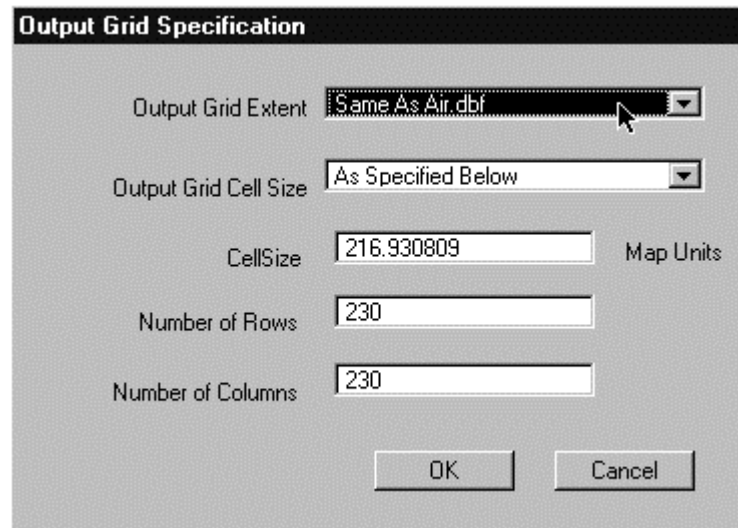
7. In the [Interpolate Surface] dialog box, select the method and indicate the Z value Field. (In this case select the **Conc** that contains the concentration value.)

Interpolate Surface

Method   IDW

Z Value Field   Conc

○ Nearest Neighbors   ○ Fixed Radius

No: of Neighbors   12

Power   2

Barriers   No Barriers

OK   Cancel
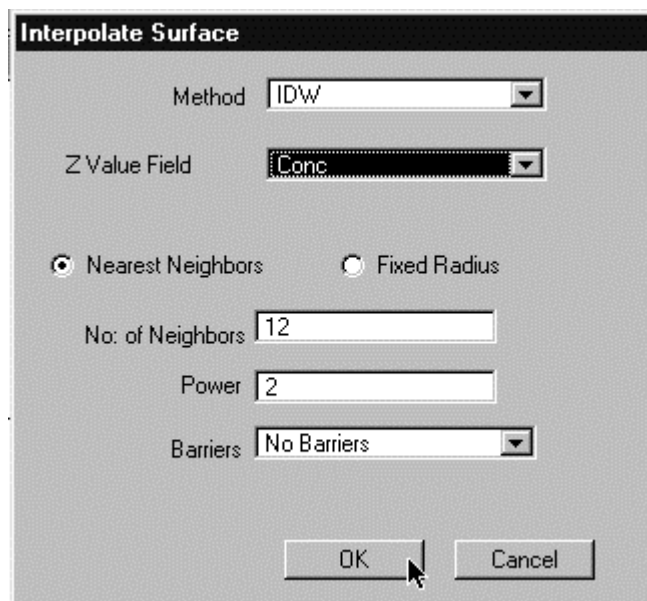
8. ArcView creates a new theme with a concentration value that you can display as follows.
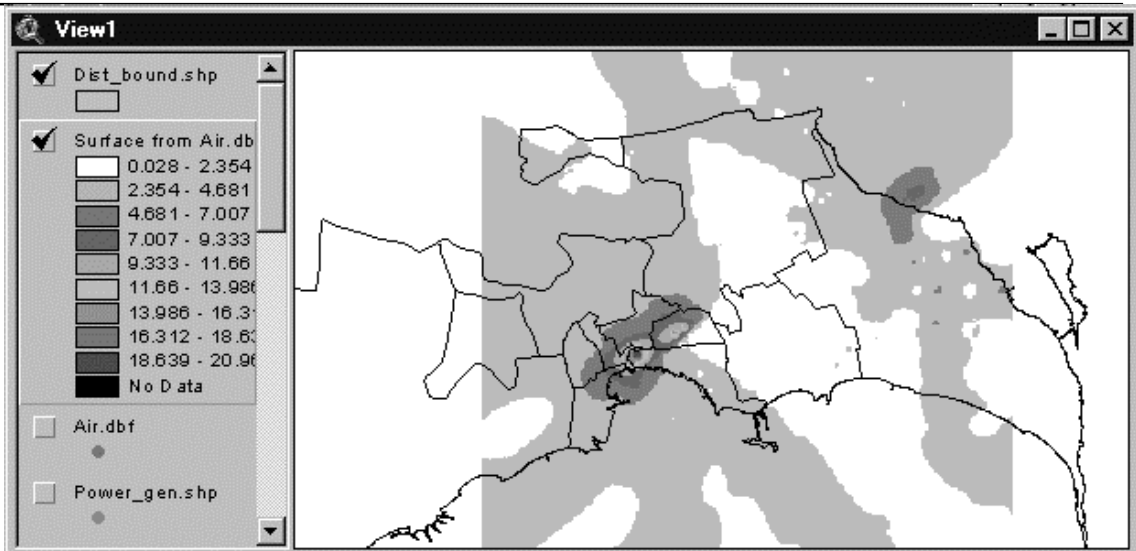
1.1.10 3D analysis

a.   Creating a TIN (Triangulated Irregular Network) from contour lines

1. Open the line theme contains elevation value you wish to create the TIN.
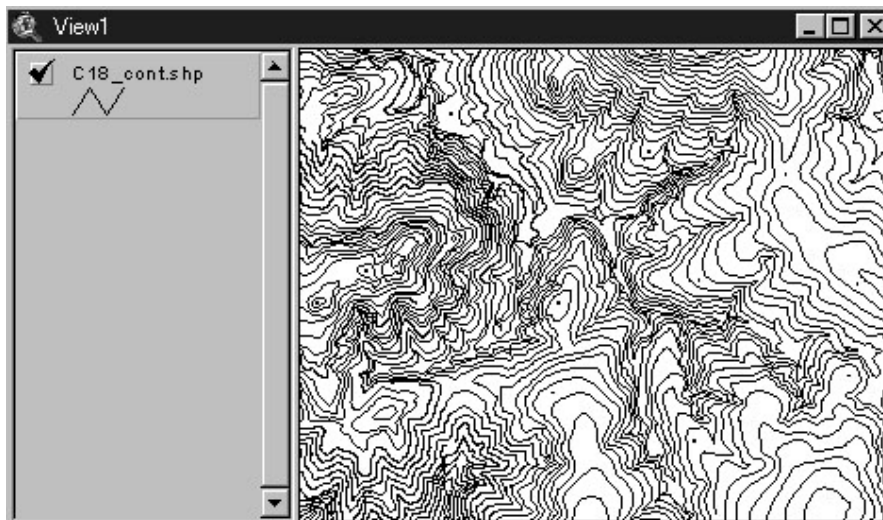
2. From the [Surface] menu, select the [Create TIN from Features].
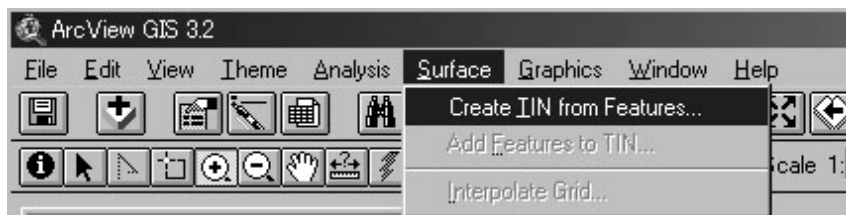
3. Input the Height source, Input as, and then click the [OK] button.
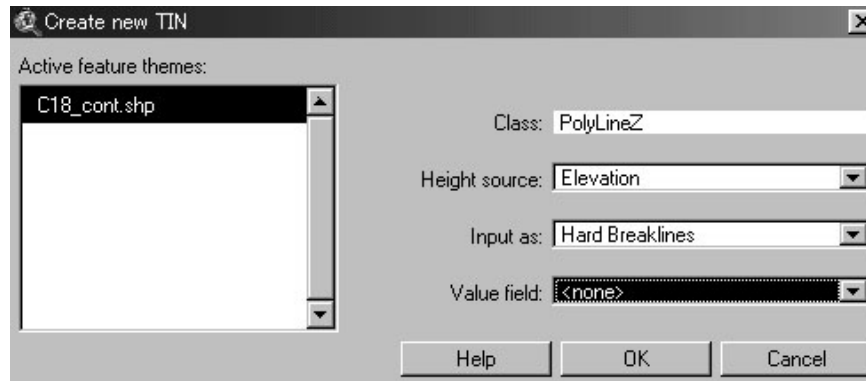
4. Input the output file name, and then click the [OK] botton.
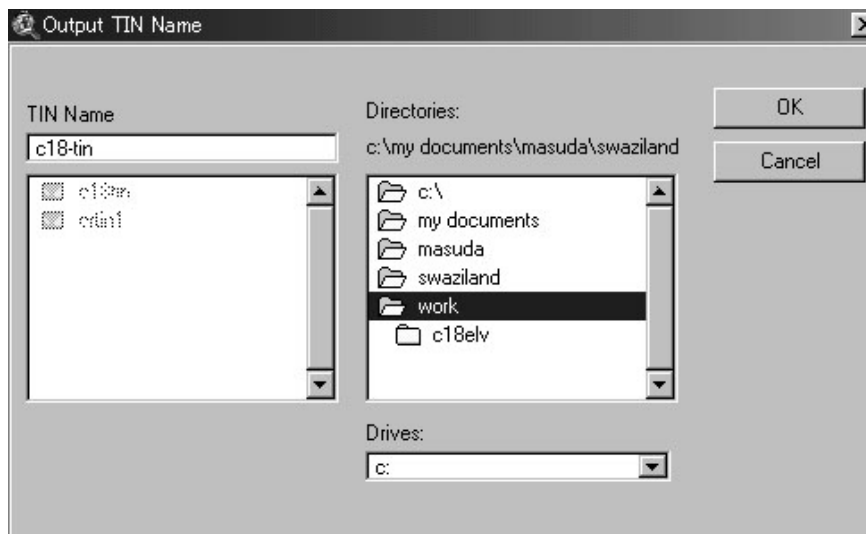
5. Now you have a TIN grid image in the view.
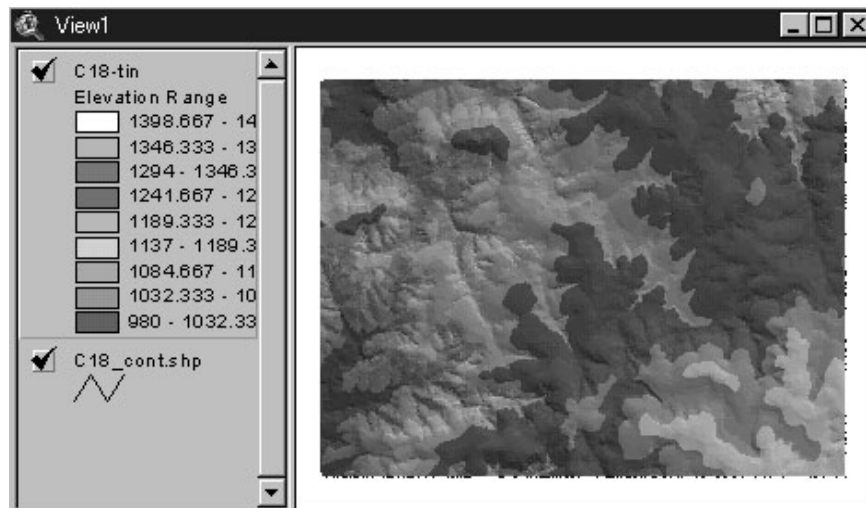
b.   Creating a Slope image using TIN

1.   From the [Surface] menu, select the [Derive Slope].
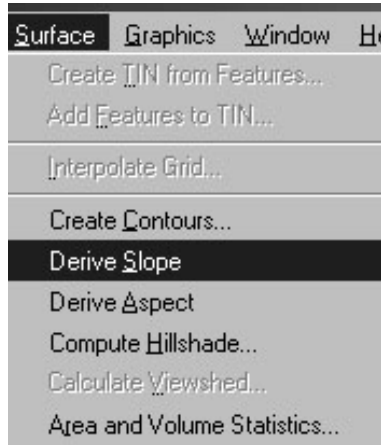
2.   Input the Output Grid Extent and Output Grid Cell Size. Number of Rows and Number of Columns are calculated automatically, and then click the [OK] button.
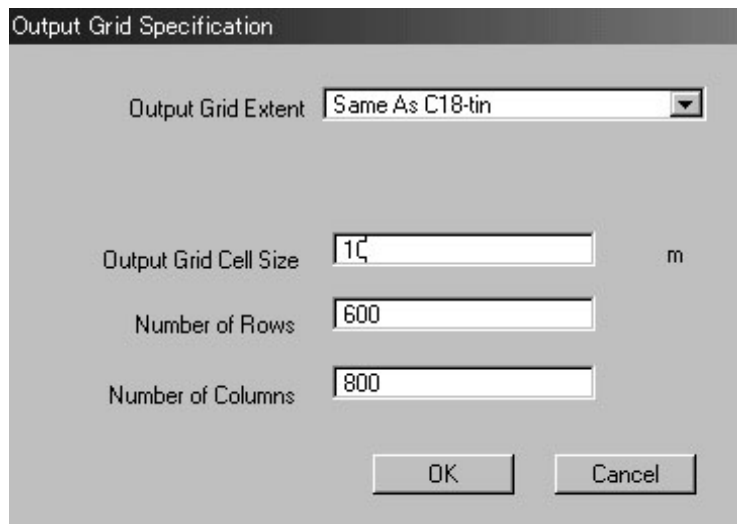
3.   Now you have a Slope image in the view.

