Eastern Cape Government
GIS Coordinating Unit

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1 The Eastern Cape Government and GIS

The concept of an integrated approach to the management, application and dissemination of spatial (and associated) data within the Eastern Cape has been investigated for some time. The responsibility of ensuring that such an integrated approach is put in place has now fallen to the Office of the Premier.

To succeed, the integrated GIS must be developed in such a way that it effectively supports the *Vision* and *Mission* of the Eastern Cape Government. The following *Vision* and *Mission* have been developed for GIS within the Eastern Cape.

Vision	*That the Provincial Government of the Eastern Cape should use GIS effectively to the benefit of all spheres of government as well asl private stake holders and, thereby, to the benefit of the people it serves…*
Mission	*To improve the utilisation of GIS as a management tool in the Eastern Cape Government Service, thereby enhancing the delivery of services to the people of the Province…*

The main aim of this initiative is then (drawn from the *Vision* and *Mission Statements*) to exploit the possibilities provided by GIS to support the departments of the Eastern Cape Government in their obligation to improve and maintain the services to the people of the Eastern Cape Province.

Provincial GIS Unit

This document reflects several policy issues, which are the following:

1. The Provincial GIS Unit will create an understanding of GIS through the government departments.
2. The Provincial GIS Unit will co-ordinate the use of datasets, but will own none. Ownership will reside with the creators of government data or with the statutory authority if the data is purchased from third parties.
3. The Provincial GIS Unit will assist in sourcing datasets
4. The Provincial GIS Unit will be fully funded, having a budget sufficient to cover all purchases ranging from consumables to information.
5. The Provincial GIS Unit will provide limited assistance to other departments within its capabilities, but will not necessarily provide a full GIS service.
6. The Provincial GIS Unit will strive to secure provincial licences for the data it stores
7. The Provincial GIS Unit will be responsible for the coordination of all GIS activities within the Eastern Cape Province in liaison with the IDC-GIS.
8. The Provincial GIS Unit will be responsible for the coordination and standardization of GIS related training activities within the Eastern Cape Province to ensure that no duplication takes place and that relevant GIS training programmes are followed.

1.1 Critical Issues

There are many influences (both external and internal) and considerations that can impact on the success of GIS within an organisation. Successful GIS installations, however, generally share a number of common characteristics.

1. Completion of a user needs assessment
2. High-level support within the organisation and long-term funding plan
3. GIS champions within the organisation
4. GIS awareness, training and education among staff (transparency)
5. Clear goals and objectives defined for GIS group
6. Definition of short-term success projects
7. Co-ordination of GIS development and staff continuity
8. Shared project ownership
9. Effective integration of GIS into the organisation

10. Development of an effective software and hardware environment

If GIS is to be installed successfully, and to have a long-term viability, it is necessary that it's design is linked to the final use to which it will be put. GIS should not be developed as an end in itself, but to support the questions of decision makers**.**

The following issues in particular are seen as critical to the achievement of the goals identified by the Eastern Cape Government as regards integrated GIS development:

Co-ordination of GIS services at a central level (i.e. data acquisition, data base maintenance, and contractor management). The development of an integrated system necessitates the establishment of a coordinating unit with sufficient GIS skills that are seen as an organisational resource (in this case the Eastern Cape Government), independent of any particular department's needs. To ensure a well structured, quality controlled database the GIS group should be totally focused and have sufficient authority to:

- prioritise application development and data acquisition initiatives (in consultation with the Inter-Departmental Committee on GIS),
- have overall management of the geographic information system, and
- co-ordinate data capture and entry of all departments and external contractors/data suppliers.

It should be noted, however, that while this Provincial GIS Unit is responsible for co-ordinating data entry to the standard, it is not responsible for entering or maintaining every data set. Organisational data sets, shared by many, will be managed and maintained by the Provincial GIS Unit. Individual departments should remain responsible for capturing and maintaining their own particular information sets, on which they are obviously the best authorities. The Provincial GIS Unit will be able to provide specialised skills and support for those departments who do not have the necessary resources, either directly or by contracting in the skills as required.

The Provincial GIS Unit must be accountable to all departments and regions, rather than favour the needs of a single department. The impartiality of the Provincial GIS Unit can be ensured by using the IDC-GIS to inform the Provincial GIS Unit of the needs of the various departments (as well as of issues, developments, and opportunities. This will promote transparency. In this way the needs of the Eastern Cape Government can be analysed as a whole, with the systems and data structured in an effective manner to meet all needs simultaneously. The Provincial GIS Unit should have the responsibility and authority to enforce data and system standards, since this will be the only way to build an integrated corporate information system.

Integration of data sets. The integration of data sets necessitates adhering to data standards. Relevant National Standards will be adopted for capturing and converting data, for describing data, for validating data and for quality checking. Feature classifications, data definitions, projection and co-ordinate systems, spatial representations, attribute definitions, attribute domains, coding schemes and symbology all need to be standardised for effective integration. Appropriate standards and procedures will be developed for activities not described in National Standards.

The Provincial GIS Unit will be responsible for developing and enforcing data capture standards with the assistance of the IDC-GIS, so that information can be incorporated directly into the corporate database. External organisations, consultants or other departments should be required to provide data compatible with the standards. Another mechanism for ensuring data quality, is to provide consultants with applications which have the standards in-built, so all data is captured directly into the standard.

Provision of effective software, hardware and network*.* An effective software, hardware and network environment is critical to the success of any organisation. The end users will only be able to effectively access the information that will be made available via the Government information system, if the issues of hardware, software and network can be eliminated. End users should not need to concern themselves with issues such as hardware incompatibility, network speeds and incorrect software versions; they merely require access to the information. The IDC-GIS should be represented on the PGITOC to facilitate communication between the GIS staff and other IT personnel of the East Cape Government.

Encouragement and facilitation of data sharing. In order to encourage the sharing of data all departments should be represented on the IDC-GIS and should regularly attend the committee meetings. This committee should develop a policy regarding data sharing, which could be implemented by the Provincial GIS Unit. Such a policy should also provide guidance with regard to copyright and fiscal issues, and procedures relating to data sharing. A further means of encouraging data sharing could be to prepare a break down of costs in a non-data sharing scenario and a data sharing scenario. This could then be presented to departmental managements by their IDC-GIS representative(s), or to a combined top management meeting for a policy decision to be taken. Where practical, provincial licences should be purchased to promote as wide as use of data as possible. The Provincial GIS Unit should be structured along legal principles to promote wide use of the data it purchases (e.g. a particular legal positioning under a provincial mandate might automatically allow sharing of data to departments). The Provincial GIS Unit should have a budget sufficient to cover all its costs (including dataset purchase). Data sharing must proceed according to the relevant National Standards. When datasets are purchased, the role of third parties acting as agents of the government institutions owning the data must be clarified.

The development of data standards and meta-data. Data standards and meta-data are critical to the development of any integrated information management system (whether spatial or not). Between them they tell us what data is, it's fitness for use, its location, its quality etc. Without them data can not be located in the first place, may be erroneously used for a purpose they were not created for or might be unrecognisable if actually discovered at a later stage. Meta-data and data standards impact heavily on all effective data use i.e. information sharing, data accessibility, data integration and obviously, data awareness. Applicable National Standards should be adopted.

