Aligning GIS to the Developmental objectives of a South African Municipality.

Presented by Phil Farrant

Abstract:
The advent of Integrated Development Planning has constituted a major watershed for local authorities in a post Apartheid South Africa.
In relation to the amalgamation process as defined by the municipal structures act, Buffalo City Municipality confronted a serious (geographical) information management problem.
While the area of jurisdiction has expanded to include vast rural areas, little base line information has been available to support planning activities.
The focus on Integrated Development Planning to combat inequitable spatial distribution of resources and imbalances between supply and demand, stressed the need for relevant and updated data as well as methods to analyse and improve the situation.
Effective integrated planning and service delivery rests on the ability of decision-makers to correctly interpret information derived from data.
Consequently, a corporate approach to implementing a GIS to manage spatial data and develop decision support tools has received priority in Council's strategic thinking.

A (very) brief introduction to the IDP (Integrated Development Planning) process

In South Africa, all development-related legislation passed since 1994 requires participatory planning processes, with the most recent Municipal Systems Act of 2000 redefining the concept of a municipality to include the community itself. This reaffirms the need for inclusive and transparent setting of local development priorities.

During the apartheid era, local government planning was characterized by the following:

❑ It was a technically-driven process without meaningful community participation.
❑ It focused on regulation and control of land use through a web of restrictions aimed at entrenching racial segregation spatially, socially and economically.
❑ It served the demands of the privileged groups in society, at the expense of the disenfranchised and the urban and rural poor.
❑ It was largely sectoral, with little integration between transport, land use and infrastructure plans.
❑ It was neglectful of issues relating to environmental sustainability and economic viability.
❑ It was largely unconcerned with poverty alleviation, social health and welfare.
❑ It neglected the facilitation of economic development.

During the 1990s, the concept of integrated planning was adapted in South Africa from strengthening international trends towards holistic and more sustainable development, and was seen locally as an appropriate method of beginning to address the deficiencies and injustices of apartheid planning.
The South African Constitution of 1996 requires that a municipality:

"must structure and manage its administration and budgeting and planning processes to give priority to the basic needs of the community, and to promote the social and economic development of the community.""

It was stressed early on that a new system of municipal planning should:
- ensure the participation of communities
- address most urgently the citizens' basic needs
- aim to disintegrate unjust spatial or institutional patterns of privilege
- aim to ensure integrated and sustainable development, and
- be focused on delivery.

A rural village

The Local Government: Municipal Systems Act has created the statutory framework within which all local authorities are obliged to embark upon a process of broadly-defined planning that is aimed ultimately at the complete reorientation of municipalities in South Africa.

The advent of integrated development planning has constituted a major watershed for local authorities in South Africa, being regarded by the national legislature as the key tool to re-orientate and refocus the vision and mission of local authorities as they prepare to manage a new developmental role.

7The goal of integrated development planning is to achieve more efficient and more effective delivery of both municipal and other services to communities, and the creation of a framework for economic and social development in the municipality.

The global trend towards democratization emphasizes the need for the equitable distribution of resources and services to the whole population.

The focus on Integrated Development Planning to combat inequitable spatial distribution of resources and imbalances between supply and demand, stressed the need for relevant and updated data as well as methods to analyse and improve the situation.

Introduction to Buffalo City Municipality

Situated on the South Eastern seaboard of South Africa, Buffalo City Municipality is an amalgamation of the City of East London, King William's Town, Bhisho (the Eastern Cape Provincial capital) and large rural areas. Whilst named a "City" the municipality is in fact mostly rural, some 2,500 square kilometres of small villages and townships. The total population of the municipality is in the region of 1,000,000 (Statistics South Africa, census 2001).