36
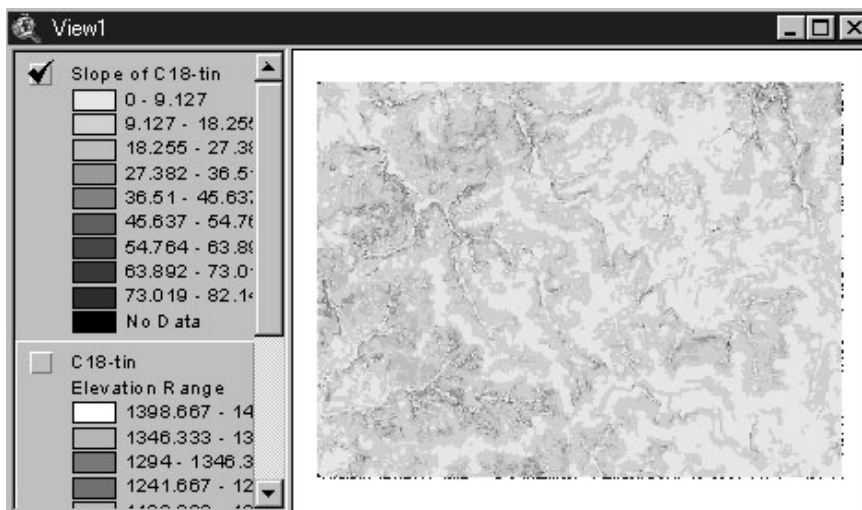
c.   Creating an Aspect image using TIN

1. From the [Surface] menu, select the [Derive Aspect].
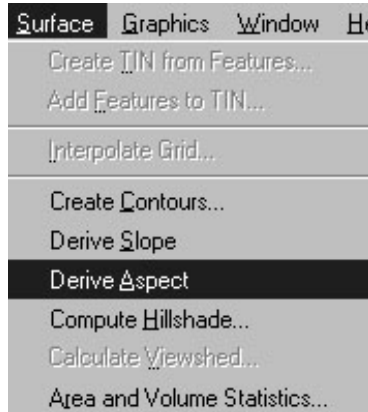
2. Input the Output Grid Extent and Output Grid Cell Size. Number of Rows and Number of Columns are calculated automatically, and then click the [OK] button.
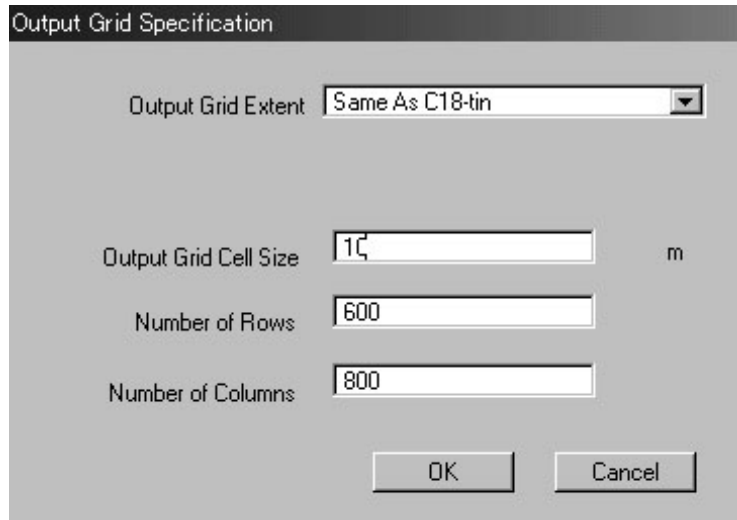
3. Now you have an Aspect image in the view.

37
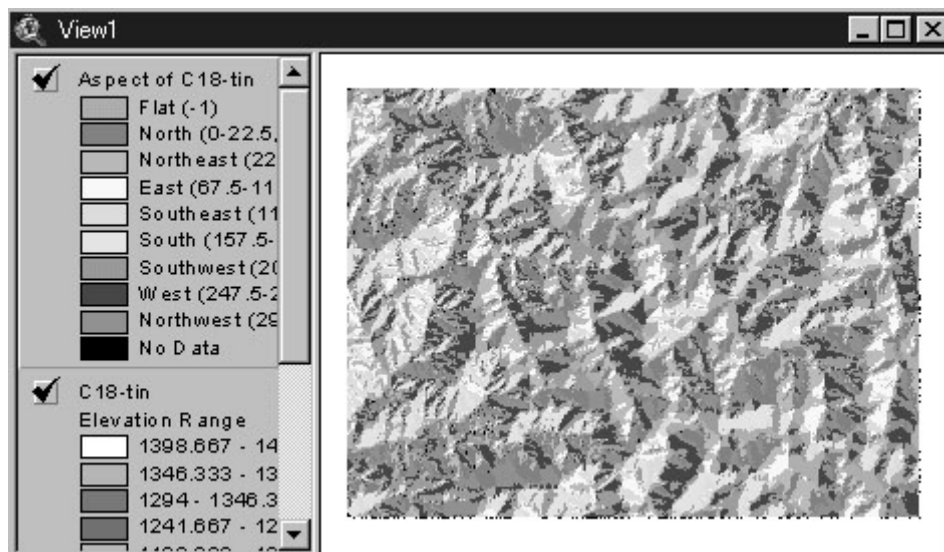
d.   Creating a Hillshade image using TIN

1.   From the [Surface] menu, select the [Compute Hillshade].
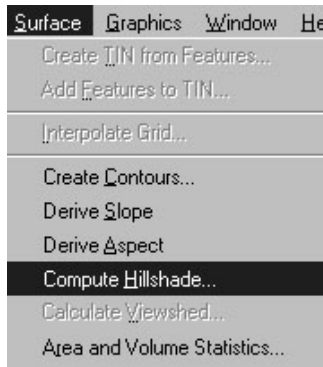
2.   Input the Azimuth and Altitude, and then click the [OK].
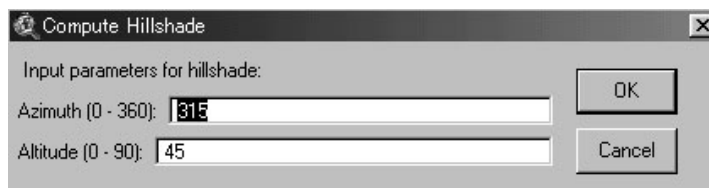
3.   Input the Output Grid Extent and Output Grid Cell Size. Number of Rows and Number of Columns are calculated automatically, and then click the [OK] button.
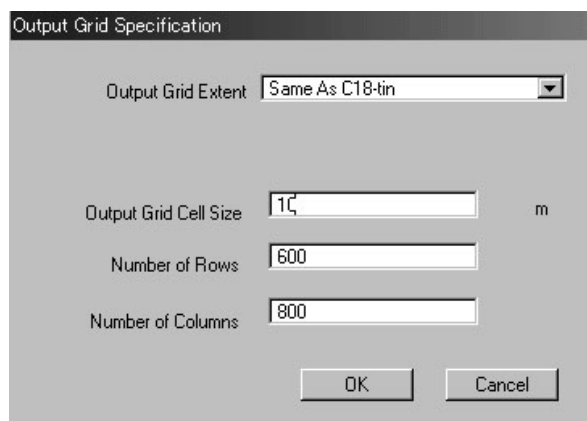
4.   Now you have a Hillshade image in the view.

38
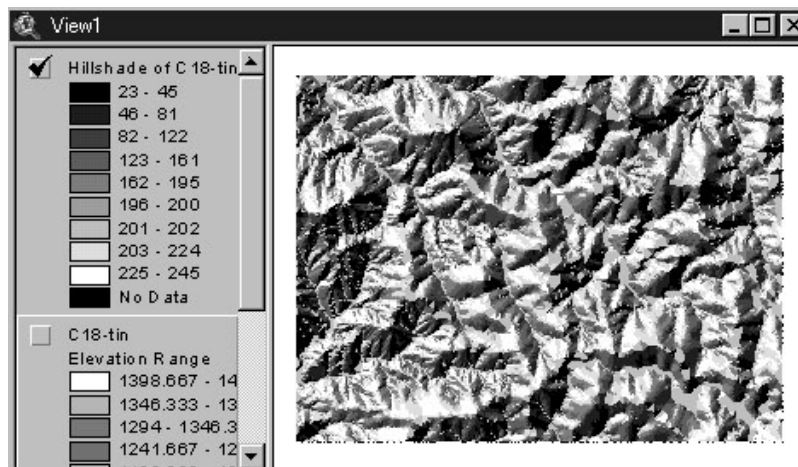
1.2   Database Management

1.2.1   Hardware

For hardware the following have been installed: 2 Workstations, 1 plotter
2 Workstations
- ✓ Dell Precision Workstation 620
- ✓ Pentium® III 500Mhz XEON Processors
- ✓ RAM Memory 1,024MB
- ✓ Monitor 21'
- ✓ 4 SCSI HD 8.5GB
- ✓ FDD 1.44
- ✓ CD-RW
- ✓ CD ROM
- ✓ Keyboard/Mouse

1 Plotter
- ✓ HP DesignJet 2500CP
- ✓ Memory 36MB

1.2.2   Software

The following software were selected:

2 Workstations
- ✓ Windows® NT® Ver. 4.0
- ✓ Arc View® 3.2
- ✓ Arc View® Spatial Analyst
- ✓ Arc View® 3D Analyst
- ✓ Arc View® Network Analyst

HP DesignJet
25000P

Workstation 1

DELL Precision 620

HDD
8.5GB

FDD 1.44MB   CD-ROM

CD-RW

Hub

Workstation 2

DELL Precision 610

HDD
8.5GB

FDD 1.44MB   CD-ROM

CD-RW
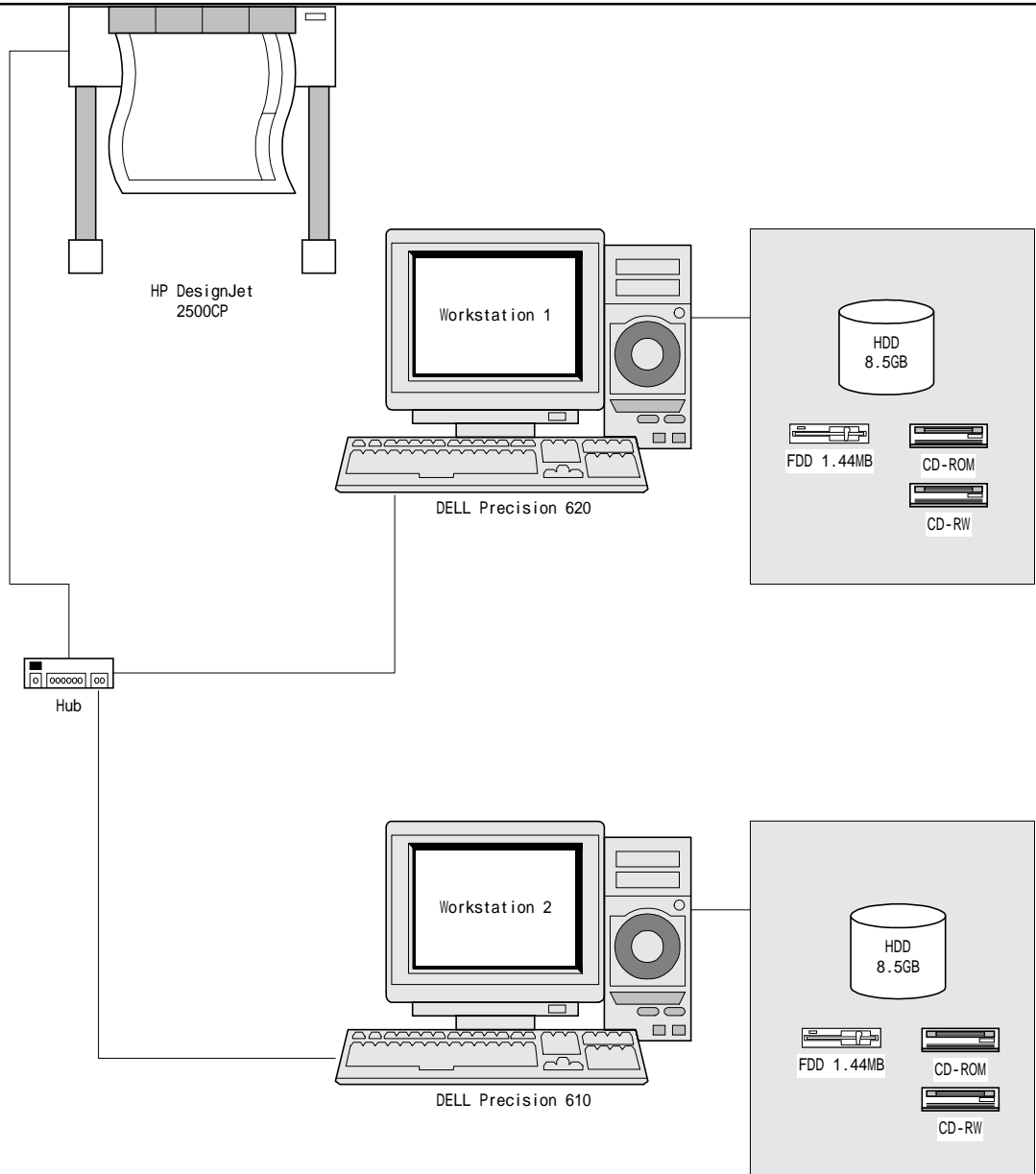
1.2.3 Using a computer

All the computers mentioned previously are connected by a LAN (Local Area Network), to ensure compatibility between resources and increased productivity. The next figure shows the configuration of the LAN, which is of the type "Star" with 8 port hubs that allow the ability to increase the number of workstations as required. The LAN is of a Client/Server mode where the Server operates by Windows NT 4.0, and the Workstations with Windows 98. For the effective use of this operating system, that is to also strictly control the users and the security of stored data, and for the effective management of valuable GIS data, the following are defined:

- *LAN Administrator:* Is the person authorised by the institution to manage the whole LAN and be responsible for the operation:
    - Account of users of the workstation.
    - Grants permission for the sharing of files and folders.
    - Data and hardware security
    - Data backup
    - Hardware configuration

- *Users: people* authorised by the administrator to use the workstations and have access to the data.

a.   To use the computer follow the steps below.

1. Turn on the Server (Administrator)
    a. Turn on the UPS connected to the Server
    b. Turn on the Server and wait until Windows$^{®}$ NT starts.
    c. Make sure that the Hub is turned on.
2. After the Server is started, turn on the workstations (Users)
    a. To start the workstations, make sure that the Server is ready.
    b. To start the session in the LAN, the users should be registered with the Server and authorised by the administrator.
    c. Input the user name and the password and then start the session.