The heightening of GIS and data awareness within the departments of the Eastern Cape Government. In many organisations there is a lack of awareness of what data and information are available and who is responsible for maintaining and providing that information. This is one of the biggest issues within GIS. Data are available and have been collected, however, they have not been effectively collated and catalogued and as such there is no record of their existence at the organisation level.

Similarly training will need to be provided according to the *level* of GIS interaction envisaged. Database builders, data analysts and modellers will require more in-depth GIS training than the casual users who want to see and query spatial information as part of a decision-making or management process. All training must be provided once technology is in place however, to ensure skills can be applied immediately, else they are quickly forgotten. The easier, simpler tools plus any *customised* software will require less training effort than generalised, complex software.

At the same time, one of the biggest obstacles to GIS uptake within an organisation is a lack of (or poor) communication and transparency. It is of critical importance that the Provincial GIS Unit ensures that GIS is properly communicated through out the government as well as the private sector. The Provincial GIS Unit should keep the IDC –GIS abreast of new developments in GIS. The IDC-GIS can also assist the Provincial GIS Unit by establishing task teams which can focus on these types of initiatives. The role of these task team would be to assist the IDC-GIS as well as the Provincial GIS Unit for fast tracking purposes.

1.2 Data Leverage

Central to the success of an integrated GIS within the Eastern Cape Government is the leverage of the data maintained within the various government departments, data collected for the departments and data that can be sourced externally. It is becoming increasingly clear that the leverage of an organisation's information is crucial to the ongoing success and growth of the organisation. Data and information need to be shared as widely as possible in order to gain the maximum benefits from the, often, expensive task of gathering it in the first place. Spatial information tends to suffer the most in terms of poor management, but ironically it is usually the most expensive to capture. The mobilisation of the spatial information within an organisation is an integral part of data leverage, providing new ways of examining and displaying existing data, and impacting on decision making and planning throughout an organisation. To this end spatial and other information need to be standardised, integrated and made easily available organisation wide, allowing more effective decision-making and planning.

In essence, the Eastern Cape Government needs to focus on the more effective use of the digital tools available to departments currently. A great deal of time and effort is wasted every day locating, re-entering and transferring data between different systems. Due to the lack of integration between systems, people do not have access to the most up-to-date information, and therefore decision-making is less effective than it could be. Spatially enabling the information available within the Eastern Cape Government would add even greater benefits. Information displayed in a map format enables patterns to be more easily identified and acted upon.

The Eastern Cape Government needs to make much better use of the information it already has. A great deal of money is spent on gathering data. All this data and related information is a critical resource and needs to be fully capitalised on.

Un-encumbering users from the problems of locating and using information and from the problems of ineffective infrastructure (software, hardware and network) will allow them to focus more directly on the job at hand. Time and costs savings will allow users to examine new ways of using data to support and enhance their current work. It is critical that users within the Eastern Cape Government are placed in a position where they can best apply their skills and focus on their specific jobs, without having to concern themselves with problems created by ineffective software and hardware and with the problems of locating relevant, mission critical data.

The spatial component of data can help facilitate this process of data usage and interpretation and indeed can be considered critical in some situations. Spatial analysis, modelling and, even simply, spatial display of data provides much more effective and powerful methods for visualising data, that are otherwise too complicated to interpret. The spatial component of data can be effective in many environments: from the office environment, for creating maps and graphics for reports, through the management environment for producing daily work plans and locating problem areas, to the research environment where it can be used for high level analysis and modelling of complex features.

1.3 Staffing Options

The most appropriate method of defining staffing requirements to support a GIS installation is to utilise a top down approach i.e. the characteristics of the GIS itself define the level of support required, which in turn defines the staffing requirements and/or positions within the organisation. This would result in every organisation having a unique staff make-up, with a suitable mix of management, system, database, development and user support. In practice, however, a staffing plan developed in this manner may not be viable for the organisation, particularly during the early stages of a GIS implementation before the technology has proved itself.

Alternatives to the perfect staffing plan include:

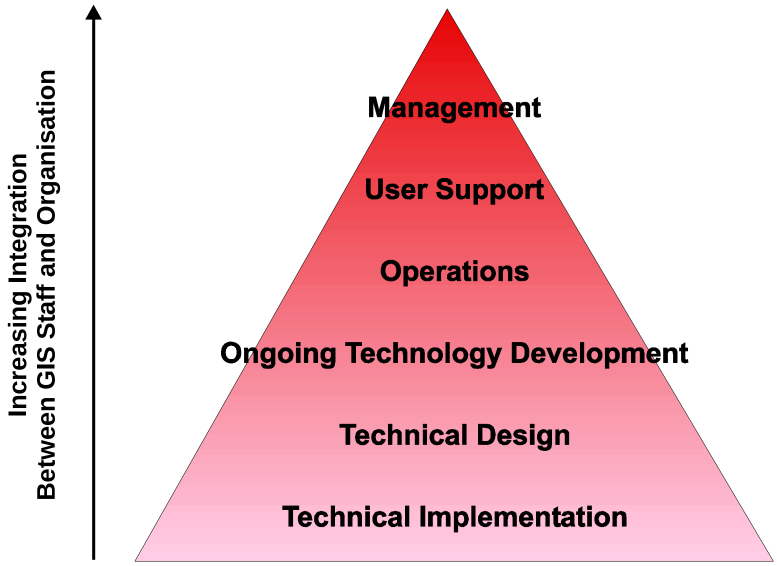
Continued use of consultants on a contract basis – costly and counter to the organisation's stated intent of building capacity amongst its staff
Appointment of personnel from within the organisation to work with and be trained by consultants – ultimately to take over from consultants
Appointment of appropriately qualified personnel from outside the organisation
Combination of the last two

It should be remembered that those departments utilising GIS will want to appoint their own staff according to their needs and requirements. This report should therefore explicitly state that the staffing options under consideration are for the GIS Co-ordinating Unit (or whatever it is to be called).

Use could be made here of the suggestions/recommendations of the original report on co-ordinating GIS within the E. Cape Govt. These were for a combination of contracting out and in house staff development; the use of a small team, initially consisting of 3 members (GIS analyst, systems analyst & data administrator), with a possible expansion later on to 8 members.

The role of GIS within the organisation. The level of outsourcing or the amount of work that is passed to consultants and contractors is dependent in particular on the amount of control over and understanding of the GIS operations that an organisation requires. This level of knowledge and control varies with GIS implementations and GIS tasks.

Tasks such as '*Technical Implementation*' and '*Technical Design*' require far less control and knowledge within the organisation, whereas tasks such as '*GIS Management*' and '*User Support*' require an understanding of the GIS group within the organisation and of the workings of the organisation itself.



Where contractors etc. are still used for the higher levels of the pyramid it is important that knowledge and technology transfer are built in as part of the contract. Otherwise it is feasible for the organisation to lose control over and understanding of their GIS installation.

Human resource issues; many issues, in particular, pay and recognition of job size, pose a problem within organisations. Market trends dictate pay levels for highly skilled, experienced GIS professionals that are outside the control and pay structures of some organisations. One of the few methods around this issue is to contract out work, such that pay scale etc. do not need to be modified

The status of GIS within the organisation; especially in the early stages of GIS implementation, but also to a certain extent later on, the available expertise is just not sufficient to cope with the tasks at hand. This is particularly important when developing a prototype system or short-term success projects, where the success or failure of the project could influence the success of the whole GIS implementation. In these cases outsourcing some of the work may be necessary to guarantee short-term, but ultimately, long-term success.