East London harbor, the only river port in South Africa

The Eastern Cape has been neglected in terms of development and is the poorest region in South Africa, with an unemployment rate of around 60%. This in itself creates huge challenges in terms of service delivery and spatial planning.
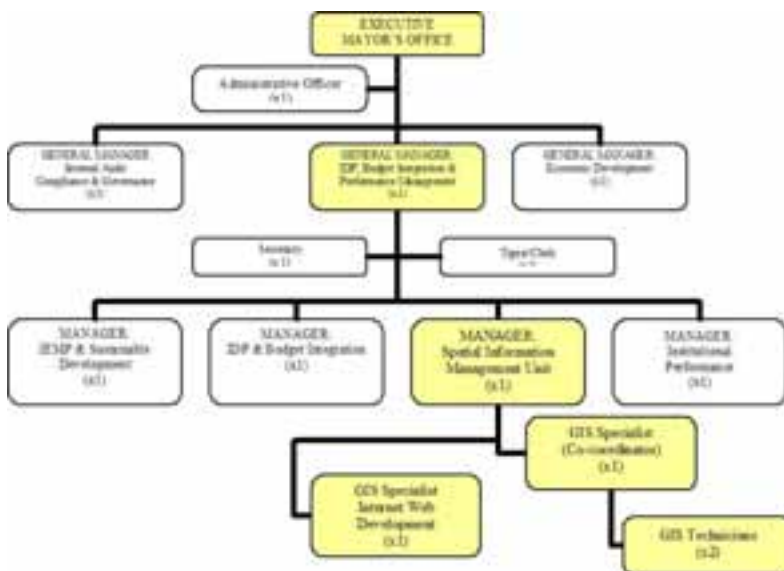
GIS as a decision making tool

Like other cities in South Africa, in relation to the amalgamation process, Buffalo City confronted a serious (geographic) information management problem. While the area of jurisdiction has expanded to embrace these rural communities, little or no base line information such as socio-economic and environmental data was available to support planning and management activities.

Likewise, the focus on Integrated Development Planning with objectives to combat the highly inequitable spatial distribution of resources including housing, infrastructure and services as well as imbalances between supply and demand across sectors, stressed the need for relevant and updated data as well as methods to analyse and improve the situation. The need to look beyond traditional planning tools to meet the development objectives of the municipality has been recognised as a priority.

To a large extend spatial analysis had been entirely absent from most social and infrastructural planning. Effective integrated planning and service delivery rests on the ability of decision-makers to correctly interpret information derived from data.

Consequently, a corporate approach to implementing a GIS to manage spatial data and develop decision support tools has received priority in Council's strategic thinking.

GIS had been implemented in the former East London Municipality but had not gained any momentum as the strategic objectives of the GIS were incorrectly defined, with the focus being on replacing record keeping systems and not aligned to the development of the city as a strategic planning tool.

Consequently the need to reintroduce GIS as a corporate support tool for managing spatial data and developing appropriate decision support tools has received high priority.

Current GIS Organogram

Approach and methodology
The role of GIS in the organisation has been defined and includes.
  o Promoting spatial information management techniques as a means of developing long-term planning strategies;
  o Facilitation of data sharing and collaborative data analysis
  o Making spatial and attribute information accessible through online GIS tools and database querying capabilities
  o Providing tools targeted specifically for user department needs
  o Development of data and metadata standards;
  o Focus on data acquisition, including data from quasi governmental departments and provincial government departments.

The challenge of developing strategies for bringing about a paradigm shift towards effective spatial planning has been high on the GIS agenda.

With the technological advances now available to municipalities, it has become possible to share spatial and attribute data between systems.

Within a municipality more than 80% of data has a spatial component that can be linked to an erf-based GIS system. This sharing of data allows for more informed decision-making, as management can view and control information from several diverse sources, in a single integrated application. The old saying of "a picture is worth a thousand words" is very true when analyzing data.

Through the development of on-line, web based, integrated GIS query tools the perception that GIS is a complicated tool used by planners and engineers for addressing very specific planning needs, is no longer true.

Setting up GIS Technical Working Groups

Integration of data, the development of standards and skills development has been paramount in the GIS strategy. To this end Technical working groups representing the municipal departmental structures have been formed

The Health Technical Working Group in action

▪ As a service provider the corporate GIS should at all times be mindful of the requirements of the user departments and individual clients.

▪ Technical Working Groups (TWGs) are needed to coordinate departmental requirements into and from the GIS.

▪ The members are recruited from the various departments in the municipality, on the lines of the IDP Thematic Task Teams, assisted by GIS staff such as the GIS Manager and GIS Analysts/Specialists.

▪ They are small operational teams composed of a number of relevant municipal sector department officials and technical specialists, who are involved in the direct management of implementation of identified programmes and projects.

GIS has been integrated into the various sector strategy plans giving an effective overview of what is planned in the municipality and where the development is scheduled to take place.
In addition to the members participating in the developmental planning of the GIS, they also are responsible for developing the spatial standards and metadata data sets required by council.

To empower the staff with GIS skills, a comprehensive training strategy was included in the GIS development framework.