1.2.4 Administering Windows NT Server (Administrators)

Windows NT is frequently marketed as an operating system that requires little or no system administration, a concept that is more based on theory than on reality. Well designed system administration tools can go a long way toward making Windows NT systems management easy and painless under normal circumstances and some of the Windows NT tools come reasonably close to this objective. Realistically, however, you can expect the unexpected to occur all too frequently.

System administrators are distinguished from ordinary users, power users, and operators in that they know what to do when things go wrong. While all these classes of users are comfortable using the system under normal circumstances, only system administrators have to know what to do when things are anything but normal. This doesn't mean you have to know the solution instantly for every problem you encounter. Sometimes you will, but more often what you bring to the situation is a

strategy for figuring out what has gone wrong and the tools for fixing it once you have done so.

Successful system administrators are continually aware that computers are used by people and organisations and that their management has to be carried out within this social context. System administration often involves a tension between authority and responsibility on the one hand and service and cooperation on the other. The extremes seem easier to maintain than any middle ground; fascistic dictators who rule "their network" with an iron hand, unhindered by the needs of users, find their opposite in the harried system managers who jump from one user request to the next, in continual interrupt mode. The trick is to find a balance between being accessible to users and their needs, and sometimes even their mere wants, while maintaining authority and sticking to the policies put into place for the overall system welfare. The goal is to provide an environment where users can get what they need to do done, in as easy and efficient a manner as possible, given the constraints of security, other users' needs, the inherent capabilities of the system, and the realities and constraints of the human community in which all of them are located.

a.   The system administrator's job

- Installing and configuring computer systems and networks, updating them as necessary, and keeping them running properly on a day-to-day basis.
- Managing users and user accounts, including both the computer-related aspects of creating and maintaining user accounts and systems, and responding to user requests, questions, and problems.
- Taking care of the peripheral devices attached to the various computer systems (printers, tape drives, non-interruptible power supplies) as well as adding or removing them as needed.
- Overseeing regular system backups, which can range from performing backups to designing and implementing a backup plan to be carried out by others.
- Ensuring that the systems and networks for which you are responsible are secure and that valuable or sensitive data is protected from undesired access.
- Monitoring system and network activity in order to quickly detect any problems related to system security, performance, or general functioning that may arise, and then responding appropriately to any anomaly that may be detected.

1.2.5 Windows NT Server Network

A LAN is a group of PCs that have been connected to enable communication and the sharing of resources. The LAN is based on a windows NT Server ("Client/Server" type) that constantly ensures security and consistency in connection, that is relatively easy to put into practice and to maintain.

Windows NT Server requires at least one "File Server" in the LAN, in which the Windows NT operating system is executed. However, the clients or the PC's connected to the LAN can adopt a different type of operating system, e.g. Windows NT Workstation, Windows 95, OS/2, Macintosh, Unix, etc.

From the point of view of an administrator, the LAN enables the centralised administration of the account of the users and the problems related with security.

The following are some of the characteristics of a secure Operating System:
- Limits access to the domain to specific users.
- Limits access to the domain to certain number of hours.
- Limits access, for user or for group, to resources of LAN like files, folders and printers.
- Limits that control type has witch users for files and directory.
- To clarify any action taken in different files or directory or the type of access that was granted or even attempted.

It is, however, important to bear in mind that the security of the operating system works like a padlock. A padlock purchased from a hardware store can only provide the protection required when used appropriately. Likewise, the security options provided by an operating system becomes ineffective if the administrator has no detailed security plan.

1.2.6   Connection of Workstations

This section focuses on the use of Windows 98 as the Workstation of the network.

a.   Installation of the network components

To set up a PC using Windows 98 as a Workstation, the establishment of the following net components is necessary.
- Network adapters or Network card
- Network clients
- Network protocols
- Network services

a.1   Network card

The hardware physically connects the PC to the network, and is, therefore, indispensable. The installation of a network card is relatively easy with the Plug-and-Play functions in Windows 98 that recognises a new device in the system. Once installed the card verifies the following.

1. Select [Network Neighborhood] then click the right button of the mouse and choose [Properties].

2. Verify in the following screen that the network card is installed.
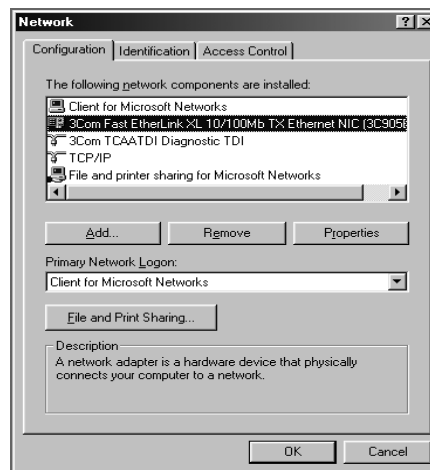
a.2   Network clients

If in the [Network] dialog box, any [Network Client] type is not installed, follow the steps shown below.

1. In the [Network] dialog box, click [Add].
2. In the [Select Network Component Type] dialog box, select [Client] and click on [Add].
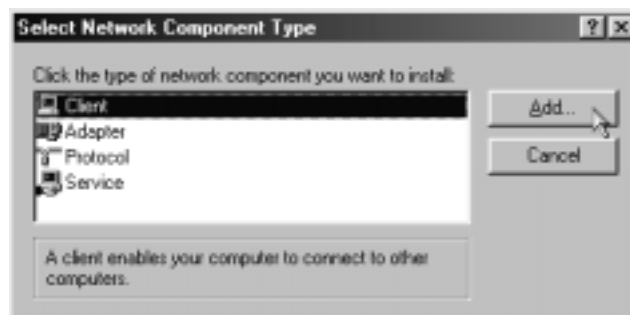
3. In the [Select Network Client] dialog box, choose [Microsoft] for the manufacturers and [Client for Microsoft Networks] for the network clients, and click on [OK]

44
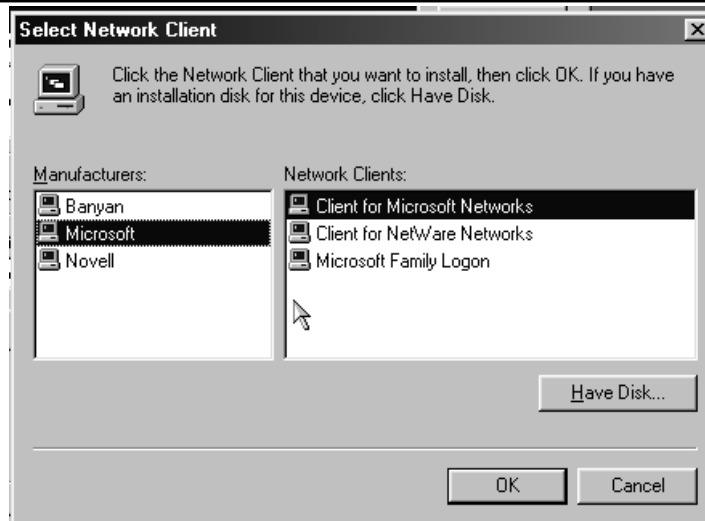
a.3   Network protocol

The network protocol determines how the computers will communicate in the network. There are a variety of protocols, but the TCP/IP will be adopted for this network. To configure the protocol, follow the steps below.

1. In the [Network] dialog box click [Add].
2. In the [Select Network Component Type] dialog box, select [Protocol] and click on [Add].
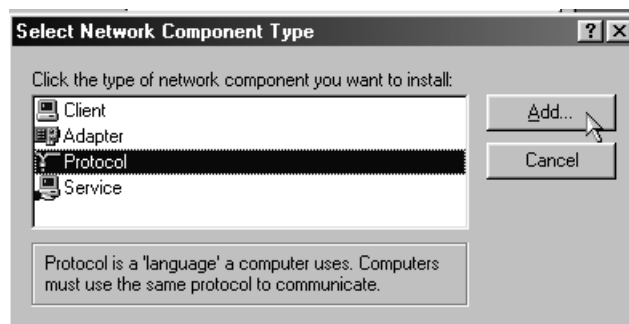
3. In the [Select Network Protocol] dialog box, choose [Microsoft] in the manufacturing type and [TCP/IP] in Network Protocols, then click on [OK]
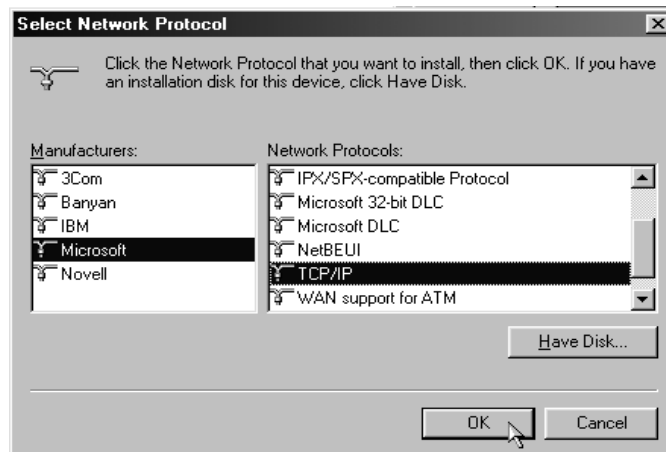
a.4   Network services

The network services determine which services will be shared. A network service should be installed if files and printers are to be shared. For configuration, follow the steps shown below.

1. In the [Network] dialog box, click on [Add].
2. In the [Select Network Component Type] dialog box, select [Service] and click on [Add].
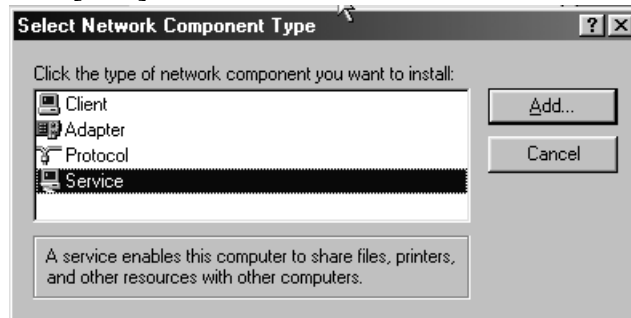
3. In the [Select Network Service] dialog box, select [File and printer sharing for Microsoft Networks] and click on [OK]
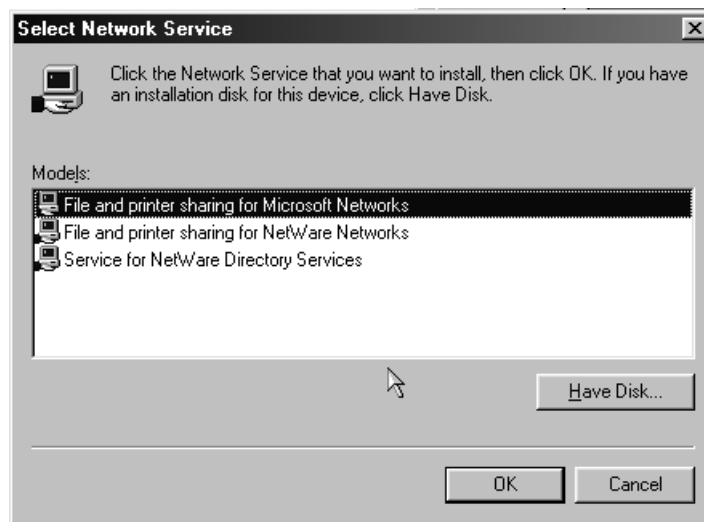
b.   Configuration of the network components

After installing all components, you will need to configure the following components to successfully establish connection to the Windows NT Server.

b.1   Client for Microsoft networks

To configure this component, follow the next steps.

1. In the [Network] dialog box, select [Client for Microsoft Network] and then click on [Properties].
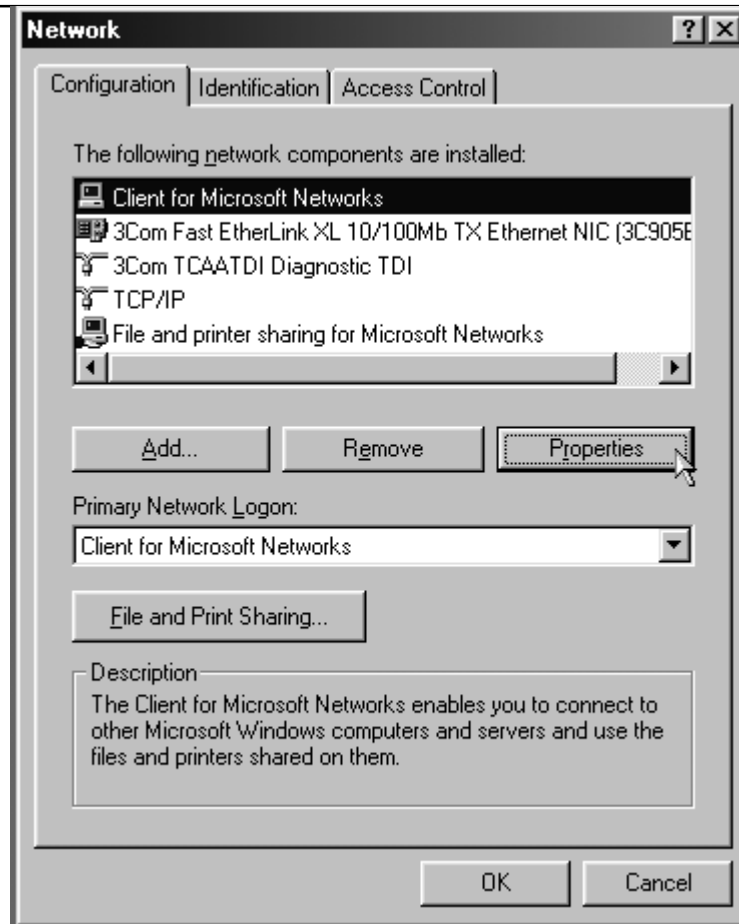
2. In the [Client for Microsoft Network Properties], click on [Log on to Windows NT domain] to enable this option, and in the [Windows NT domain], type the name of the domain of the Server, in this case "DOMAIN", because it was configured this way.
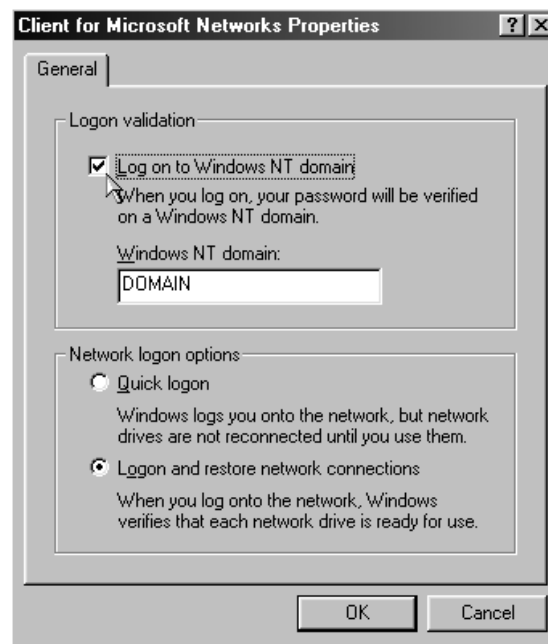
3. Click on "OK", to finish the configuration.

b.2   Configuring the protocol TCP/IP

To configure this component, follow the next steps.