In certain circumstances the demand on the GIS may outrun the resources and capabilities of the organisation i.e. critical staff resignations, advanced GIS requirement. In these cases too it may be necessary, in the short-term, to outsource some of the tasks.

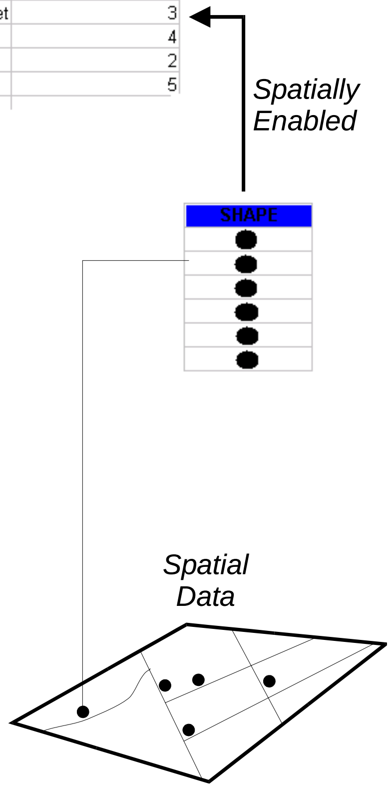
2 Database Design

As outlined above, there are a number of issues that are critical to the success of a GIS within an organisation. These are often summarised as data, people, software, hardware and applications. Probably the most important issues, however, revolve around data - database design, data standards and metadata. If data issues, in particular, are not addressed at an early stage and in a fairly rigorous manner then the GIS will be ineffective and the potential benefits that can be accrued will be reduced, simply due to the fact that users cannot locate, integrate and share data.

Database design is, in general, a fairly subjective and intuitive process governed by certain rules and guidelines that are laid down, and that stress the importance of particular issues that are known to affect database performance and integrity. The design of a GIS database is no different to that of any standard database, just with the added complexity that a spatial component must be considered.

2.1 Spatial Database Design

HOTEL#	HOTELNAME	NO_ROOMS	LOCATION	FACILITIES#
5	Belvedere	15	Market Street	1
3	Courtyard	50	Pretorius Street	3
2	Holiday Inn	10	Main Street	4
4	Hyatt	200	Church Street	2
1	Royal	35	10th Street	5



FACILITIES#	FACILITY#
1	1
1	3
1	4
1	5
2	1
2	3
2	4
3	1
3	2
3	3
4	1
4	2
4	3
4	4
4	5
4	6
4	7
5	1
5	3

FACILITY#	FACILITY
1	Bar
2	Laundry
3	Restaurant
4	TV Room
5	Pool Room
6	Swimming Pool
7	Valet Service

Those GIS which have survived in the market place for more than a few years are constantly redesigned to take advantage of the technologies and methodologies that are shaping the computer world as a whole. The increasing power of the PC, the availability and cheapness of RAM, the development of the Internet/Intranet, object-orientation all have impacted on the development of GIS. The structure and design of spatial databases is no exception. Over the years databases have changed from proprietary formats to published formats, from single map sheets to seamless database layers, from local data storage to centralised data servers.

Currently the biggest trends in spatial database design are the concepts of Object Orientation (OO) and, linked to that, the critical issue of openness of data, software and hardware. With OO, individual features within a database will no longer be limited to representations such as points, lines and polygons, but will be geo-objects that have their own associated rules and procedures. OO will require a whole new look for spatial database design, an issue that is still currently being investigated. The related issue of openness (interoperability) is, however, already critical to spatial database design. Openness requires that data can be accessed simply from many different applications, whether it is spatial or not. This implies that data need to be stored in common database environments that are optimal for data access and query.

The spatial database engine (SDE) allows both the spatial and related attribute data of a spatial data layer to be stored within standard relational database management systems (RDBMS). RDBMS, maintain data in a form that most database designers are used to, and the only difference between designing the same database with a spatial component is that an additional field is added to the entity table that stores the spatial feature (*see figure above*).

In the simple example above it is obvious that the underlying database design has not changed. The entity tables, lookup tables and joining tables required by a normalised database design are all correctly in place. The spatial features have simply been added to the main entity table (in this case the *HOTEL*) as an additional field; a process called *spatially enabling* a database table. The database can now be queried as if nothing has changed. However, if a visual representation of the data is required then a map can be created from the same data, or even basic spatial analysis and queries can be applied to the data.

3 Database Design: Integrated GIS for the Eastern Cape Government

Africon (Bisho office) carried out a survey in 1998 of the main Departments within the Eastern Cape Government, as regards their requirements of an integrated GIS. From this survey it was possible to piece together the requirements of the various Departments regards data (*see Appendix I*).

3.1 Data Layers

Within the data requirements of the Eastern Cape Government there are three distinct groupings that need to be considered as part of the development of an integrated GIS.

Project and project management data; data pertaining to projects that have been completed or are currently underway. This has a small spatial component, that is to say project location, but is mostly a stand-alone database and management system in its own right. All that will be considered, as part of this project, is that the correct links are maintained between the infrastructure database and the project attribute data. The project database is intrinsically linked to the infrastructure database in that projects are either carried out on infrastructure features or create new infrastructure features.

Infrastructure data; infrastructure data are the main data that the Eastern Cape Government is interested in. It is the data they are responsible for and pertains to the facilities and services they provide for the people of the Eastern Cape Province.

Background or base data; the base data is the data that can be used to make the infrastructure data more meaningful. Displaying or analysing this data with the infrastructure data assists the user in making more effective well-informed decisions.

The table below lists the main data layers (split into the three categories) identified as being critical to the Eastern Cape Government succeeding in their mission and vision.

Project Data	Infrastructure Data	Base Data
Project and project	Health and welfare facilities	Roads

Project Data
management data- base
Project data layer

Infrastructure Data
Clinics
Hospitals
Mobile hospitals
Crèches etc.
Education facilities
Schools
Universities
Emergency classrooms etc.
Community infrastructure
Post offices
Religious buildings
Recreational facilities
Police stations etc.
Transportation infrastructure
Roads
Railways
Airports
Harbours
Facilities
Government facilities
Utility and service infrastructure
Electricity
Water and sanitation
Communications
Commercial infrastructure and sites
Development areas

