GIS IS COMING OUT OF THE CLOSET

Paper Presented by :

Graeme Martin

Author:

Graeme Martin, *Senior Project Manager,*

Spatial Vision

65th Annual Water Industry Engineers and Operators' Conference
Kardinia Heights Centre - Geelong
4 and 5 September, 2002

GIS IS COMING OUT OF THE CLOSET!

Graeme Martin, *Senior Project Manager,* Spatial Vision

ABSTRACT

A recent survey of the Victorian water authorities found that Geographic Information Systems (GIS) are well-established across 17 of the 23 organisations. However, a generational shift from use of the GIS by a small number of backroom specialists to corporate-wide deployment is underway. In 2002, 40% of water authorities have, or are in the process of, implementing GIS that will enable everyone from front-desk staff, engineers and managers to access the latest details and locations for assets, complaints and customers.

The paper provides an insight into the common benefits, disappointments and issues faced by each of Victoria's metropolitan, urban and rural water authorities in using GIS, based on a recent industry-wide survey. The paper also explores the typical approach to implementing a corporate GIS.

1.0 INTRODUCTION

The water authorities in Victoria, like their counterparts across Australia, are under increasing pressure to more efficiently manage their asset infrastructure whilst meeting environmental and customer performance standards. The 23 Victorian authorities range widely in service type, number of connected clients, geographic factors and service area. However, they face common challenges in managing millions of dollars of assets and meeting the service demands of clients, government and other stakeholders.

Geographic Information Systems (GIS) are a mature technology that are widely used across utility service providers charged with managing valuable, dispersed infrastructure. GIS provides a powerful tool to capture and record the extent of assets, schedule their replacement; identify the impacts of outages; plan works activities, manage customer queries and analyse environmental issues.

This paper describes the extent of use of GIS across each of the Victorian metropolitan, urban and rural water authorities. A recent survey of each of the Victorian authorities conducted by Spatial Vision found that 17 have implemented GIS and another 4 operate Computer Aided Drafting (CAD) systems for digital mapping of their assets. In total, all bar one authority have operational GIS or CAD, or contracted out this service or are planning to implement GIS. The paper outlines the key findings from this survey.

1.1 Method

The survey of each of the 23 authorities was conducted via telephone in February and March 2002. In most cases, a copy of the survey form was e-mailed to the authority for perusal prior to the telephone interview. In general, the survey respondent was responsible for operation of the authority's GIS or equivalent.

1.2 Results

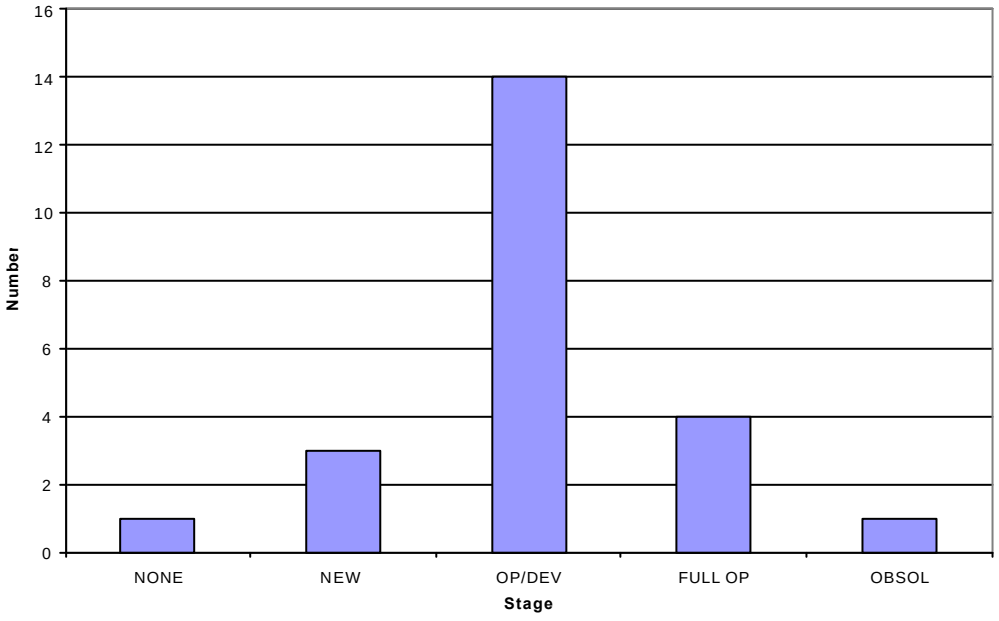
Given differences in the size and nature of the authorities, the survey results have been summarised using four categories: Metropolitan Authorities (3); Large Urban Authorities (greater than 35,000 connections - 7), Small Urban Authorities (less than 35,000 connections - 8); and Rural Water Authorities/Suppliers (5). Quotes from individuals are cited for qualitative support, however, the responses of individual authorities have been kept confidential.