1. In the [Network] dialog box, select [TCP/IP] and click on [Properties].
2. In the [TCP/IP] dialog box, select the [IP Address] window. Click on [Specify an IP address], to enable this option and then type [IP address] and the [Subnet Mask].
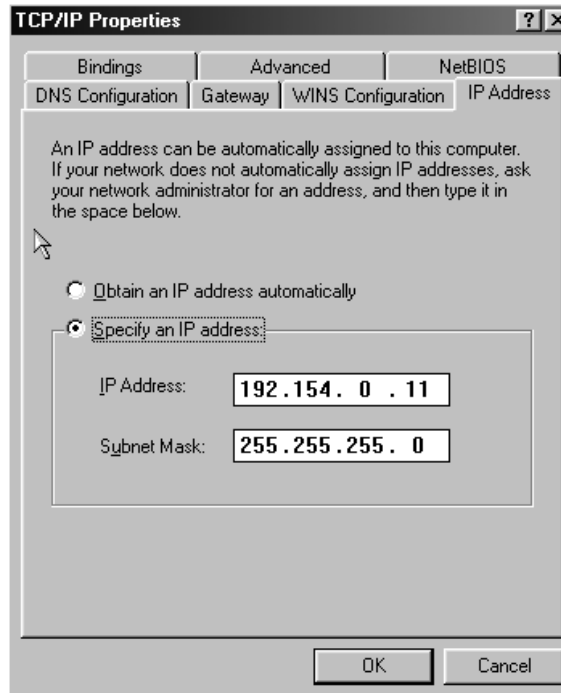
3. Each network should decide on an IP address. The IP address to be adopted for this network is as shown below:

    IP Address for workstations: 192.154.0.11 up to 192.154.0.99
    Subnet Mask: 255.255.255.0

    These addresses will be modified as the network grows.
4. Click on [OK] to finish the configuration.

b.3   Configuring the identification in the network

It is necessary to configure the identification of the computer to avail of the network services. To do so, follow the steps below.

1. In the [Network] dialog box, select the [Identification] window. In [Computer Name], type the name that will identify the Computer inside the network. In [Workgroup], type the same domain that is configured in the Server, in this case "DOMAIN", and then type the description of the computer in [Computer Description].
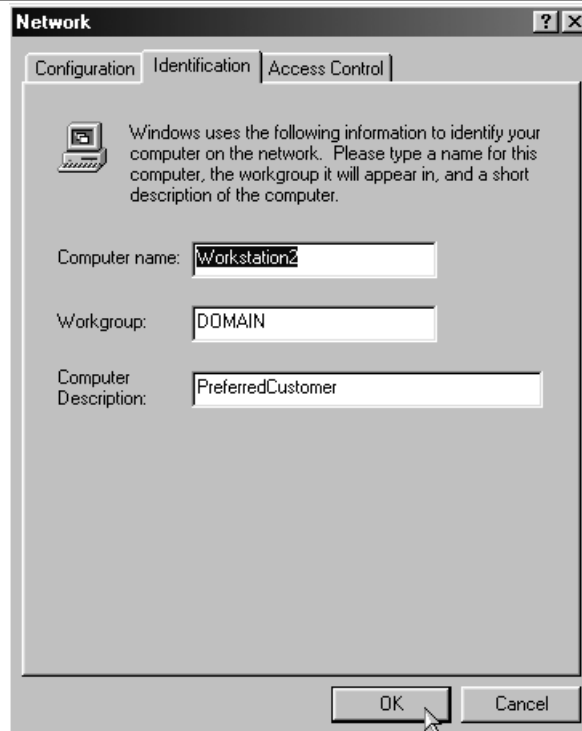
2. Click on "OK", and then restart the computer to activate all changes made.

c.   How to register in the Windows NT Network

Once the components have been added and configured, the computer will restart. Thereafter, follow the steps below.

1. When the computer starts, the registration dialog box will appear on screen.
2. Before registering make sure that the Server is on, and the [Username] is registered in the network domain.
3. In the registration dialog box, type the [User Name], the password [Password] and the domain of the Server [Domain], in this case "DOMAIN".

1.2.7 Administering the Windows NT Server

This is part of the network administrator's task; it is the administration who has access to the server. This task also forms the base of the system's security. In fact, to grant access to a system is the first point of verification of any security plan. Windows NT includes an Administration of users with complete characteristics that it allows you to create and to administer users' account, the same as users' groups.

a.   Understanding the domains

A domain is the main base of a Microsoft NT Network. Basically, a domain is a group of computers and related network resources. At least one of the computers should be Windows NT, but it could have many more servers in the domain. Because the domain is a logical organisation it doesn't have geographical limits. This means that a single domain could be in the same room, in the same building or disseminated all over the city or all over the world.

If commonly used with Internet, a Microsoft network domain can be easily confused with a domain of the Internet. Although these can be parallel organisations of

computers, both are not exactly the same thing. In the world of Internet, the domain identifies the Internet from the rest of the world, as long as a Microsoft network domain is used strictly to handle users and the resources to those that users can have access.

To establish a domain, at least one Windows NT Server is required. This system acts as the Primary Domain Controller (PDC), and as the place that holds all the information related with the users and the resources for the domain.

b.   Understanding the users and groups

Inside a domain of the Windows NT network, the following four specific elements are available:

- **Servers:** This refers to the computers that are executed under the Windows NT Server and that make information and resources available for the domain.
- **Workstations:** These are the computers that, through the execution of a variety of operating systems, gain access to, or in some cases provide, information that is available in the network.
- **Users:** These are individuals that are entitled to use the workstations or the Servers in order to have access to the resources in the net. The access of general users is limited. The users are assigned an account and each obtains a name and a password that serve as an identification in order to access the network.
- **Groups:** These are combined users. Through categorisation, groups of users simplify user administration. The account of the individual users can be assigned to different user groups. When belonging to a user group, automatically the account has access to certain data and resources in the network.

c.   Administering the user manager for domain

One of the responsibilities of the network administrator is to establish directives for the account. To administer the user account, the [User Manager for Domain] is the tool to be used.

1. Select [Program] in the [Start] menu.

2. Select [Administrative Tools (Common)], and then [User Manager for Domain]. This will prompt the next dialog box [User manager-Domain].

d.   Administering User Account

One of the challenging tasks of a network administrator is maintaining a precise and up-to-date database of users. This task is very important in terms of security and the database should be constantly updated to facilitate administration.

1. Select [Programs], in the [Start] menu, and select [Administrative Tools Common].
2. In the [User Manager-Domain] window, select [New User] in the [User] menu. This will prompt the [New user] dialog box, where the addition of a new user is typed in.
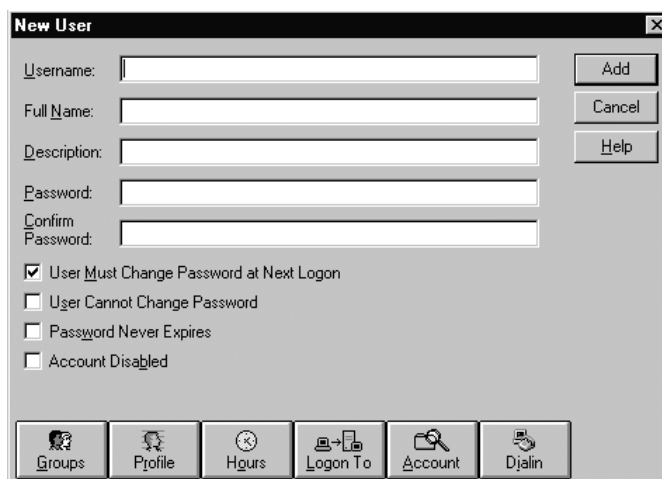
Adding a new user account does not require a lot of information. The minimum requirement is a [Username], password [Password]; the latter will be confirmed in the [Confirm Password] section. Other information may be added as well.

Users Must Change Password at Next Logon. If this option is selected, the user must modify his password when he registers for the first time in the network. This means that the password that is provided in the dialogue box of [New User] is temporary, effective only when registering for the first time. For security purposes this option should be selected.

User Cannot Change Password. If this option is selected the user won't be able to change his own password. If the password expires, it will be changed by the administrator.

Password Never Expires. If this option is selected the user will never need to change his/her password.

Account Disable. This option can be used to temporarily disable an account. This option is automatically selected if the user has been designated temporarilly and if the account has expired.

3. In the lower part of the dialog box of [New User] are some buttons that allow the designation of additional information into the account.

4. After specifying the user's information, click on [Add] to add a new user.

e.   Administering user groups

Grouping users facilitates user management and gives the users within the group the rights designated to the group that they belong to. The following are the three main groups used in the Windows NT Server.

*   *Local Groups*: Are used to assign permission for the use of the local domain. This can contain users and Global groups, including Global groups from other trusted domains.
*   *Global Groups***:** Contains user accounts only. This is used to export user accounts to other domains, where they can be imported into Local Groups on trusting domains
*   *Special Groups*: Used by Windows NT Server for system access, and do not contain user or group accounts.

e.1   Global groups

Global groups contain users from the local domain. They are also used to export users to another trusting domain. Global groups do not have rights to perform any administrative tasks. For instance, the built-in global group, Domain Admins, can only perform administrative tasks if it is made a member of the local group Administrators.

(1)   The built-in global groups

The following table lists the Global groups built-in the Windows NT Server.

Global Group Name	Members	Who can modify?	Initially a member of
Domain Administrator	Administrator	Administrators	Administrators
Domain Guests	Guest	Administrators Account Operators	Guests
Domain Users	Administrator	Administrators Account Operators	Users

(2)   How to use groups in domains

Let's consider some recommendations concerning the use of Global and Local group memberships as outlined by Microsoft.

Function	Group to use
Export users to another domain	Global
Assign permissions and rights to local domain resources	Local
Give rights to users from another domain	Local
Combine groups	Local
users need access to Windows NT Workstations or NT servers in a domain	Global

(3)   Add global groups

1. To add a new group of users, simply select the option in the menu [Users] in the dialog box [User Manager Domain].
2. If there is a need to add a global group, select [New Global Group].
3. To define the global group, simply provide a name for the group and an optional description, then select the account of users that you want as member of the group.
4. To add members, select the user's name in the list [Not Members], and then click on Add.
5. After the group has been defined, click on [OK]. The new global group will appear in the inferior part of the [User manager].

e.2   Local groups

Local groups are limited to the domain [or computer] they are created on. They are created using User Manager, and a number of pre-existing Local groups have been provided.

Local groups created on a Windows NT Server [non BDC or PDC] or Windows NT workstation are limited to that computer only. In contrast, a Local group created on a domain controller can be used on any server, which is a member of that domain, but cannot be used outside the domain.

(1)   Built-in local groups

Microsoft recommends that you use the existing Local groups where possible. The following table lists the Local groups built-in the Windows NT Server.

Available on	Local Group Name	Members	Who can modify?	Rights
DC	Account Operators (AO)	None	Administrators Account Operators Server Operators	Create, Delete, Modify user accounts and groups. Cannot modify the Administrator or Server Operator groups
W+S+DC	Administrators (AD)	Domain Administrator	Administrators	Create, Delete, Manage user accounts and groups. Share directories and printers. Grant resource permissions. Install OS files and programs.
W+S+DC	Backup Operators (BO)	None	Administrators	Backup and Restore servers. Logon locally. Shut down the server.
W+S+DC	Guests (G)	Guest	Administrators Account Operators	

W+S	Power Users			
DC	Print Operators (PO)	None	Administrators	Share and remove sharing printers. Manage printers. Logon locally. Shut down servers.
W+S+DC	Replicator	None	Administrators Account Operators Server Operators	Used with the Directory Replication Service.
DC	Server Operators (SO)	None	Administrators	Share and remove sharing resources. Format the server disks. Logon locally. Backup and restore servers. Shut down servers. Lock and unlock servers.
W+S+DC	Users (U)	Domain Users	Administrators Account Operators	

Note:

   W = NT Workstation

   S   = Windows NT Server

   DC = Domain Controller

(2)   Default rights for built-in local groups on Windows NT Server

The following rights are visible in User Manager for Domains.

Rights	AD	AO	BO	E	G	PO	SO	U
Access this computer from the network	Yes			Yes				
Backup Files and directories	Yes		Yes				Yes	
Change the system time	Yes						Yes	
Force shutdown from remote location	Yes						Yes	
Log-on locally	Yes	Yes	Yes			Yes	Yes	
Manage auditing and security log	Yes							
Shut down the system	Yes	Yes	Yes			Yes	Yes	
Restore files and directories	Yes		Yes				Yes	
Take ownership of files	Yes							

The following rights are NOT visible in User Manager for Domains [defaults which you cannot change].

Rights	AD	AO	BO	E	G	PO	SO	U
Assign user rights	Yes							
Create and manage user accounts	Yes	Yes						
Create and manage global groups	Yes	Yes						
Create and manage local groups	Yes	Yes						Yes
Create common groups	Yes						Yes	
Format the servers hard disk	Yes						Yes	
Keep local profile	Yes	Yes	Yes			Yes	Yes	
Lock the server	Yes			Yes			Yes	
Share and stop sharing directories	Yes						Yes	
Share and stop sharing printers	Yes					Yes	Yes	
Unlock the server lock	Yes						Yes	

Unlocking a server that has been locked by another user would lead to the loss of any work in progress. Users will only be able to add local groups if they have access to the User manager for Domains. Everyone has the right to lock an NT Server, but does not have the right to logon locally.