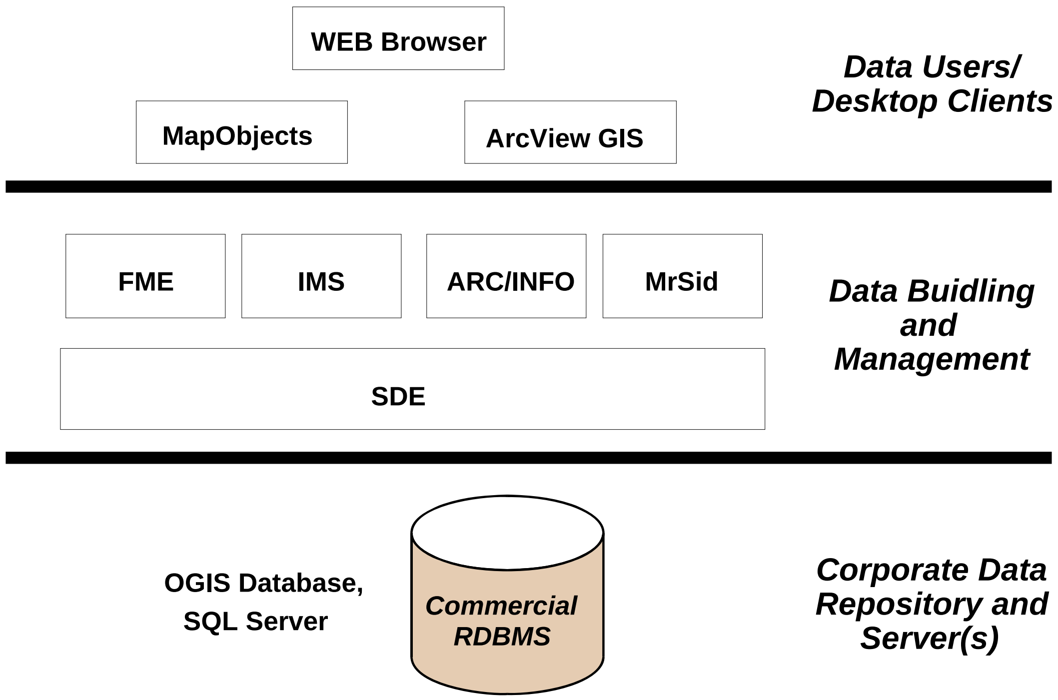
Base Data
Railways
Lines
Stations
Administrative boundaries
Provincial
Magisterial
Electoral areas
TLC
TRC
District Councils
ECG regions
Cadastre/Erven
Farm boundaries
Land tenure/ownership
Census data
Settlements
Cities
Towns
Villages
Communities
Water bodies
Rivers
Lakes
Dams/reservoirs
Catchments
Topographic data
Contour lines
Spot height
Slope/aspect
Vegetation
Veld types
Land types
Conservation areas
Geology
Soils
Afforestation
Land cover
Climatic data
Precipitation
Runoff
Tourism
Mineral resources
SMMEs
Other data
Scanned CAD drawings
CAD drawings
Satellite imagery
Ortho-photos
Scanned topographic map sheets
Pictures
Video

Some layers actually fall in two categories, for example roads which are maintained by the Department of Public Works but which are also a critical base layer (needed by many departments simply as background information).

3.1.1 Client/Server Technology

Enterprise GIS solutions support a variety of users throughout an organisation, all requiring varying levels of access to shared, common spatial and attribute data. Access, retrieval and display of these data, however, place significant demands on the associated computer environment and so appropriate hardware, software and network technologies are key to the success of this solution.

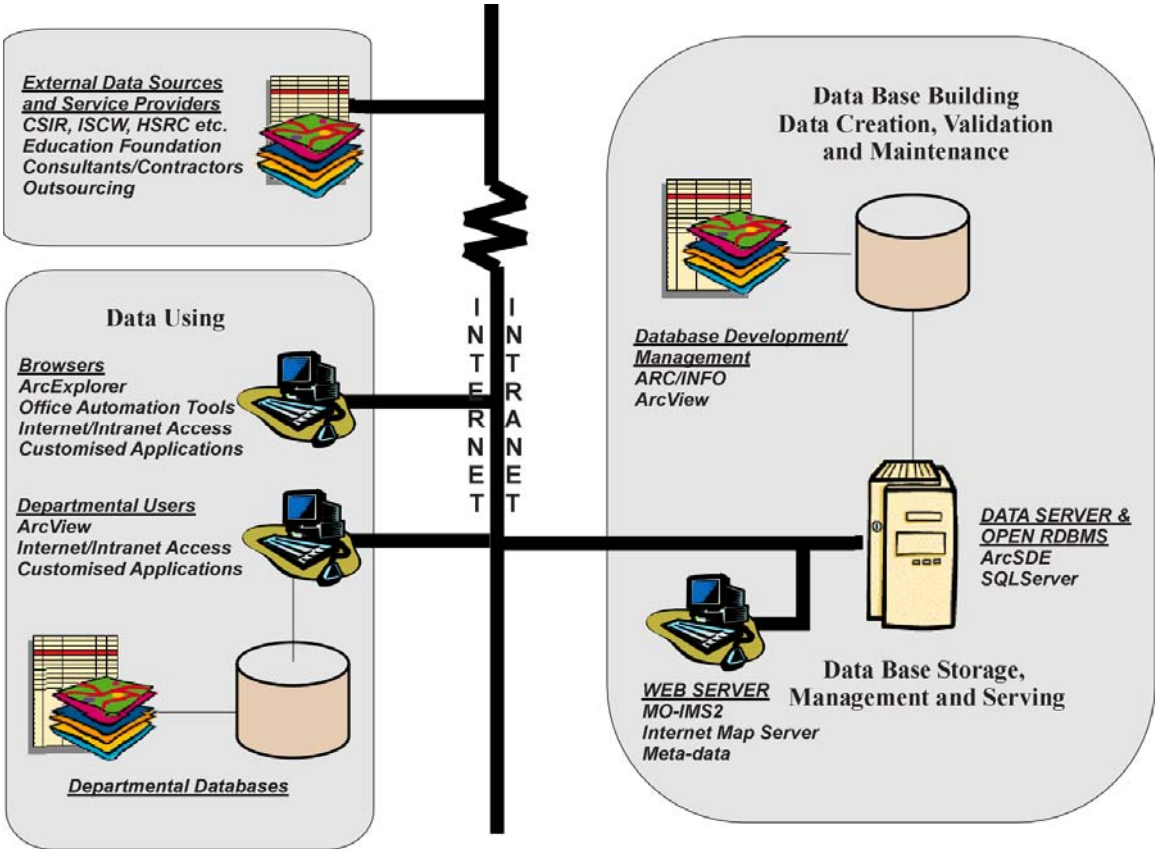
The current solution provides a fully integrated hardware and software platform that will provide the most effective access to data within the Eastern Cape Government. It is based on a three-tier approach to enterprise GIS, a state-of-the-art technique that helps to optimise existing computing and infrastructure resources.



In this tiered structure *(see figure above)*, client applications (upper tier) are able to access geo-data and geo-processing services provided by application servers (middle tier) and one or more data servers (lower tier). The open data environment of commercially available RDBMS comprise the data server layer, while server engines such as SDE, ARC/INFO and the Internet Map Server (IMS) make up the application server layer and client tools such as ArcView, ArcExplorer, MapObjects and WEB browsers form the client application layer. This environment provides the flexibility to support traditional TCP/IP network environments as well as the rapidly growing Intranet and Internet environments. This open environment also ideally suits existing heterogeneous hardware environments, making it easy to take advantage of changes and developments in computer hardware and software.

3.1.2 Client/Server Design at the ECG

The following, stylised, diagram provides an overview of the current structure of the integrated GIS within the Eastern Cape Government (additional features such as plotting and backup capacity are not indicated).



The above design provides a very flexible environment. Centrally stored common data sets are easily accessible both locally and via the Internet/Intranet, while departmental data are stored and maintained locally, but can be readily integrated with the organisational data. Appropriate software and hardware technology will allow users at various levels – management, planners, IT and GIS professionals - to access data in a relevant manner.