Implement a Skills Development Program

An important factor in the successful GIS implementation in Buffalo City Municipality is the continuing availability of trained staff. Addressing effective staffing and appropriate training is an important part of the strategy.
A key objective with the training must be to try to eliminate the disparities between the departments and reach to a level where all can 'talk the same language'. Consequently, the training principle is a step-by-step process allowing all involved to participate in broad introduction training and at the same time producing a few GIS experts

There is a misconception that any staff member can be sent on the very specialized GIS training courses, offered by program vendors, and the staff member will return from a week-long training course as a GIS specialist. Whilst there is a need for this very specialized training, this in not ideally suited to meeting the staff training requirements.'

There are two main groups of staff that work directly with GIS: skilled specialists (analysts and technicians) and GIS end users, typically staff that need geographic information in their daily work, without having the necessary skills to be considered GIS specialists.

Also there are managers who need to know of the capabilities of the GIS without needing the specialist knowledge on how to use the GIS.

Training
Subsequently in the strategy adopted by Buffalo City Municipality, extensive in-house training programmes have been developed to address the three levels of basic GIS training required in the organisation.
- Basic users
- Data custodians
- Overview users (mangers and politicians)

- Specialist training (ArcGIS), offered by GIMS – the South African suppliers of ESRI products, is available to advanced users and specialists.

GIS end users need GIS for their daily tasks, but may not have the time or capacity to be trained as GIS specialists. Their requirements are for an introduction to GIS, which give the participants an understanding of what a GIS is, what it is intended for and how it is structured. The training focuses on the use of customised web tools and how these can assist the user in the course of their daily duties. To date some 600 staff members have attended the one-day Introductory GIS course.

The Data Custodian Training module is intended for departmental data custodians that manage sectoral databases and make the trainees competent with database building and management. Where

possible the participants use real data from their own sector and the outcome of the training are an understanding of their own database needs.

The objective is to make at least one representative from each of the departments competent and confident to organise, build, update and insert data into geographic databases.
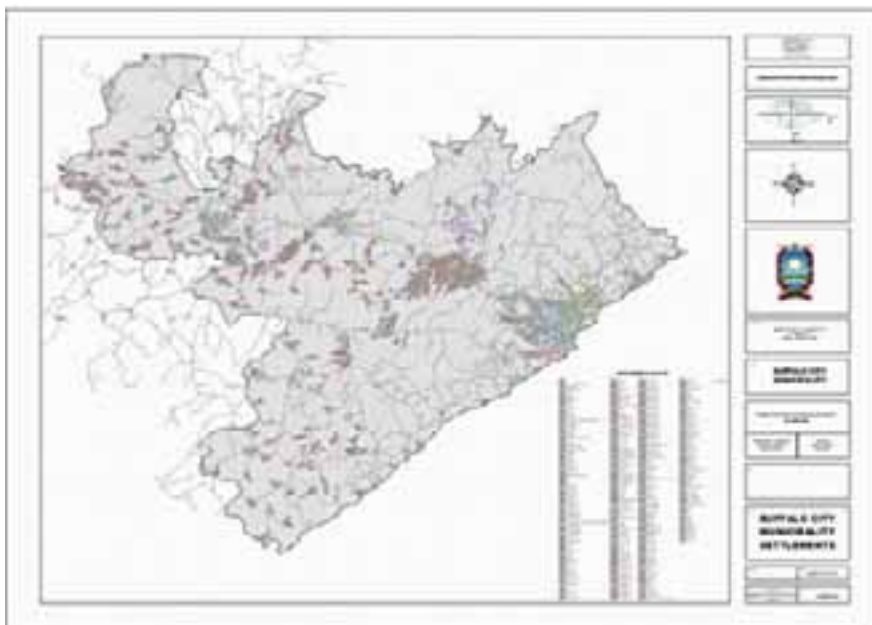
At the end of the course participants have a working understanding of the concepts, terminology and tools used to create and manage mapping data in a local government environment.

Finally, applied training is offered to the 'top' end users of the system; councillors, top and medium level management, that will not work directly with the GIS but require an overview of GIS and be informed on how GIS can be used as a tool to assist with the decision-making process.

Councilors learning about GIS

GIS in the analysis phase

Buffalo City Municipality settlements

The Municipality has developed a spatial dataset, digitised directly from aerial photography, which accurately identifies the geographic location of some 250 rural communities (settlements) within the region. Together with the demographics of these communities (to a large extent they match the sub place areas defined by Statistics SA for the 2001 census) these datasets become the backbone for planning rural development and meeting service level goals and objectives.