(3)   Add a local group

1. To add a local group of users, select (File, New, Local Group).
2. The information that aids the creation of a local group is almost the same as the one used to create a global group. The difference lies in the manner the group is formed.
3. When initial members are added to the first local group, click on [Add] and then the [User Manager]. This would show the new dialog box that contains the list of all the global groups and users' account in the system.
4. The local groups allow you to define a global group as members. To add the members, simply select the names in the superior part of the dialog box and then click on [Add].
5. Click on [OK] and the names specified are added to the new local group as initial members.
6. After the local group has been defined, click on [OK].

f.   Sharing files and folders

1. Creating a share under Windows NT is quite easy. Simply find the folder you want to share, right-click on the folder and select the menu option labeled "Sharing".

2. A dialog box will pop up with a tab entitled "Sharing". This is the exact same panel that comes up if you right-click on a folder and select "Properties" - the only difference is that the "Sharing" tab is pre-selected for you. Click on the "Shared As" radio button. The "Share Name" field will automatically be filled in with the same name as the folder; it is possible however to change the name.

f.1   Share and permissions

Many Windows NT administrators are very confused about how share permissions work. The basic problem is that there are *two* types of permissions involved - share and file permissions. Below are their definitions:

- *Share Permissions*: These are the permissions for who is allowed to connect to that share, and what they are allowed to do in that share (i.e., only read files, change files, create and delete files, etc.). Share permissions only apply when connecting to shares over a network. Shares are not used at all when connecting to files on the computer you are currently on (Microsoft calls this "logged on locally").

- *File Permissions*: These are Windows NT security file permissions, which apply to files at all times (whether connecting remotely or locally). These permissions specify who can access that file or folder, and what they can do to it (i.e., only read files, change files, create and delete files, etc.). To set these permissions, you must be using NTFS. If the drive/partition is formatted as FAT, file permissions cannot be set.

When a person attempts to connect to a share to read a file, NT does the following (and denies access if any check fails):
- Checks to see if that user has permission to connect to the share
- Checks to see if that user has read access to the share
- Checks to see if that user has file permissions to that file in the share
- Checks to see if that user has read access to that file in the share

As you can see, a lot of checks are done. Basically, Windows NT is going to apply the *most-restrictive rules* when granting access to files.

By default, when you create a share, Windows NT sets the share permissions to "Everyone/Full Control". Go back into the Sharing properties of the share created previously, and this time click on the "Permissions" button. It should look like this:

This is called default "pass through share security", because it is simply letting anyone on your network connect to this share (whether in your domain or not!), and granting them full control over the files there. Remember, though, that if you are using NTFS, they must also have file-level permissions to really access the files.

If you are familiar with file-level permissions (and you certainly should be), you'll notice that this panel is nearly identical to the one used for setting file-level permissions. Using it, you can define who is allowed to access this share.

Examples.

For example, say you have a folder named "test1" with three files in it, FILE1, FILE2, and FILE3. You set up a share granting EVERYONE full control. However, on each file you set it to be full control for administrators, and No Access for domain users. What happens when a user connects to that share? They can connect, and see the file names, but attempts to do anything result in an 'access denied' on the file.

If you change FILE2 to be full control by everyone, you allow anyone to use it - but not files FILE1 and FILE3. This works the other way around, too. Assuming that you set all three files to Full Control by Everyone via file permissions. You then change the SHARE permissions to only allow Read access by Domain Administrators (no other access). Here's what would happen:

- Domain administrators can connect to the share. When connected to the share, they can ONLY read the files. (Note that if they log on locally to the system, they don't need to use a share, and they have Full Control)

- Domain users can't connect to the share at all. Like Domain Administrator, they have full control over the files IF they are logged on locally to the computer, since the files are set as Full Control.

g.   Sharing printers

1. Select [Setting] from the [Start] menu, then select [Printer].
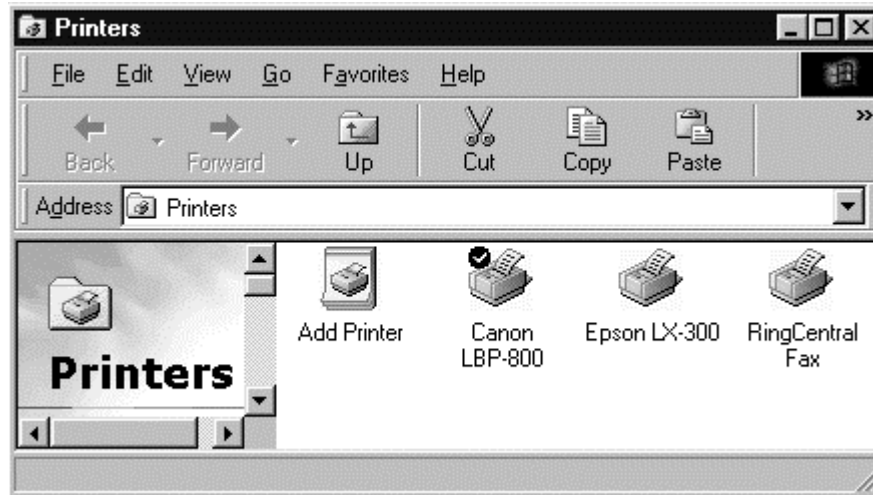
2. In the [Printer] folder, select the printer to use in the LAN, click the right mouse button, and then select [Properties].
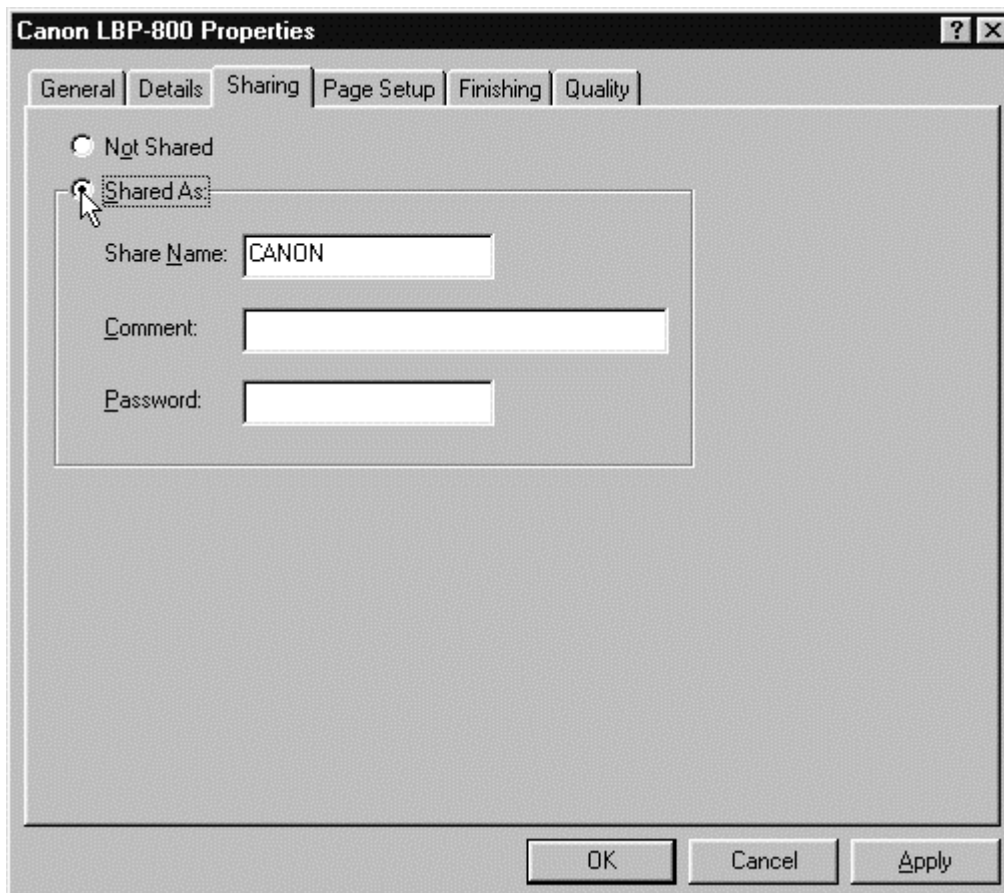
3. In the printer [Properties] dialog box, select the [Shared as] option and type the [Share Name], and then click [OK]
4. Now this printer is available for all in the LAN.

APPENDIX 5
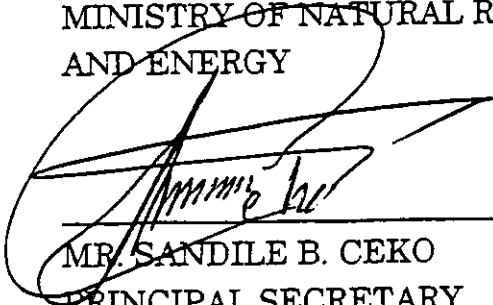
SCOPE OF WORK
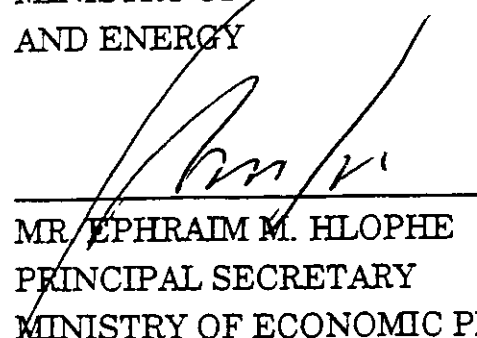
27 JANUARY 1999
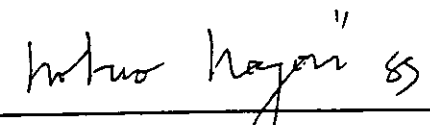
SCOPE OF WORK

FOR

THE STUDY ON DIGITAL MAPPING PROJECT

FOR

THE SMOOTH IMPLEMENTATION OF THE DEVELOPMENT PLAN

IN

SWAZILAND

AGREED UPON BETWEEN

THE SURVEYOR GENERAL'S DEPARTMENT

OF

THE MINISTRY OF NATURAL RESOURCES AND ENERGY

AND

THE JAPAN INTERNATIONAL COOPERATION AGENCY

MBABANE, JANUARY 27, 1999

_____
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I. INTRODUCTION

In response to the request of the Government of Swaziland (hereinafter referred to as "GOS"), the Government of Japan has decided to conduct the Study on Digital Mapping Project for the Smooth Implementation of the Development Plan in Swaziland (hereinafter referred to as "the Study") in accordance with relevant laws and regulations in force in Japan.

Accordingly, the Japan International Cooperation Agency (hereinafter referred to as "JICA"), the official agency responsible for the implementation of the technical cooperation programmes of the Government of Japan, will undertake the Study in close cooperation with the authorities concerned of GOS.

The present document sets forth the scope of work with regard to the Study.

II. OBJECTIVES OF THE STUDY

The objectives of the Study are:

1.   to prepare digital orthophoto maps covering the whole country (17,363km2) at the scale of 1:10,000, which shall be used as base maps for the smooth implementation of the Development Plan in Swaziland; and

2.   to pursue technology transfer in the course of implementation of the Study.

III. STUDY AREA

The Study area shall cover the whole country of Swaziland.

IV. SCOPE OF THE STUDY

In order to achieve the objectives mentioned above, the Study shall cover the following items.

1. Acquisition of Aerial Photographs
    1:30,000 black and white aerial photos covering the Study area shall be taken.
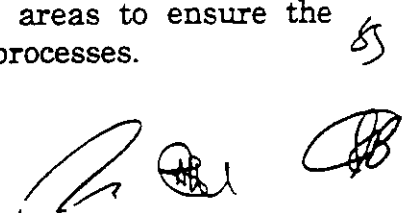
2. Photogrammetric Process
    Photogrammetric process shall be conducted throughout the Study by the method of digital photogrammetric systems.

3. Scanning of Aerial Photographs and Inner Orientation
    Scanning of aerial photos with the resolution of about 15 microns and inner orientation shall be conducted.

4. Division of the Study Area into Block Areas
    The Study area shall be divided into several bloc areas to ensure the accuracy of products and smooth conduct of the following processes.

5. Ground Control Point Survey and Pricking

   Ground control point survey and pricking shall be carried out in cooperation with the Swazi side. The results shall be incorporated into digital photogrammetric systems.

6. Field Identification

   Topographic information shall be mainly identified with aerial photos and existing maps. The field identification shall be conducted in case that the information be proved difficult to be interpreted on the photos. Administrative boundaries, geographical names and cadastral data shall be provided by counterpart personnel.

7. Aerial Triangulation

   Aerial triangulation shall be processed by using batch processing as much as possible.

8. Generation of Digital Terrain Models and Orthophoto Processing

   The generation of digital terrain models (DTM), the orthophoto processing and the generation of contour lines shall be performed by using batch processing as much as possible. The contour intervals shall be 10 m in general and 5 m in flatter areas.

9. Digital Plotting

   Digital plotting shall be conducted. Only major items such as trunk roads and rivers shall be mapped.

10. Editing and Structurizing of Digital Topographic Data

    Digital topographic data shall be structurized and edited on a draft orthophoto map.

11. Maps and Data Files

    Orthophoto maps with cadastral boundaries and digital orthophoto data files at 1:10,000 shall be produced.

12. Technology Transfer

    Items "5. Ground Control Point Survey and Pricking" and "6. Field Identification" of the Study shall be carried out in the close cooperation with counterpart personnel.

    Technology transfer for the utilization and management of digital orthophoto data shall be implemented, and a seminar for promoting technology transfer shall be held upon the submission of Draft Final Report.

V. STUDY SCHEDULE

The Study will be conducted in accordance with the tentative schedule shown in APPENDIX.

VI. REPORTS AND FINAL PRODUCTS

JICA shall prepare and submit the following reports and final products of the Study in English to GOS.