3.1.3 SDE Structure and Design

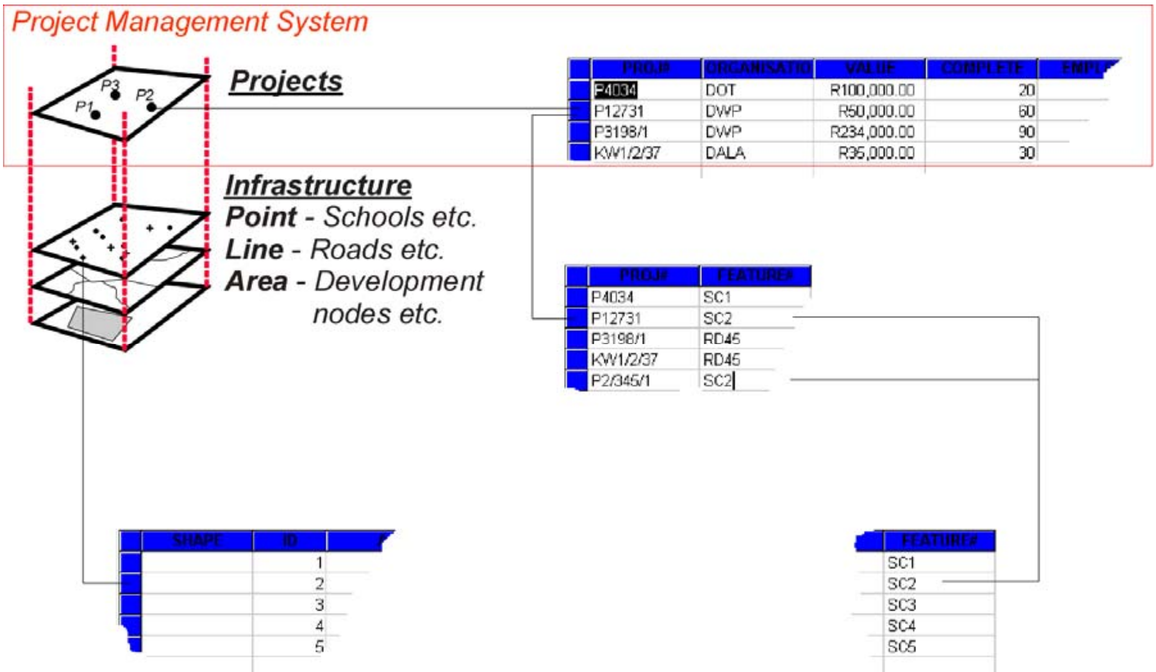
The SDE structure makes use of the capabilities of SQLServer to provide an effective solution to the issue of departmental data versus system wide or public data.

Within SQLServer a number of databases have been created that can each be accessed by a certain group of users. Base data are stored within a database called *sdebase* that can be accessed by all users, in browse mode, and which contains additionally the project data. Other databases are named based on the department's data that they store i.e. *sdedpw* is the database that stores data that can only be accessed by users from the Dept. of Public Works.

Each user is similarly allocated to relevant groups. All groups have access to *sdebase* while only those groups that should have access to a particular department's data are granted access to the department named database.

3.2 Project Data

Linking to the project and project management database is critical to the success of the overall SDE implementation. However, as part of this project we are only going to focus on the link between this database (the maintenance of which is the responsibility of another project) and the GIS data.



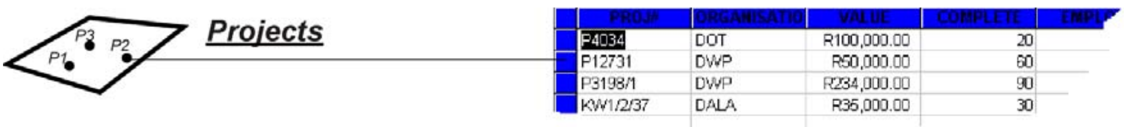
The project database is, as has already been stated, a stand-alone application. As part of this implementation, however, it is necessary to provide access to certain information held within it, to create a project layer within SDE and to provide links back to the actual GIS data.

The above, initial, design fulfils both these needs, with the project management system remaining as a stand-alone product that can be queried and accessed by any user without recourse to a GIS, as well as providing a link to/from the GIS as required.

Layer Name	Description
Projects	Projects layer
Layer	Currently loaded data

The benefit of the above design is that the initial component is fairly quick to implement based on the existing data structures and availability i.e. there are project locations within an existing GIS layer that can be quickly linked to the projects database.

The currently implemented design can be viewed as follows:



The project attribute data has been refined down to the following table, in essence the data common to all projects. The project ID solely exists to provide a link from the projects layer to the projects attribute table, as no other column can be guaranteed as unique or not null at this time.

ITEM	DESCRIPTION

PROJ_NO	Project Number
PROJECT_NAME	Project Name
PROJ_DESC	Project Description
LOCATION	Location
PRINCIPAL	Principal Department
AGENT	Agent
CAPEX	Expenditure
STATUS	Project Status
PROPSTART	Start Date
ACTUALSTART	Start Date (Actual)
PROPEND	End Date
ACTUALEND	End Date (Actual)
F_ACCDUE	
F_ACCDON	
INTERVENTION	Intervention Required
D_JOBS	Number of Direct Jobs
I_JOBS	Number of Indirect Jobs
OPPORTUNITY	Opportunities
PROJ_ID	Project ID

A number of issues need to be cleared up around this table, however. The biggest issue is a standardisation of the way fields are classified i.e. at the moment the CAPEX field is coded as a character (R400000) making it useless for statistics and summaries.

The final design, however, will be more effective if the project layer itself falls away. All links will then be directly between the project database and the feature on which the project is being carried out. There are a number of benefits that accrue from designing the database in this way:

Each project feature is only depicted once. This means that if a school has twenty projects completed on it and a number of projects ongoing, there is only one source in the infrastructure layer. In the existing structure each project will appear as a separate location (providing room for potential for error due to multiple entries).
There is a single point of entry for querying the database. There is no need to query the projects database and then link that result back to the actual infrastructure layers.
New infrastructure appears immediately in the relevant infrastructure layer.

The only draw back to both these designsis that a considerable amount of effort will be required to link the project records to the relevant infrastructure feature.

3.3 Infrastructure Data

Within the infrastructure data there are two levels of data:

data that are maintained and only accessed by a particular department
data that are maintained by a particular department but need to be accessed by all users

This situation is similar in many respects to that of the project management data where many departments have stand-alone databases of which only a small portion is of interest to other users (or security issues preclude other users from having access to that data).

Once again it is not necessary to store all the data on the main server, although if the user or department prefers this can be arranged. Only the critical data that can be used and is of use by other departments will be linked directly to the spatial data.

Layer Name	Subject	Description
HLTH	Community Services	Health and Welfare Facilities

EDU	Community Services	Education Facilities
COMM	Infrastructure	Community Infrastructure
ROAD	Services/Transport	Road Network
FACIL	Services/Transport	Transportation Facilities
GOV	Infrastructure	Government Facilities
ELEC	Utilities	Electricity Supply
WATER	Utilities	Water Supply (DWA)
WATER	Utilities	Water Supply (DHLG)
PHONE	Utilities	Communications
IND	Planning	Industrial Sites
DEV	Planning	Development Sites
	Layer	Currently loaded data

3.4 **Base Data**

Standard base data will all be stored on the main server. In this way each department has access to the same data sets as each other department, which means that decisions will be made based on the same starting point.