Analysis of planning proposals;

With service delivery being paramount on the IDP agenda, it is essential for planners and managers to know where development must be focussed. If the IDP objectives are to be met, planning and development must be coordinated where it is needed most.
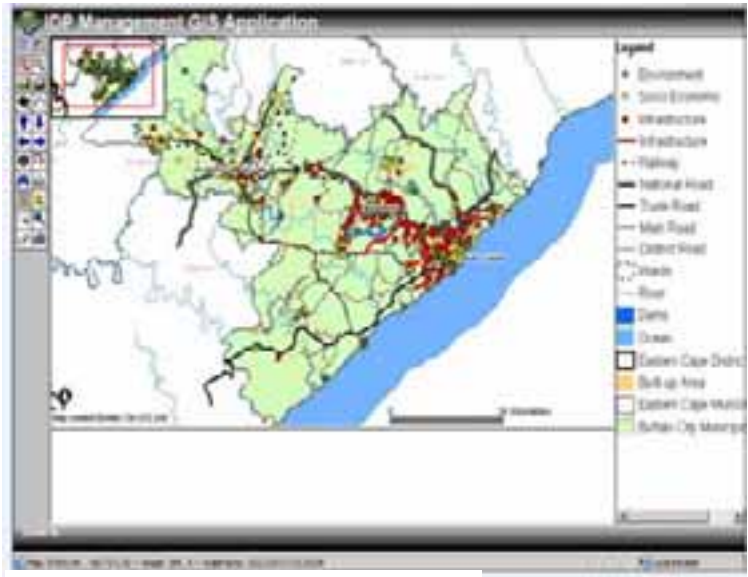
One of the most important functions of the GIS is to be able to visualise what is happening on the ground and to analyse spatial trends.

The advantage of using visual aids such as GIS is that experts and laymen alike can quickly analyse the information and make decisions based on these observations.

IDP has implemented a policy that requires all departments to submit an on-line detailed business plan for each proposed project. A policy of "No Business Plan, No budget" applies, which means that all projects are channelled through the IDP process. Each business plan is assessed and budgets and priorities are allocated accordingly.

As a physical location is required for each of these projects, a geographic analysis of the budget becomes possible (where is the budget being spent)?

Along with a budget analysis, a list of beneficiaries for each project, either at ward (political allotments) or community level, can easily be produced.

Spatial distribution of Projects

When a spatial comparison is made between these projects, departmental master plans and the Spatial Development Framework (SDF), it becomes obvious where this planning is out of synchronisation with the overall development strategy of the municipality, and where isolated planning is being initiated

Project Details

Identifying backlogs in service delivery

Another key objective of Integrated Development Planning is to address basic service delivery and identify service delivery shortfalls.

Using spatial analysis techniques identifying who has services and who does not becomes an easy exercise.

When a spatial analysis of service delivery components is conducted in an integrated fashion, gaps in service delivery areas are immediately highlighted. These in turn are compared to the departmental master plans and the Spatial Development Framework (SDF) and planning priorities are identified.
By interrogating both the spatial and attribute data, is it possible to identify not only the extent of service delivery but also the quality.
As an example, planners may know that a settlement is serviced with a water main, but without knowing the capacity the water pipe servicing the area, the quality of the service cannot be determined.

Using the ability of GIS to perform calculations based on distances, it is possible to analyse basic levels of service. Once the positions of the services are known e.g. standpipes, distances from these points are easily calculated using land parcel layouts (in the formal areas) or the location of informal dwelling units in the rural or informal development areas.

Infrastructure Construction

Focus on Infrastructure Maintenance

With the focus on failing infrastructure due to maintenance backlog issues, GIS identifies high risk areas by using up-to-date asset registers and infrastructure layouts. Whilst each of the individual disparate management systems will identify risks within that particular discipline, comparisons to other infrastructures layouts cannot be made.
By making use of information integration strategies, information from the various management systems are consolidated into a layered representation of service delivery infrastructure and critical areas that affect service delivery become easily identifiable.
Maintenance planning can then be prioritised in these high risk areas.

All these examples are reliant on accurate and up-to-date service layout and attribute information availability.

Maintaining good infrastructure asset records is not only a requirement of the auditor general but makes sound business sense as well.

Buffalo City Municipality is not yet at the stage where the analysis capability of GIS can be fully integrated into the planning activities of the service departments.