1. Inception Report
   20 copies   At the beginning of the Study
2. Progress Report 1
   20 copies   In the fourth (4) month from the beginning of the Study
3. Progress Report 2
   20 copies   In the eleventh (11) month from the beginning of the Study
4. Draft Final Report
   20 copies   In the twenty third (23) month from the beginning of the Study
5. Final Report
   25 copies   At the end of the Study
6. Final Products

(1) Negative films of aerial photos	1 set
(2) Contact prints of aerial photos	1 set
(3) 1:10,000 scale negative films of orthophoto maps	2 sets
(4) 1:10,000 scale printed orthophoto maps	10 sets
(5) 1:10,000 scale digital orthophoto data	
- digital orthophoto data files (eg. CD-ROM)	50 sets

VII. UNDERTAKING OF GOS

1. To facilitate smooth conduct of the Study, GOS shall take the following necessary measures:
   (1) to secure the safety of the Study Team;
   (2) to permit the members of the Study Team to enter, leave and sojourn in GOS for the duration of their assignment therein, and exempt them from foreign registration requirements and consular fees;
   (3) to exempt the members of the Study Team from taxes, duties and other charges on equipment, machinery and other materials brought into and out of GOS for the conduct of the Study;
   (4) to exempt the members of the Study Team from income tax and charges of any kind imposed on or in connection with any emoluments or allowances paid to the members of the Study Team for their services in connection with the implementation of the Study;
   (5) to provide necessary facilities to the Study Team for remittance as well as utilization of the funds introduced into GOS from Japan in connection with the implementation of the Study;
   (6) to secure permission for entry into private properties or restricted areas for the implementation of the Study;
   (7) to secure permission to acquire necessary radio frequency for the implementation of the Study;
   (8) to secure permission for the Study Team to take all data and documents

produced in the course of implementing the Study and the copy of existing data and documents including topographic maps, original manuscripts, aerial photos and digital data related to the Study out of GOS to Japan;

(9) to secure necessary permission for aerial photography by foreign registered aircraft for the implementation of the Study;

(10) to obtain the necessary permission from the neighboring Governments for the execution of aerial photography by the Study Team at the area of border line; and

(11) to provide medical services as needed, including air transportation for emergency. Its expenses will be chargeable to members of the Study Team.

2. GOS shall bear claims, if any arises, against the members of the Study Team resulting from, occurring in the course of, or otherwise connected with, the discharge of their duties in the implementation of the Study, except when such claims arise from gross negligence or willful misconduct on the part of the members of the Study Team.

3. The Surveyor General's Department of the Ministry of Natural Resources and Energy (hereinafter referred to as "SGD") shall act as a counterpart agency to the Study Team and also as a coordinating body in relation with other governmental and non-governmental organizations concerned for the smooth implementation of the Study.

4. SGD shall, at its own expense, provide the Study Team with the following, in cooperation with other organizations concerned:
(1) available data and information related to the Study,
(2) counterpart personnel,
(3) suitable office space with necessary equipment in Mbabane,
(4) credentials or identification cards, and
(5) appropriate number of vehicles with drivers.

VIII. UNDERTAKING OF JICA

For the implementation of the Study, JICA shall take the following measures:

1. to dispatch, at its own expense, the Study Team to Swaziland; and

2. to pursue technology transfer to the Swazi counterpart personnel in the course of the Study.

IX. CONSULTATION

JICA and SGD shall consult with each other in respect of any matter that may arise from or in connection with the Study.

APPENDIX

TENTATIVE STUDY SCHEDULE

MONTH	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Work in Swaziland																									
Work in Japan																									
Reports & Final Products	IC/R			△ PR/R 1							△ PR/R 2												△ DF/R	△ F/R, F/P	

IC/R: Inception Report
PR/R: Progress Report
DF/R: Draft Final Report
F/R: Final Report
F/P: Final Products of Digital Orthophoto Mapping

APPENDIX 6
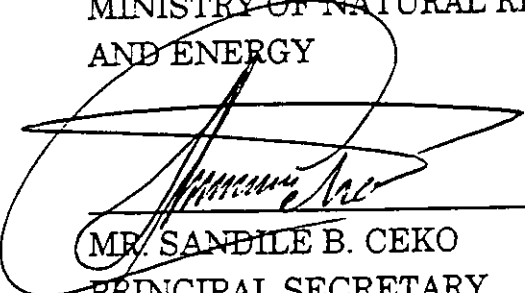
MINUTES OF MEETING ON THE SCOPE OF WORK
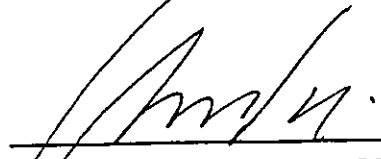
27 JANUARY 1999
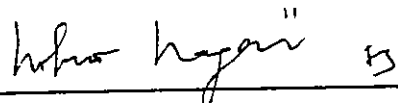
MINUTES OF MEETING

ON

SCOPE OF WORK

FOR

THE STUDY ON DIGITAL MAPPING PROJECT

'FOR

THE SMOOTH IMPLEMENTATION OF THE DEVELOPMENT PLAN

IN

SWAZILAND

AGREED UPON BETWEEN

THE SURVEYOR GENERAL'S DEPARTMENT

OF

THE MINISTRY OF NATURAL RESOURCES AND ENERGY

AND

THE JAPAN INTERNATIONAL COOPERATION AGENCY

MBABANE, JANUARY 27, 1999

MR. ALBERT B. N. MHLANGA
SURVEYOR GENERAL
MINISTRY OF NATURAL RESOURCES
AND ENERGY

MR. SANDILE B. CEKO
PRINCIPAL SECRETARY
MINISTRY OF NATURAL RESOURCES
AND ENERGY

MR. EPHRAIM M. HLOPHE
PRINCIPAL SECRETARY
MINISTRY OF ECONOMIC PLANNING
AND DEVELOPMENT

MR. NOBUO NAGAI
LEADER
PREPARATORY STUDY TEAM
JAPAN INTERNATIONAL
COOPERATION AGENCY

In response to the request of the Government of Swaziland (hereinafter referred to as "GOS"), the Government of Japan dispatched the Preparatory Study Team (hereinafter referred to as "the Team") organized by the Japan International Cooperation Agency (hereinafter referred to as "JICA"), headed by Mr. Nobuo NAGAI, to Swaziland from 13 to 28 January, 1999, to conduct the preparatory study for the Study on the Digital Mapping Project for the Smooth Implementation of the Development Plan in Swaziland (hereinafter referred to as "the Study").

The Team held a series of discussions on the Scope of Work with the officials of the Surveyor General's Department of Ministry of Natural Resources and Energy (hereinafter referred to as "SGD") and other organizations concerned. The list of attendance is shown in Appendix 1.

The main points confirmed between both sides are as follows:

1. Title of the Study
    Both sides agreed that the title of the Study shall be "The Study on Digital Mapping Project for the Smooth Implementation of the Development Plan in Swaziland".

2. Aerial Photography
    Both sides agreed that in case the aerial photography is not completed during the study period due to unfavorable weather conditions or other reasons, both sides will consult with each other to seek possible solutions.

3. Cadastral Data
    SGD explained that the orthophoto data shall contain the existing cadastral data and necessary data conversion shall be conducted by SGD in the course of the technology transfer of the Study. The Team agreed.
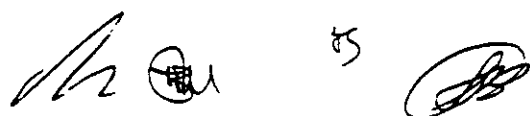
4. Geodetic Reference System
    Both sides agreed that the current geodetic reference system shall be applied in the course of the Study.

5. Transfer of the Study Equipment
    SGD requested the transfer of the relevant study equipment after the completion of the Study to expand and reinforce the organization's capacity. The Team responded that the JICA Headquarters will examine the SGD's request shown in Appendix 2.

6. Information Disclosure
    Both sides agreed that the orthophoto maps and digital data produced

through the course of the Study shall be widely disclosed to the public.

7. Undertaking of GOS

SGD explained that the undertaking of GOS shall be secured, except for the provision of vehicles with drivers because SGD is suffering the fiscal shortage, and they hoped JICA will shoulder the cost. The Team replied that they will convey it to the JICA Headquarters, however, the procurement procedure will require the comparison of the costs between rental and purchasing cases.

8. Undertaking of JICA

SGD requested that counterpart personnel shall take the opportunity of training in Japan related to the Study. The Team promised to convey it to the JICA Headquarters.

Appendix 1

The List of Attendance

1. Swazi side

   Mr. Albert B. N. MHLANGA   Surveyor General, SGD
   Mr. Leanard S. MDLULI   Assistant Surveyor General, SGD
   Mr. Esau S. DLAMINI   Assistant Surveyor General, SGD
   Mr. Sydney B. SIMELANE   Assistant Surveyor General, SGD

2. Japanese side

   Mr. Nobuo NAGAI   Leader, Preparatory Study Team
   Mr. Koichi KITO   Study Planning, Preparatory Study Team
   Mr. Sotoshi NAKADA   Precision Management Planning, Preparatory Study Team
   Mr. Yoshitake EGAWA   Basic Mapping Planning/Technology Transfer Planning, Preparatory Study Team
   Mr. Hisashi MORI   Study Implementation Planning, Preparatory Study Team

Appendix 2

SURVEYOR GENERAL'S DEPARTMENT

EQUIPMENT REQUEST TO JICA

ITEMS	QUANTITY	COMMENTS
1. GPS Recievers	1 Set (2 units)	Currently SGD has 1 set Leica Recievers. The set requested will supplement the existing set and the mapping project., but it be nice to get an additional set to facilitate easy technological transfer.
2. (i) Arc View or Micro-Station Geographics software.	2 licenses	To develop GIS capability of SGD. The Japanese Team in conjunction with SGD would evaluate the choice between the two packages.
(ii) Computers (PC's) Specification: • Pentium II 300 MHz or better. • 128 MB RAM • 6.5 GB Hard Disk • 2MB VGA Card • 512 K Cache Memory • 3Com Network Card	2	They will be used for the digital orthophoto maps and the GIS.
3. Orthophoto Storage Cabinets	2 units	These would safely store the new 1:10,000 Scale orthophoto maps
4. Inkjet Plotters (600 dpi)	2	These would assist customer demands, as the new orthophoto maps will be very popular, and the department would like to serve the public efficiently.
5. Large Ammonia Printer	1	For reproducing orthophoto maps from transparencies to paper copies

APPENDIX 7

MINUTES OF MEETING ON THE INCEPTION REPORT

12 JULY 1999

MINUTES OF MEETING
FOR

THE STUDY ON DIGITAL MAPPING PROJECT
FOR THE SMOOTH IMPLEMENTATION OF THE
DEVELOPMENT PLAN IN SWAZILAND
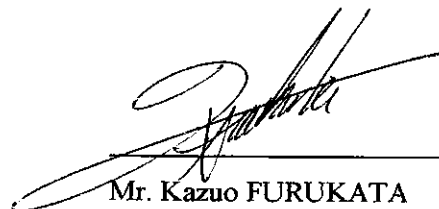
AGREED UPON BETWEEN

THE SURVEYOR GENERAL'S DEPARTMENT
OF
THE MINISTRY OF NATURAL RESOURCES AND ENERGY
AND
JAPAN INTERNATIONAL COOPERATION AGENCY

MBABANE, 12 JULY 1999

_____
Mr. Albert B. N. MHLANGA
Surveyor General
Surveyor General's Department
Ministry of Natural Resources and Energy

_____
Mr. Kazuo FURUKATA
Leader
JICA Study Team
Japan International Cooperation Agency

Japan International Cooperation Agency Study Team for the "The Study on the Digital Mapping Project for the Smooth Implementation of the Development Plan in Swaziland" (hereinafter referred to as "JICA Study Team"), and the Surveyor General's Department (hereinafter referred to as "SGD") held a meeting concerning the Inception Report on "The Study on the Digital Mapping Project for the Smooth Implementation of the Development Plan in Swaziland" on the 9th day of July 1999. The meeting took place at SGD office in a friendly atmosphere. The members who attended the meeting are listed in Appendix-1.

As a whole, SGD agreed on the Inception Report prepared by JICA Study Team. However, SGD submitted a request as per attached sheet, and JICA Study Team promised to convey this request to the JICA headquarter.

APPENDIX-1

LIST OF ATTENDANTS

Swazi Side:

Mr. Albert B. N. MHLANGA	Surveyor General
Mr. Sipho MDLULI	Assistant Surveyor General
Mr. Esau S. DLAMINI	Assistant Surveyor General
Mr. Sydney SIMELANE	Assistant Surveyor General

Japanese Side:

Mr. Kazuo FURUKATA	Leader of JICA Study Team
Mr. Masami SUGITA	System chief engineer
Mr. Kazutoshi MASUDA	GIS engineer
Ms. Odile GAYON	Coordinator

Observer

Mr. Hiroshi TAKANOHASHI	JICA
Mr. Yoshitake EGAWA	Technical Advisor, JICA

APPENDIX 8

MODIFICATION REQUEST

9 JULY 1999

SURVEYOR GENERAL'S DEPARTMENT
LAND SURVEYING & MAPPING

Ministry of Natural Resources and Energy
P.O. Box 58,
MBABANE, SWAZILAND
Tel: (09268) 42321   Fax: (09268) 49357

Our Ref: S.G.54

9th July, 1999

Mr. Yukihisa SAKURADA
Managing Director
Social Development Study Department
Japan International Cooperation Agency
Tokyo, JAPAN

RE: REQUEST IN RELATION TO THE STUDY ON THE DIGITAL MAPPING PROJECT

Dear Sir

I am aware that the department will be going through the Inception Report for the "Study on the Digital Mapping Project for the Smooth Implementation of the Development Plan in Swaziland" with the JICA study team. However, we have now and again been debating on the final products and requested equipment as stated in the Scope of Work agreed in January 1999.

It would be very helpful and we shall be most grateful if you could accept the following items:-

1.   Printed maps

   We feel that the best quality up-to-date printed maps would be absolutely useful and would meet the user's needs with satisfaction. Therefore we would like to request an increase to 100 sheets which would enable the department to adequately supply immediately all the Government Ministries and other users.

2.   CD.ROM

   We have been thinking about the supply of 50 sets of CD-ROMs and we would like JICA to reconsider this supply. We feel that we would not need at this stage so many CD-ROMs but printed maps. Therefore the supply of 5 sets would be considered adequate.