Layer Name	Category	Descriptor
ROAD	Services/Transport	Roads
RAIL	Services/Transport	Railways
RAIL	Services/Transport	Stations, sidings etc.
AIRF	Services/Transport	Airfields and airports
HARB	Services/Transport	Harbours
PROV	Political	Provincial Boundaries
MAG98	Political	Magisterial Districts
SUB	Political	Suburbs
EA96	Political	Electoral Areas
TLC	Political	Transitional Local Councils
TRC	Political	Transitional Rural Councils
DC	Political	District Councils
ECGR	Political	Eastern Cape Government Regions
ERF	Cadastre	Cadastre/Erven
FARM	Cadastre	Farm Boundaries
LAND	Cadastre	Land Tenure/Ownership
SETT	Population	All settlements
CITIES	Population	Cities and Large Towns
TOWNS	Population	Towns
VILLAGES	Population	Villages
COMMUNIT	Population	Communities
RIV	Hydrology	Rivers
DAMS	Hydrology	Lakes and dams
RES	Hydrology	Reservoirs
CAT	Hydrology	Catchments
CONT20	Topography	Contours (20 metre intervals)
CONT100	Topography	Contours (100 metre intervals)
SPOT	Topography	Spot Heights
ENVAK	Environment	Acock's Veld Types
ENVRL	Environment	Rebelo and Louw Veld Types
ENVLB	Environment	Lubke Vegetation Types
NPB	Environment	National Parks
PNR	Environment	Provincial Nature Reserves
DCNR	Environment	District Council Nature Reserves
NHS	Environment	Natural Heritage SItes

GEOL	Geology/Pedology	Geology
SOIL	Soil/Land Types	Soil/Land Types
FOR	Land Cover	Forestry (Indigenous/Plantation)
LCNAT	Land Cover	Land Cover
TOUR	Recreation/Tourism	Tourism Areas
MIN	Geology/Pedology	Mineral Deposits
SMME	Business	Industry (SMMEs)
	Layer	Currently loaded data

The database design for most of the base data cannot really be modified as in general it is created and maintained by external organisations. As such it tends to come in a ready-to-use format.

4 Data Standards and Procedures

Data standards are necessary because information is increasingly being recognised and managed as a valuable corporate asset. The current approach to managing information in an organisation is by a single store in a central database (Enterprise Wide) to ensure that all users are working with current information and that no duplication occurs. It is important that datasets are as useful as possible to as many users as possible. Standards define the quality and format of data, which ensures that users receive useful data in a usable format. Standards also provide a framework for collaboration, allowing data capturing to done concurrently by several contractors in formats that will eventually prove compatible. Data standards simplify communication by providing a common reference point in discussions and specifications and promote consistency.

Standards for a GIS involve naming and defining files, features, attributes and codes, as well as standards for editing and data maintenance i.e. tolerances and procedures. To encourage an organisation or group identity, it is also useful to have standard symbology that can be used when required i.e. trees or roads or rivers or land cover are depicted the same on all departmental maps.

Basic issues covered by data standards would generally include:

1. Common projection and co-ordinate systems

Standard naming and coding conventions (both for data files and attributes)
Defined accuracy standards
Common/well defined data formats and exchange standards
Required Metadata standards

There are basically three types of data standards that can be applied to geo-spatial data, they are:

Data format standards
Data quality standards
Data documentation standards

The Eastern Cape Government needs to formulate an information policy that specifies its rules for sharing, disseminating, acquiring, standardising, and classifying data and for the inventory of information throughout the organisation.

A useful means of managing and providing access to data, including establishing and enforcing standards, is an automated data dictionary or data catalogue. Establishing a data dictionary for the whole organisation is one way to achieve complete standardisation.

4.1 Metadata and Data Catalogues

Metadata is essentially data-about-data. Typical information contained in a data catalogue (a database of data-about-data) would generally describe the content, attributes, currency, accuracy, quality, condition, coverage, source and availability of the data set. A data catalogue not only allows users to investigate what data is available for their area of interest, but also to see if it is fit for the use they intend to put it to. Metadata has four major roles as outlined by Danko, 1997.

To locate data
To evaluate data: is the data appropriate for its intended use (fitness of use)?
To extract data: What format is the data available in? How should it be processed? How can it be accessed?

- **To employ data:** What are limitations of the data? How should/can it be interpreted?

Metadata will conform to the relevant National Standards. The metadata will be available in digital format on the GIS web page.

5 Outstanding Issues

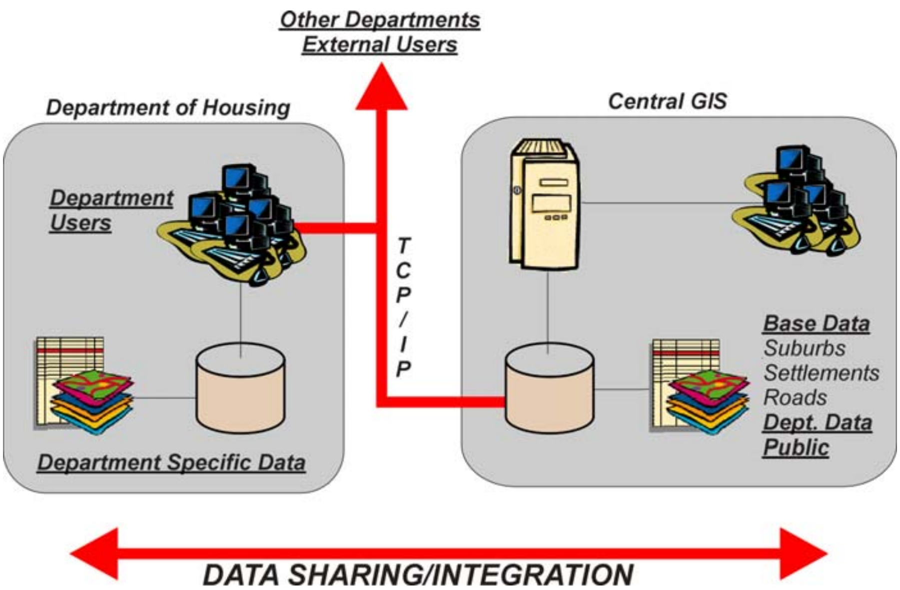
There are a number of issues that need to be finalised before the initial completion of the integrated GIS within the Eastern Cape Government.

- **Outstanding data:** there are a number of base data layers that are not available currently within the Eastern Cape Government and need to be sourced externally, or where the data available within the Eastern Cape Government could be improved upon by the addition of new data.

  New data are constantly being created and/or improved upon by external organisations, consultants and contractors and it is critical that the Eastern Cape Government keeps close contact with what is available. Once a useful or relevant database is located it should (where possible) be incorporated into the central database.

  The ideal funding arrangement for data procurement is to allocate a budget to the GIS room. This will avoid the complications of the various departments having to find total or partial funding for the datasets they require, and will allow centralised control of purchasing.