Once a determined effort is made by the service departments to capture the spatial components of the infrastructure assets, and these are linked to the maintenance/management systems for these assets, effective spatial analysis becomes a reality.

The monitoring process

Once GIS analysis has been used to facilitate the selection and prioritization of the IDP projects and these projects have been approved through the IDP and Budget allocation processes, it becomes paramount that the performance of these projects are carefully monitored.

An application to facilitate the monitoring of IDP projects has been developed by the GIS unit. The application is based on the IDP business plans, which ensures that all projects, both capital and operational, are incorporated into the management and monitoring process.
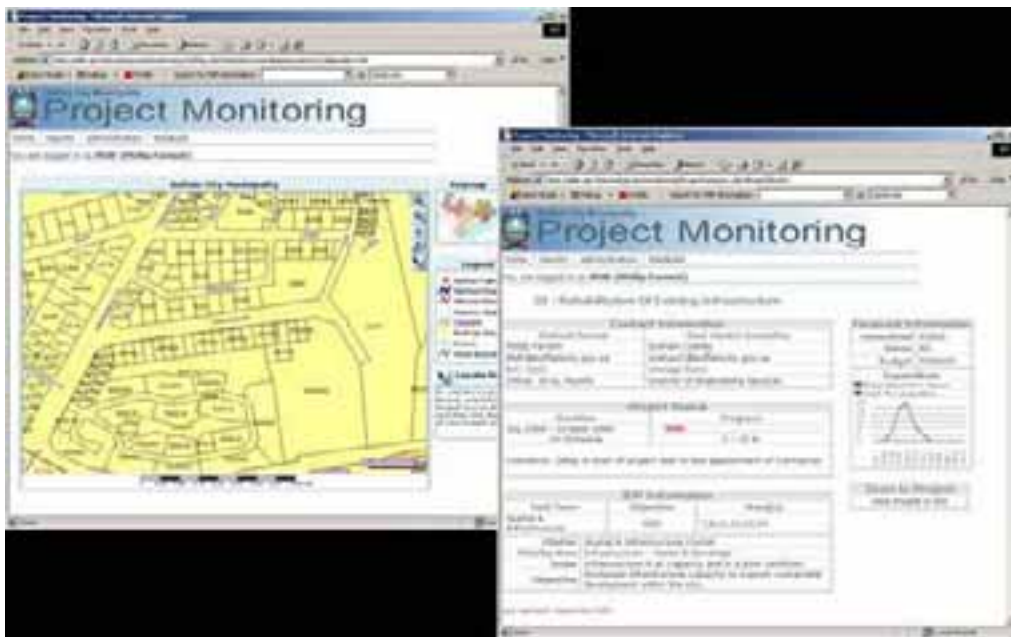Details such as physical location, communities served, budget allocation, cash flows and other information are accessed directly (not extracted, with the risk of multiple versions) from the Business Plans.
By attaching budget expenditure (extracted from the municipal financial system) and other indicators such as physical progress (entered by the project managers) early warning signs for project non-performance are easily developed.

Updating the physical progress of the project along with identifying any possible issues is an on-line manual process with project custodians being required to furnish this information of a monthly basis.

The implementation of such a management tool has several advantages:

1. **Central reporting tool:**

    Progress, budget, IDP and other management reports are required for the projects. A properly structured application can facilitate a central reporting database from which standard, structured reports are required against predefined requirements. With the technology available ad-hoc reporting is also available using third party report generators.

2. **User friendly interface to the state of the projects.**

    The application has a user friendly Intranet based front end to the GIS system and information databases. Managers can select Indicators for populating a status map and can easily view which projects are on or behind schedule as well as which projects are under or overspent. Project indicators are coloured according to their status, red for problematic projects and green for projects without issues.
    By clicking the cursor on the project, selected through the map interface, access to the database is granted and all the project details are immediately available to the manager.

Through the project, management has immediate access to:
- o Project expenditure
- o Actual progress
- o Project Issues
- o The spatial distribution of the projects

3.   Monitoring Performance;

GIS in Buffalo City Municipality has developed an accurate base map showing all individual erven (land parcels) as well as an accurate spatially enabled road network. All rural communities and villages have been identified and added to the base map. When viewed together with the aerial photography and service infrastructures, an accurate picture of what the municipality looks like is readily available.

By using spatial and attribute query tools on the databases, indicators can be extracted and used to measure the performance of the municipality against predetermined baseline targets.
As the data is date stamped, an analysis over time will determine growth trends and the meeting of the municipalities' strategic objectives.