3.   Aerial photographs

   We would request JICA to consider supplying the department with one (1) set immediately once the aerial photography has been processed, instead of at the end of the study. Such new photographs would enhance the work of not only

the department but also other organisations in many of its projects, e.g. disputes, cadastral, land use planning, forestry, etc.

4. GPS Equipment

We understand the concern about the use of the GPS equipment before the end of the project. However the GPS equipment would very much help the Department to clear a heavy backlog on Cadastral Surveys. The Department is always under pressure from the Ministry of Housing and Urban Development to survey various townships and the use of such equipment would enable the department to cover a lot of ground before the JICA study Team returns to Swaziland in July/August 2000.

We also understand that the department will have to be fully responsible for the equipment's safety, and we will do our utmost best to operate and maintain the equipment carefully. Thus we request for the use of this GPS equipment during the period when the JICA study team is in Japan.

We trust you will give the above your favourable consideration.

Yours faithfully

Albert B.N. Mhlanga
Surveyor General

APPENDIX 9

TENTATIVE SPECIFICATIONS OF THE ORTHOPHOTO MAPPING

SEPTEMBER 1999

SURVEYOR
GENERAL'S
DEPARTMENT
LAND SURVEYING & MAPPING
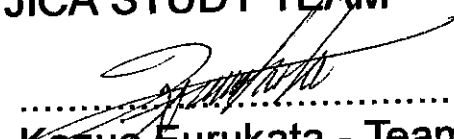
THE STUDY ON DIGITAL MAPPING PROJECT FOR THE SMOOTH IMPLEMENTATION OF THE DEVELOPMENT PLAN IN SWAZILAND

TECHNICAL SPECIFICATIONS OF THE PROJECT AGREED BETWEEN THE JICA STUDY TEAM AND THE SURVEYOR GENERAL'S DEPARTMENT

Mbabane, Swaziland   September 1999

JICA STUDY TEAM

....
Kazuo Furukata - Team Leader

SURVEYOR GENERAL'S DEPARTMENT

....
Albert B. N. Mhlanga - Surveyor General

SPECIFICATION FOR 1:10,000 ORTHOPHOTO MAPS

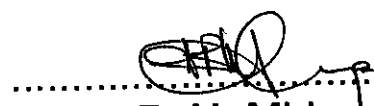| FEATURE NAME	LEVEL	FONTS	CASE	POINT SIZE	COMMENTS
BOUNDARIES					
INTERNATIONAL BOUNDARY					from cadastral
REGIONAL BOUNDARY					from cadastral
URBAN BOUNDARY					from cadastral
GAME RESERVSE BOUNDARY					from cadastral
CADASTRAL TEXT					
FARM NUMBER ≥ 50 ha		UNIVERS		30	from cadastral
FARM NUMBER < 50 ha		UNIVERS		15	from cadastral
PLACE/FEATURE NAME					
TOWN NAME	22	UNIVERS	U/C	50	from MicroStation
FOREST NAME	16	UNIVERS	U/C	30	from MicroStation
PLACE NAME	18	UNIVERS	U/C	30	from MicroStation
AREA NAME	20	UNIVERS	U/C	30	from MicroStation
HILL NAME	24	UNIVERS	U/C	30	from MicroStation
MOUNTAIN / RANGE NAME	26	UNIVERS	U/C	30	from MicroStation
TOWNSHIP NAME	46	UNIVERS	U/C	30	from MicroStation
GAME RESERVE NAME	42	UNIVERS	U/C	30	from MicroStation
RAILWAY STATION	28	UNIVERS	U/L/C	25	from MicroStation
RIVER NAME	30	UNIVERS	U/L/C	25	from MicroStation
SCHOOL NAME	32	UNIVERS	U/L/C	25	from MicroStation
GOLF COURSE	21	UNIVERS	U/L/C	25	from MicroStation
SPORT FIELDS	23	UNIVERS	U/L/C	25	from MicroStation
DIPPING TANK NAME	38	UNIVERS	U/L/C	25	from MicroStation
TRIG NAME	40	UNIVERS	U/L/C	25	from MicroStation
DAM NAME	44	UNIVERS	U/L/C	25	from MicroStation
POWER STATION	61	UNIVERS	U/L/C	25	from MicroStation
FIRE LOOKOUT POST	62	UNIVERS	U/L/C	25	from MicroStation
SPOT HEIGHT		UNIVERS	U/L/C	15	from DTM
INDEX CONTOUR VALUE		UNIVERS		15	from DTM
BOUNDARY PILLAR	52	UNIVERS	U/L/C	25	from GPS
PUBLIC PLACES					
HOSPITAL	13	UNIVERS	U/L/C	25	from MicroStation
HEALTH CENTRE	17	UNIVERS	U/L/C	25	from MicroStation
CLINICS	15	UNIVERS	U/L/C	25	from MicroStation
CHURCH	54	UNIVERS	U/L/C	25	from MicroStation
POST OFFICE	55	UNIVERS	U/L/C	25	from MicroStation
POLICE STATION	56	UNIVERS	U/L/C	25	from MicroStation
STORE	57	UNIVERS	U/L/C	25	from MicroStation
HOTEL	58	UNIVERS	U/L/C	25	from MicroStation
TRANSMISSION STATION	59	UNIVERS	U/L/C	25	from MicroStation
MINERAL WORKS	60	UNIVERS	U/L/C	25	from MicroStation
AIRPORT	48	UNIVERS	U/L/C	25	from MicroStation
AIRSTRIP	50	UNIVERS	U/L/C	25	from MicroStation
R.D.A.	63	UNIVERS	U/L/C	25	from MicroStation
INKHUNDLA	51	UNIVERS	U/L/C	25	from MicroStation
INSTITUTION	12	UNIVERS	U/L/C	25	from MicroStation

MARGINAL INFORMATION					
DESTINATION	36	UNIVERS	U/L/C	25	from MicroStation
GRID	39	UNIVERS			from Kokusai Kogyo co.
SHEET NAME	41	UNIVERS	U/C	100	from Excel list
MAP SCALE	43	UNIVERS		50	1:10,000
SHEET NUMBER	45	UNIVERS		50	from Excel list
SHEET INDEX	47	UNIVERS			from Kokusai Kogyo co.
JICA note					from Kokusai Kogyo co.
HISTORY					from Kokusai Kogyo co.
SGD note					from SGD

Technical note

1. Cadastral Data base

  1-1 Printing data

   · SGD shall prepare all data (divided into 4 regions) by CD-ROM or FD,
     except urban areas.

   · Two (2) types of fonts shall be used as ID number for each parcel on the
     maps (15 point < 50 ha < 30 point).

   · River lines on the cadastral data shall not be indicated on the ortho photo
     maps.

  1-2 GIS data

   · All necessary data shall be prepared by SGD, after conversion and error
     correction to appropriate GIS formats from original existing "UNIGIS" data
     base.

   · GIS data base shall be established by joint technical cooperation between
     JICA Study Team and SGD.

2. Map Production (Ortho photo map)

  2-1 Annotation data

   · Specification for 10,000 Ortho photo maps prepared by SGD, agreed upon
     between JICA Study Team and SGD as attached hereby.

   · Every annotation data shall be prepared on CAD data, and the text files or
     spread sheets such as Excel files by SGD, based on the Specification
     mentioned above.

   · Every annotations and the numbers such as spot heights shall be indicated
     by black color on the maps.

   · Marginal information such as the JICA note, photography dates, mapping
     process, and the cadastral details, shall be indicated on the maps.

   · Grid lines shall not be indicated on the maps.

  2-2 Topographic features

   · Topographic features such as roads, rivers, and lakes will be plotted on the
     course of the mapping works, shall be utilized for GIS analysis, not be
     indicated on the maps.

   · The line data such as the contour and the cadastral detail shall be indicated

by black color on the maps

2-3 Sheet index & Sheet names
- Sheet index map shall be prepared by SGD, based on the existing 1:50,000 topographic maps.
- Each sheet names shall be decided and adopted into sheet index map, mentioned above by SGD.
- Both of the data shall be provided to JICA Study Team by FD.

2-4 Control point data
- Only existing Trig. Points shall be indicated on the ortho photo maps.
- Data of the Trig. Points shall be provided to JICA Study Team by FD.

3. Photo Control Survey
3-1 Datum
- National coordinates system : Lo = 31 system
- Spheroid : Clark 1886
- Elevations : based on the B.M. (National elevation system = Mean sea level)

3-2 Implementation
- Photo control survey shall be carried out by the technical cooperation composed four(4) groups, using the two (2) GPS belonging to SGD, and the other two (2) GPS provided by JICA.
- Necessary materials shall be prepared by SGD for the establishment of the monument as well as Control points and/or Bench marks.

3-3 Post processing of the captured data and the network adjustment
- GPS data shall be analyzed and adjusted as photo control points, based on the existing coordinate system, cooperated with both sides on the technical transfer program, using of the latest software provided by JICA.

APPENDIX 10

AGREEMENT ON UTILIZATION OF GPS EQUIPMENT AND AERIAL PHOTOGRAPHY

13 SEPTEMBER 1999

SURVEYOR
GENERAL'S
DEPARTMENT
LAND SURVEYING & MAPPING

Ministry of Natural Resources and Energy
P.O. Box 4700, MBABANE, SWAZILAND

Tel: (+268) 404 2321 Fax: (+268) 404 9357
Email: sgd@realnet.co.sz

THE STUDY ON DIGITAL MAPPING PROJECT FOR THE SMOOTH IMPLEMENTATION OF THE DEVELOPMENT PLAN IN SWAZILAND

AGREEMENT BETWEEN THE SURVEYOR GENERAL'S DEPARTMENT AND THE JICA STUDY TEAM

ON

UTILIZATION OF THE GPS EQUIPMENT AND AERIAL PHOTOGRAPHY

The Surveyor General's Department, having requested the utilization of the GPS receivers from JICA during the Orthophoto Mapping phases in Japan, undertakes:-

1. To store the GPS equipment in a secure office in the Department's building.

2. To assume full responsibility of the equipment during the absence of the JICA Study Team in Swaziland.

3. In case of Mechanical problems, the department will be responsible for any repairs.

4. To return the GPS to the JICA Study Team at a time of commencement for the Second Year's field survey.

The execution of the photo control surveys has provided good on-the-job training for SGD surveyors, to fully utilize the GPS for SGD's cadastral surveys during the period mentioned above.

Two (2) Sets Aerial Photography Prints

The department has further requested JICA to allow the department to keep two (2) sets of contact prints of aerial photography. This is to allow the department to effectively utilize this latest information of photography for the Development Plan in Swaziland, for example the Usutu River Basin Study, the Maguga Dam Project, to name a few.

The department undertakes to store the photography safely in its map-storage room and to effectively utilize this photography for various applications.

Signed on this 13th Day of September 1999
At the Surveyor General's Department, Mbabane.

For Surveyor General's Department

Albert B.N. Mhlanga
Surveyor General

For JICA Study Team

Kazuo Furukata
Team Leader

Description of the Equipments for the field survey provided by JICA

1. GPS Receiver

[Reference setup]

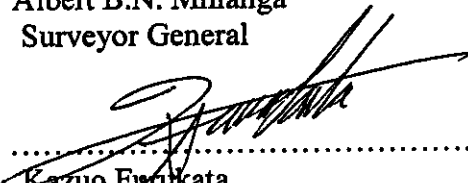| No.	Code	Description	Quantity
1	667122	SR 520 Dual–frequency GPS Geodetic Sensor	1
2	667126	AT 502 Dual–frequency external antenna with 5/8″ thread adopter for connecting SR 530/520/510	1
3	636959	2.8m antenna cable	1
4	667127	TR 500 Data Terminal for starting and collecting information with SR 520	1
5	636984	GKL 23 battery charger	1
6	667211	PCMCIA 4Mbyte Flash–Ram card	1
7	667136	Container for GPS Sensor, Data Terminal, Plug in Batteries, Cablee & Accessories	1
8	667194	Manual for using GPS	1
9	563630L	Local light weight alminium tripod	1
10	667308	GDF 112 Basic Tribrach with optical plummet	1
11	667216	GRT 145Carrier with 5/8″ thread	1
12	409667	GEB 71 Large battery 12V/7AH	1
13	560130	1.8m Cable connects TR 500 to SR 510,/520/ 530	1

[Rover setup]

No.	Code	Description	Quantity
1	667122	SR 520 Dual–frequency GPS Geodetic Sensor	1
2	667126	AT 502 Dual–frequency external antenna with 5/8″ thread adopter for connecting SR 530/520/510 External antenna AT 201	1
3	667127	TR 500 Data Terminal for starting and collecting information with SR 520	1
4	667200	1.2m antenna cable	1
5	667201	1.6m extension for antenna cable	1
6	560130	1.8m cable connects TR 500 to SR 510/520/530	1
7	667123	GEB 121 plug in battery NiMH, 6V 3.6AH	3
8	667124	Extension plate GD 121 for GKL 121	1
9	667211	PCMCIA 4Mbyte Flash–Ram card	1
10	667223	Grip with circular bubble & fixing element	1
11	667221	Bottom section of aluminium pole with steel tip	1
12	667222	Top section of aluminium pole with 5/8″ thread	1
13	667138	Holder for TR 500 on pole	1
14	667137	Minipac, holds Sensor, batteries and cables	1
15	667228	Telescopic rod with 5/8″ thread, fits Minipac	1
16	5100100	Rost rod pole support	1
17	563630L	Local light weight alminium tripod	1

[Post processing software]

No.	Code	Description	Quantity
1	667245	SKI–PRO software on CD, English version	1
2	667250	L1 + L2 data processing protected option	1
3	667251	Datum & Map transformation protected option	1
4	667256	SKI–PRO License with 1 Dongle + Download cable	1
5	667253	Design & Network protected option	1

2. Lap–top PC

No.	Code	Description	Qantity
1		AUWA Laptop PC (Pentium 2, 333MHz)	2
2		Power supply cable	2
3		Windows 98	2
4		Carry bag	2

APPENDIX 11

MINUTES OF MEETING ON THE PROGRESS REPORT

10 AUGUST 2000

MINUTES OF MEETING

FOR

THE STUDY ON DIGITAL MAPPING PROJECT FOR THE SMOOTH IMPLEMENTATION OF THE DEVELOPMENT PLAN IN SWAZILAND

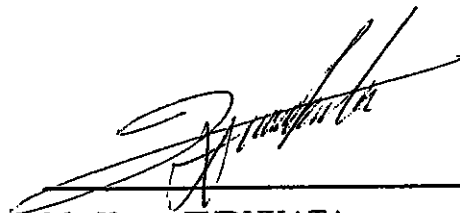### AGREED UPON BETWEEN

THE SURVEYOR GENERAL'S DEPARTMENT OF THE MINISTRY OF NATURAL RESOURCES AND ENERGY AND JAPAN INTERNATIONAL COOPERATION AGENCY

MBABANE, 10 AUGUST 2000

Mr. Albert B. N. MHLANGA

Surveyor General

Surveyor General's Department

Ministry of Natural Resources and Energy

Mr. Kazuo FURUKATA

Leader

JICA Study Team

Japan International Cooperation Agency

Previous to commencement of the 2nd phase field survey for "The Study on Digital Mapping Project for the Smooth Implementation of the Development Plan in Swaziland", the Study Team dispatched by the Japan International Cooperation Agency (hereinafter referred to as "JICA") and the officials of the Surveyor General's Department of the Ministry of Natural Resources and Energy (hereinafter referred to "SGD") carried out the series of discussions concerning the Progress Report and the Technical Items for the field survey from 7th to 10th August 2000. The list of attendance is shown in Appendix-1.