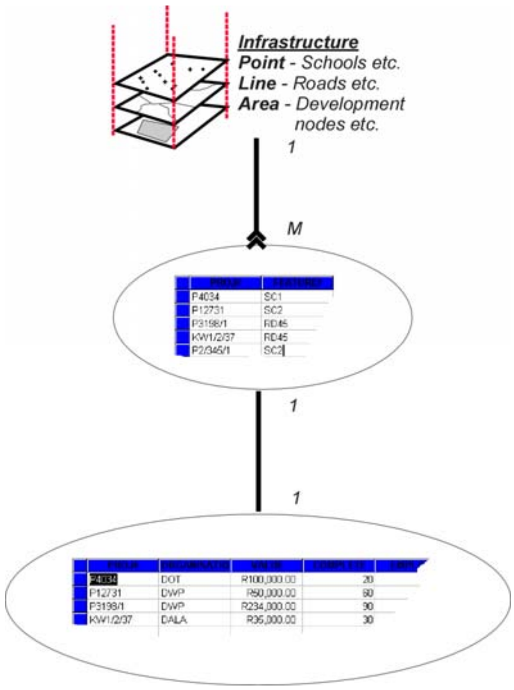
- **Departmental data:** the various departments within the Eastern Cape Government all have various levels of database and/or GIS use.



Some of the databases are extensive and focus on many department critical issues that are of little or no interest to the general users. It does not make sense to make all this data available generally, while at the same time it similarly does not make sense to move the database from the environment where it is already effective.

The Department of Housing (DH) is a typical example, where a large project database has been developed using MicroSoft Access and has been dynamically linked to relevant spatial data layers. Much of the spatial data required by the DH can be readily stored and accessed from the central server and still linked to the database at the DH. At the same time it makes sense that the less sensitive and more generally useful data be shared within the Eastern Cape Government as a whole. This ***public department data*** would most effectively be stored on the central database.

- **Project layer completion:** Considerable effort needs to be invested in the project database. As noted above. There is currently no way of linking from actual infrastructure (spatial objects) to the project database.



Ultimately, there is a one-to-many relationship between the projects and the infrastructure (i.e. a school might have many projects carried out on it), which can best be handled in this situation by utilising a join table.

Each infrastructure feature (not necessarily a single feature i.e. a number of road segments) needs to have a unique ID# which can be used to link it to its related projects. These unique Ids need to be created and the join table created.

Linear features (roads) can as noted above have a project being carried out on one or more of their pieces. This will be accommodated through the use of measures (supported by SDE), whereby a virtual segment can be identified that is composed of a number of linear segments by defining a start and end point.

APPENDIX I: DATA LAYERS REQUIRED BY EASTERN CAPE GOVERNMENT

	Data Available Within ECG			Data Not Currently Available			
	Created By	Maintained By	Owned By	External Source	Contract Capture	Capture Internally	Feature Type
Infrastructure …							
Education Facilities	EF	EF	DE				Point
Health and Welfare Facilities				MegaSub			Point
Post Offices				MegaSub			
Police Stations	AF	AF	SAP	MegaSub			Point
Other Government Facilities							Point
Religious Buildings							Point
Community Infrastructure							
Commercial Sites (zoning must be reflected on separate layers)							Point
Utilities Electricity Bulk Water Sanitation Telkom	 Eskom AF AF Telkom	 Eskom AF AF Telkom	 Eskom DHLG DHLG Telkom				Point/Line
Recreational Facilities							
Transportation Facilities Rail Airports Roads Ports/Harbours	 DPW AF AF AF	 DPW AF AF AF	 DPW AF DPW AF				 Point Line Point Line Point
Cellular Coverage							Area for coverage Points for masts

	Data Available Within ECG			Data Not Currently Available			
	Created By	Maintained By	Owned By	External Source	Contract Capture	Capture Internally	Feature Type
Projects Consolidated Municipal Infra. Dept. of Agric. Community Water and Sanitation Municipal Infra Health Facility Dept. of Education Presidential Discretionary Funds Dept. of Public Works National Public Works	Eastern Cape Govt Depts.	Eastern Cape Government Depts	Eastern Cape Govt Depts				Point/Line/Area

Base Data (including administrative boundaries)…

Roads	DPW	AF	DPW				Line
Vegetation	DEAT	DEAT	DEAT	DEAT			Area
Veld Types	DEAT	DEAT	DEAT	DEAT			Area
Land Types	ISCW	ISCW	ISCW	ISCW			Area
Afforestation Commercial Indigenous	 ETEK ETEK	 ETEK ETEK	 DWAF DWAF	 ETEK/DWAF ETEK/DWAF			 Area Area
Railways	TRANSNET	TRANSNET	TRANSNET	TRANSNET			Line
Railway Stations	TRANSNET	TRANSNET	TRANSNET	TRANSNET			Point
Contour Lines	AF	AF	AF				Line
Spot Heights							Point
Slope/Aspect							Area
Built-up Areas Cities Towns	 DWAF DWAF	 UWP UWP	 UWP UWP	 DWAF DWAF			 Area Point

	Data Available Within ECG			Data Not Currently Available			
	Created By	Maintained By	Owned By	External Source	Contract Capture	Capture Internally	Feature Type
Villages	DWAF	UWP	UWP	DWAF			Point
Communities	DWAF	UWP	UWP	DWAF			Area
Geology	GSC	GSC	GSC	GSC			Area
Soil	ISCW	ISCW	ISCW	ISCW			Area
Climate	WRC	WRC	WRC	WRC			Area
Water Bodies							
Rivers	DWAF	DWAF	DWAF	DWAF			Line
Lakes/Dams etc	DWAF	DWAF	DWAF	DWAF			Area/Point
Pipelines							Line
Catchments	WRC/DWAF	WRC/DWAF	WRC/DWAF	WRC/DWAF			Area
Erven	CDSM						
Farm Boundaries	CDSM	CDSM	CDSM	CDSM			Line/Area
Communal Boundaries	DWAF	DWAF	DWAF	DWAF			Line/Area
Coastline	AF	AF	AF				Line/Area
Provincial Boundaries	ENPAT	ENPAT	ENPAT	ENPAT			Line/Area
Magisterial Boundaries	AF	AF	AF				Line/Area
Transitional Local Council Boundaries	DWAF	AF	DWAF				
Transitional Rural Council Boundaries	AF	AF	AF				
District Councils	AF	AF	DPW				
Dept. of Education Boundaries	AF	AF	DPW				Area
Dept. of Public Works Boundaries	AF	AF	DPW				Area
Dept. of Health Boundaries	AF	AF	DPW				Area
Dept. of Economic Affairs Boundaries	AF	AF	DPW				Area

	Data Available Within ECG			Data Not Currently Available			
	Created By	Maintained By	Owned By	External Source	Contract Capture	Capture Internally	Feature Type
Conservation Areas National Parks Provincial Nature Reserves Local Authority Nature Reserves Private Nature Reserves Conservancies National Heritage Sites							Area
Homogenous Farming Areas	DALA	DALA					Area
Land Tenure/ Ownership	CDSM	CDSM	CDSM	CDSM			Area
Hiking Trails etc.							Line
Land Cover	DALA/DHLG			CSIR/DWAF			Area
Census data Population Employment Labour force Education	SS	SS	SS				 Area Area Area Area
SMMEs							Point
Tourism Areas							Area/Point
Community Projects	DPW	DPW	DPW				Point
Mineral Resources							Point

Scanned CAD							Image
Videos							MPEG
Pictures							Image
CAD Drawings							CAD

	Data Available Within ECG			Data Not Currently Available			
	Created By	Maintained By	Owned By	External Source	Contract Capture	Capture Internally	Feature Type
Orthophotos							Image
Satellite Imagery							Image
Scanned Topo-cadasatral	GIMS	GIMS	GIMS				Image