GIS applications to support management

Several GIS applications have been developed in the GIS Unit to assist managers and users in the organization

Health care application

The purpose of the Primary Health Care GIS application is to provide for a means of analysing Health Information.
Primary Health Care Information is extracted from the DHIS (Department of Health Information System) on a monthly basis. From this information, eight Key Indicators are extracted.
The Key Indicators have been linked, via GIS, to Health Facilities making it possible to detect and monitor spatial trends in the Indicators.
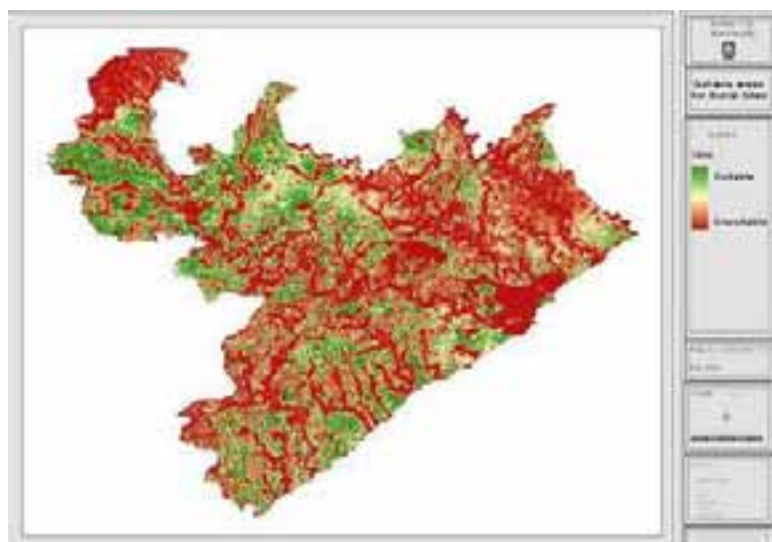

The Health GIS application on the corporate ArcIMS site

Burial Management

The GIS Unit has developed a GIS burial management system whereby the 20 formal cemeteries can be managed on-line from any location within the municipality along with the option to create assessment and cemetery status reports. Currently the capturing of the paper based records for these cemeteries is an ongoing process.

Most of the informal cemeteries have been identified and mapped which becomes

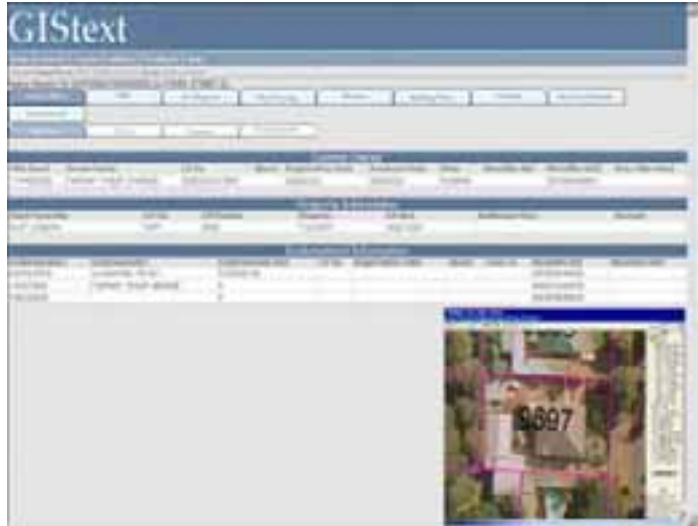important when planning new infrastructure and developments.

Through a GIS analysis of the municipality, possible new cemetery sites in the city have been identified to assist with the problem of Buffalo City Municipality running out of burial space.

GIStext / CityMap Information Application.

Information dissemination to management and staff is a key requirement of the corporate GIS. To meet the increasing demand for spatial information, the development of sophisticated GIS dissemination tools has ensured that GIS is now available to all that are connected to the municipal data network.
By far the most often used GIS tools are the Internet map servers that disseminate spatial data using a web browser. GIS thematic maps and layered information maps are easily developed by specialist GIS operators, and are then published by the web server.
If care is taken in the development of these maps, most of the dissemination and data sharing requirements for the GIS are taken care of.

Special Achievements in GIS
The highlight in the implementation of GIS in the Buffalo City Municipality was the winning of a "Special Achievements in GIS" award at the 2004 ESRI conference in San Diego.

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