As a whole, SGD agreed on the Progress Report prepared by JICA Study Team. However, SGD submitted a request letter concerning to modification of the numbers of the final products that are mentioned on the Scope Of Work, as per attached sheet, and JICA Study Team promised to convey this request to the JICA headquarter.

Regarding the Technical Items, renewal Specification and the Categorisation Plan for the annotation database provided by JICA Study Team based on the SGD's original Specification has been discussed at these meeting, and agreed upon between both side after the partial amendment of the method.

APPENDIX-1

LIST OF ATTENDANTS

Swaziland Side:

Mr. Albert B. N. MHLANGA	Surveyor General
Mr. Leonard S. MDLULI	Assistant Surveyor General
Mr. Esau S. DLAMINI	Assistant Surveyor General
Mr. Sydney B. SIMELANE	Assistant Surveyor General

Japanese Side:

Mr. Kazuo FURUKATA	Leader of JICA Study Team
Mr. Masami SUGITA	System Design 1 (Hardware configuration)
Mr. Kazutoshi MASUDA	System Design 2 (GIS)
Mr. Satoru NISHIO	Survey Supervisor 1 (Map editing)
Mr. Morten STRAND	Survey Supervisor 2
Mr. Daisaku KIYOTA	Digital Map Data Editing
Mr. Masahiko TAKAHASHI	Coordinator

Observer

Mr. Hisashi MORI	Technical Advisor, JICA

APPENDIX 12

MODIFICATION REQUEST OF THE FINAL PRODUCTS

9 AUGUST 2000

SURVEYOR
GENERAL'S
DEPARTMENT
LAND SURVEYING & MAPPING

Ministry of Natural Resources and Energy
P.O. Box 4700, MBABANE, SWAZILAND

Tel: (+268) 404 2321 Fax: (+268) 404 9357
Email: sgd@realnet.co.sz

Our Ref: SG. 54

9th August, 2000

Mr. Takanori Jibiki
Managing Director
Social Development Study Department
Japan International Cooperation Agency
TOKYO, Japan

Dear Sir,

THE STUDY ON DIGITAL MAPPING PROJECT FOR THE SMOOTH
IMPLEMENTATION OF THE DEVELOPMENT PLAN IN SWAZILAND

RE: REQUEST IN RELATION TO THE STUDY
ON THE DIGITAL MAPPING PROJECT

With Reference to the department's request dated 9th July 1999, and being aware of the
final products to be handed over to our department, as stated in the Scope of work agreed
in January 1999, I would like to re-submit our request and would be grateful if you could
accept the following:-

1. Printed Maps.

We would like you to consider increasing the supply of the printed orthophoto maps
from 10 sets to 100 sets. Having inspected the proof copies of the printed maps provided
by the JICA Study Team during this second phase in Swaziland, we are quite amazed by
the top quality of these maps, that ten (10) sets would be consumed within one (1) month
of delivery. Furthermore, the Swaziland Government has initiated new several projects
entitled 'Millenium Projects which will include amusement parks, new international
airport to name a few. These printed maps could not have come at a better time and
would facilitate in these projects, to help in the re-settlement schemes. Already orders
have been received from current ongoing projects, namely the Komati (Maguga) Dam
Project; these maps are needed for the planning of large irrigation schemes. The Ministry
of Agriculture and the Ministry of Natural Resources and Energy (particularly the Rural
Water Department and Energy Section), are all queuing up for these maps.

I have no doubt that there would be a scramble for these maps on the first day of delivery,
that we would not be able to supply, and that is why we sincerely request for the supply
of 100 sets of these printed orthophoto maps.

2/..............................

2.   CD - ROM

We would like to re-submit that JICA could reconsider the supply of 50sets CD-ROMs. Our main emphasis would be to sell printed maps more especially at the initial stages after the delivery. At this stage therefore we feel five (5) sets of CD-ROMs would be considered adequate.

I would like to thank JICA for allowing the department to use the GPS equipment during the last year when the JICA Study Team was in Japan. This equipment has indeed helped the department to execute the backlog of cadastral surveys much quicker, and the department will continue to look after this equipment as per the agreement signed in September 1999.

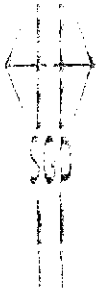We trust you will give the above your favourable consideration

Yours faithfully

Albert B.N. Mhlanga
Surveyor General

APPENDIX 13

ACKNOWLEDGEMENT RECEIPT OF THE NEGATIVE FILMS AND PC WITH GIS SOFTWARE

10 AUGUST 2000

SURVEYOR
GENERAL S
DEPARTMENT
LAND SURVEYING & MAPPING

Ministry of Natural Resources and Energy
P.O. Box 4700 MBABANE SWAZILAND

Tel: (+268) 404 2391 Fax (+268) 404 9357
Email: sg@iafrica.co.sz

THE STUDY ON DIGITAL MAPPING PROJECT FOR THE SMOOTH IMPLEMENTATION OF THE DEVELOPMENT PLAN IN SWAZILAND

ACKNOWLEDGEMENT RECEIPT OF THE AERIAL PHOTOGRAPHY NEGATIVE FILMS AND THE DESKTOP COMPUTER WITH SOFTWARE

The Surveyor General's Department hereby acknowledges the receipt from JICA;

1.   The aerial photography negative films as per our request dated 14 February 2000.

The department is very grateful to JICA for these negative films as it will now be in a position to supply photographic prints to various project initiatives.

The department undertakes to store securely these negatives films, and to release them to the JICA Study Team if and when required before the finalization of the project.

2.   The Desktop computer with software.

The department is further grateful to JICA for the desktop computer with software as handed by the JICA Study Team during the phase 2 programme in Swaziland. The department undertakes:

(i)   to assume full responsibility of this equipment during the absence of the JICA Study Team in Swaziland.

(ii)   to ensure that the office on which it is kept and used, is secure at all times

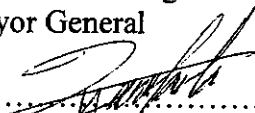(iii)   to be responsible for any repairs in case of mechanical problems.

These items were handed to the Surveyor General's Department by the JICA Study Team.

Signed on this 10th Day of August 2000.

For Surveyor General's Department   ....

Albert B.N. Mhlanga
Surveyor General

For JICA Study Team   ....

Kazuo Furukata
Team Leader

APPENDIX 14

AGREEMENT
FOR THE SPECIFICATIONS OF
THE ORTHOPHOTO MAPPING

SEPTEMBER 2000

THE STUDY ON DIGITAL MAPPING PROJECT FOR THE SMOOTH IMPLEMENTATION OF THE DEVELOPMENT PLAN IN SWAZILAND

TECHNICAL SPECIFICATIONS OF THE PROJECT AGREED BETWEEN THE JICA STUDY TEAM AND THE SURVEYOR GENERAL'S DEPARTMENT
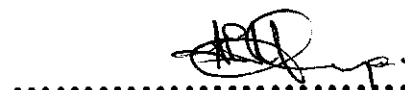
MBABANE, SWAZILAND   *SEPTEMBER 2000*

JICA STUDY TEAM

....
KAZUO FURUKATA – TEAM LEADER

SURVEYOR GENERAL'S DEPARTMENT

....
ALBERT B.N. MHLANGA – SURVEYOR GENERAL

In order to achieve the objectives mentioned on the Scope of Work for "The Study on Digital Mapping Project for the Smooth Implementation of the Development Plan in Swaziland", the Surveyor General's Department and the JICA Study Team held a series of meetings within a period of the 2nd phase field survey, for discussion and consulting each other in every respects of the technical items.

The results of the meetings are as follows.

1. Specification for the Orthophoto Mapping

   Both sides agreed on the Specification on which to base the production of the orthophoto mapping, that is being prepared by the JICA Study Team. This specification is based on the original SGD orthophoto mapping Specification with some amendment.

   Refer to an attached Specification.

2. Marginal Information

   2-1 Sheet Index Diagram

   Sheet Index Diagram shall indicate all the adjoining sheets numbers, even if they fall outside the country.

   2-2 Publishing

   A phrase of "Copyright" shall be replaced by : "Published by the Surveyor General's Department" at the bottom-left of the maps.

3. Map Sheet Name

   All of the map sheet names shall be adopted as prepared and presented by SGD.

4. Annotation data

   As a result of the undertaking of SGD, required annotation data shall be furnished to the JICA Study Team by CD-R after the revision and additional works, based on the Specification mentioned above.

   This annotation data shall be indicated on each Orthophoto Map.

5. Cadastral data

   All the cadastral data such as lines and ID numbers which has been revised and confirmed by SGD as a final data, shall be indicated on each

Orthophoto Map, based on the printed sheets prepared by JICA Study Team.

6. Consultation

SGD and JICA Study Team shall consult each other by the E-mail and/or Fax, in respect of any interrogative items arising.

APPENDIX 15

MINUTES OF MEETING ON THE DRAFT FINAL REPORT

JULY 2001

**SURVEYOR
GENERAL'S
DEPARTMENT
LAND SURVEYING & MAPPING**

MINUTES OF MEETING
FOR
THE DRAFT FINAL REPORT
OF
THE STUDY
ON
THE DIGITAL MAPPING PROJECT
FOR
THE SMOOTH IMPLEMENTATION OF THE DEVELOPMENT PLAN
IN
SWAZILAND

SURVEYOR GENERAL'S DEPARTMENT (SGD)
OF
THE MINISTRY OF NATURAL RESOURCES AND ENERGY

AND

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

MBABANE

JULY 4, 2001

Mr. Albert B. N. MHLANGA	*Mr. Kazuo FURUKATA*
Surveyor General	Leader
Surveyor General's Department (SGD)	JICA Study Team
Ministry of Natural Resources and Energy	Japan International Cooperation Agency (JICA)

Japan International Cooperation Agency (hereinafter referred to as "JICA") dispatched the Study Team to Swaziland for the implementation of the 3rd phase of the Study on Digital Mapping Project for the Smooth Implementation of the Development Plan in Swaziland (hereinafter referred to as "the Study") from June 27, 2001, in compliance with the Scope of Work for the Study, which was agreed upon by the Surveyor General's Department (hereinafter referred to as "SGD"), Ministry of Natural Resources and Energy and JICA on January 27, 1999.

At the beginning of the 3rd phase of the Study, the Study Team held a meeting for the presentation and explanation of the Draft Final Report, with the officials of SGD on July 2, 2001.   The attendance list is attached in the Appendix.

A series of discussions concerning the Draft Final Report regarding technical items and the composition of the Report, were carried out.

As a whole, both sides agreed about technical items on the Draft Final Report prepared by Study Team.   However, both sides also agreed that the Final Report should not include Appendix 5 (Coordinates List and the Descriptions of the Photo Control Points) of the Draft Final Report.

Additionally, the attached document was submitted by SGD for possible consideration by JICA regarding further assistance for an "Integrated Nationwide Geographic Information System" based on the Digital Mapping Project.   The Study Team promised to convey it to JICA Headquarters.

APPENDIX

LIST OF ATTENDANTS

<u>Swaziland Side</u>:

Mr. Albert B. N. MHLANGA Surveyor General
Mr. Esau S. DLAMINI Assistant Surveyor General
Mr. Sydney B. SIMELANE Assistant Surveyor General

<u>Japanese Side</u>:

Mr. Kazuo FURUKATA Leader of JICA Study Team
Mr. Kazutoshi MASUDA System Design (GIS)
Mr. Daisaku KIYOTA Digital Map Data Editing
Ms. Chiyo KIGASAWA Coordinator, GIS Presentation

THE MANAGING DIRECTOR
SOCIAL DEVELOPMENT STUDY DEPARTMENT
JAPAN INTERNATIONAL COOPERATION AGENCY
Dear Mr. Takanori JIBIKI

Re : <u>Integrated Nationwide Geographic Information System</u>

4, July 2001

The Surveyor General's Department hereby Commends the JICA Study Team on the excellent presentation of the Draft Final Report. The Surveyor General's Department further appreciates the preparation by the JICA Study Team of the manuals for GPS and GIS which would provide a good reference for future GPS and GIS operations.

The Surveyor General's Department recognizes that Digital Orthophoto Maps form a very good base for GIS and thus requests the JICA Study Team to consider assisting in the establishment of "Integrated Nationwide Geographic Information System" which would facilitate amongst other things policy formulation development and implementation by the Government of Swaziland. Policies under review in Swaziland include poverty alleviation, land and environmental sustainable development and management and the fight against HIV/AIDS.

The Project Proposal on GIS will be submitted by the Government of Swaziland shortly, as the Government of Japan has extensive know-how and has implemented GIS projects in developing countries.

I sincerely hope that JICA will consider the request of the Surveyor General's Department.

Yours sincerely,

Albert B. N. MHLANGA
Surveyor General
Surveyor General's Department
Ministry of Natural Resources and Energy