ORGANISATION ABBREVIATIONS

DE Department of Education
DALA Department of Agriculture and Land Affairs
DHLG Department of Housing and Local Government
PP Presidential Projects
DOT Department of Transport
DSS Department of Safety and Security
DPW Department of Public Works
SAP South African Police Service
DEAET Department of Economic Affairs, Environment and Tourism
PO Premier's Office
DHW Department of Health and Welfare
AF Africon
SS StatsSA
EF Education Foundation
GSC Geological Services Council
DEAT Dept. of Environment Affairs and Tourism (National)
DWAF Dept. of Water Affairs and Forestry
ETEK Environmentek: CSIR
ISCW Institute Soil Climate and Water
CDSM Chief Directorate: Surveys and Mapping
WRC Water Research Commission

APPENDIX II: LAYERS IN SDE

Transitional Local Councils		**Layer:** TLC
ECTLC_ID	NUMBER	15
NAME	CHARACTER	100

Education Regions		**Layer:** TEDU
NAME	CHARACTER	100

Soil		**Layer:** SOIL
SIRI_CDE	CHARACTER	3
ASD	CHARACTER	41
DST	CHARACTER	40
DSS	CHARACTER	92
RLF	CHARACTER	18
DSS_ID	NUMBER	15
DSSERIES	CHARACTER	15
DSSP	NUMBER	15
DST_ID	NUMBER	15
DSTEXTURE	CHARACTER	15
DSTP	NUMBER	15
LOWPT	NUMBER	15
HIGHPT	NUMBER	15
RANGE	NUMBER	15
CLASS	CHARACTER	2
COLOR	NUMBER	15

Settlements		**Layer:** SETT
VILL_NAME	CHARACTER	29
MAJOR	CHARACTER	16
LABEL	CHARACTER	100
COMMUTPDES	CHARACTER	30

Roads		**Layer:** ROAD
FROMKM	NUMBER	10
TOKM	NUMBER	15
ROAD	CHARACTER	10
SELECT1	CHARACTER	1
SELECT2	CHARACTER	1
FROMROAD	CHARACTER	30
TOROAD	CHARACTER	30
PAVEUNPAVE	CHARACTER	8
ROUT_NO	CHARACTER	16
SELECT3	CHARACTER	6
LEGEND	CHARACTER	100

Rivers		**Layer:** RIV
NAME	CHARACTER	40
CLASS	CHARACTER	40

Railroads		**Layer:** RAIL
TYPE1	CHARACTER	50
TYPE2	CHARACTER	50

Provincial Nature Reserves		**Layer:** PNR
RES_NAME	CHARACTER	65
RES_ID	NUMBER	15
C_ID	NUMBER	15
C_NAME	CHARACTER	65

National Parks		**Layer:** NPB
RES_NAME	CHARACTER	65

Natural Heritage Sites		**Layer:** NHS
NAME	CHARACTER	37
OWNER	CHARACTER	37
CONTACT	CHARACTER	40
ADDRESS	CHARACTER	40
ADDRESS1	CHARACTER	40
CITY	CHARACTER	30
CODE	CHARACTER	4
SIZE_HA	NUMBER	15
TELEPHONE	CHARACTER	15
PROVINCE	CHARACTER	4
REGION	CHARACTER	1
HOMELANG	CHARACTER	1
BIOME	CHARACTER	3
GRID	CHARACTER	13
EST_DATE	DATE	36
FARM_NUM	CHARACTER	6
ACOCKS	CHARACTER	2
ENDANGER_A	CHARACTER	40
ENDANGER_P	CHARACTER	40
CRITEREA_1	CHARACTER	40
CRITEREA_2	CHARACTER	40
CRITEREA_3	CHARACTER	40
CRITEREA_4	CHARACTER	40
CRITEREA_5	CHARACTER	40

Magisterial Districts		**Layer:** MAG98
MAGID	NUMBER	15
MAGIS_NAME	CHARACTER	100
DC	CHARACTER	50
PROVINCE	CHARACTER	50

Geology		**Layer:** GEOL
COLOR	NUMBER	15
DESCRIPTION	CHARACTER	85

Rebelo and Lowe Veld Types		**Layer:** ENVRL
TYPE	NUMBER	15
BIOME	CHARACTER	20
VEG_DESCRI	CHARACTER	50

Lubke Veld Types		**Layer:** ENVLB
DESCRIPT	CHARACTER	45

Acock's Veld Types		**Layer:** ENVAK
VELD_TYPE	NUMBER	15
DESCRIPTION	CHARACTER	100

Education Facilities		**Layer:** EDU
ECSCH_	NUMBER	15
ECSCH_ID	NUMBER	15
ACCESS_QUA	CHARACTER	4
NO__OF_CLA	NUMBER	15
CONDITION	CHARACTER	5
EBRDAVAIL	NUMBER	15
ECR	NUMBER	7
DISTRICT	CHARACTER	19
REGION	CHARACTER	17
NO__OF_EDU	NUMBER	15
EMIS	CHARACTER	10
EMIS_NO_	NUMBER	15
FENCING	CHARACTER	7
FUNDING	CHARACTER	5
LATITUDE	NUMBER	15
BRDAVAIL	NUMBER	15
LCR	NUMBER	7
NO__OF_LEA	NUMBER	15
LER	NUMBER	7
LONGITUDE	NUMBER	15
LTR	NUMBER	7
LTRANSNUM	NUMBER	15
MAGISTERIA	CHARACTER	16
NO__OF_MED	NUMBER	15
LANGUAGE_M	CHARACTER	6
NAME	NUMBER	34
NATIONAL_I	CHARACTER	11
OTHER_FACI	CHARACTER	8
OTHER_USES	CHARACTER	5
OWNER	CHARACTER	4
PLATOONING	CHARACTER	1
POWERSHORT	CHARACTER	7
PROVINCE	CHARACTER	2
REGISTRATI	CHARACTER	9
SCHOOL_TYP	CHARACTER	3
SHELTERS	NUMBER	15

NO__OF_SPE	NUMBER	15
SPORTS_FAC	NUMBER	15
SUPPORT	NUMBER	15
SURVEYPROV	CHARACTER	2
TELECOMMUN	CHARACTER	5
TOILETS_BO	NUMBER	15
TYPE_OF_TO	CHARACTER	11
TOILETS_GI	NUMBER	15
TOILETS_ST	NUMBER	15
TOILETS_LE	NUMBER	15
TRANSPORT	CHARACTER	1
TRANSPORT_	CHARACTER	4
WATER_AVAI	CHARACTER	6

Enumeration Areas		**Layer:** EA96
CSSID	NUMBER	15
EANUMBER	NUMBER	10
MAGNAME	CHARACTER	16
DISTNAME	CHARACTER	34
LGNAME	CHARACTER	25
COUNCIL	CHARACTER	16
PLACE_NO	CHARACTER	13
PLACE_NAME	CHARACTER	22
PLACE_TYPE	CHARACTER	16
SUBURBS_NO	CHARACTER	16
SUBURBS	CHARACTER	27

Airfields		**Layer:** AIRF
ECAIR_ID	NUMBER	15
NAME	CHARACTER	50
AIRPORT	CHARACTER	1

Dams		**Layer:** DAMS
NAME	CHARACTER	40
CLASS	CHARACTER	40

District Councils		**Layer:** DC
REGIONALDC	NUMBER	15
REGIONNAME	CHARACTER	50

District Council Nature Reserves		**Layer:** DCNR
RES_NAME	CHARACTER	65