2.0 STATUS OF GIS IMPLEMENTED

The degree of implementation of GIS varies between authority type: Metropolitan:100%; Large Urban:100%; Small Urban: 50%; and Rural: 60%. Whereas some of each of the four types of authorities first implemented GIS as far back as 1988, the average year of first implementation of GIS also relates to the type of business. The averages were Metropolitan: 1992; both Urban: 1994 and Rural: 1996.

The operational deployment of GIS technology, like other information technology applications, tends to follow a cyclical process of implementing one level of technology followed by a subsequent system replacement or upgrade. Figure 1 highlights the current status of GIS across the authorities. NEW refers to authorities without a GIS but in the process of selecting or implementing one. OP/DEV refers to those sites with an operational GIS but under development. Several authorities said that although their GIS was fully deployed they continued to enhance its use hence the dominance of this category. FULLOP refers to GIS considered fully operational. OBSOL refers to a GIS considered obsolete by the relevant authority.

Figure 1: ***Stage in GIS Life Cycle in Water Authorities***



The top six reasons for implementing the current GIS in the authorities, in order of importance are presented in Table 1.

Table 1: ***Reasons for Implementing GIS***

MAJOR REASON (from list provided)	Total Ranking
Locating assets	1
Asset replacement planning	2
Integration with Asset Management System	3
Work planning and management	4
Locating complaints	=5
Locating customers	=5

Clearly the primary driver for authorities to decide to implement or upgrade their GIS is to better manage their assets. The main benefits from implementing the GIS perceived by those surveyed were also mostly related to asset management (Table 2). However, the response to this question could be expected to vary according to the role of the person in the organisation interviewed.

Table 2: ***Benefits from Implementing GIS***

MAIN BENEFIT (from list provided)	Total Ranking
Quantifying the location	**1**
Asset replacement planning	**2**
Value and condition of assets	**3**
Quick access – customer/complaint locations	**4**
Workforce management planning	**5**

Not all of the organisations that have implemented GIS were satisfied with it. Ten percent felt that the organisation did not value their investment in GIS. One organisation noted that it took a while to get general satisfaction with the GIS and that they needed to manage user and senior management expectations. Another organisation said that while the operational workforce appreciated the GIS outputs, senior management did not think they were getting adequate value from the investment.

The greatest disappointments from implementing GIS varied with the type of authority (Table 3). The cost of GIS software was clearly a common issue for all authorities. However, for Rural Authorities the availability or cost of technical support was also a common major issue.

Some of the small authorities believed their major challenge to implementing GIS to be amassing sufficient resources and an appropriate organisational structure. The small size of these authorities was a major impediment and so they were considering multi-client solutions (ie setting up collaborative GIS arrangements) to share costs and resources with other similar organisations.

Table 3: *Greatest Disappointment from Implementing GIS*

MAIN DISAPPOINTMENTS (from list provided)	Metro Ranking	Large Urban Ranking	Small Urban Ranking	Rural Ranking	Total Ranking
Cost of software licence agreements	2	2	1	1	**1**
Cost of/ unavailability of technical support	4	1	2	2	**2**
Data management issues and costs	1	3	3	4	**3**
Lack of broad access to GIS maps & views	3	2	4	5	**4**
Other	6	5	1	3	**5**
Cost of on-going user training and support	5	4	6	4	**6**

3.0 GIS SOFTWARE

Water Authorities in Victoria use a range of GIS and CAD software; in several cases running software applications from more than one software vendor. This may be due to limitations of the software and / or work practices. For example, specific staff may be skilled in one software application for data maintenance, whereas another application may be necessary for viewing and enquiries.

The Total Applications row (Table 4) identifies each of GIS and CAD applications (grouped by the software vendor) used by the authorities. For example, there are six authorities (Total Applications) using MapInfo; one authority uses it exclusively (Single Vendor) and five other authorities use it in conjunction with other vender software.

The authorities with GIS applications from only one vendor are listed in the row Single Vendor. The ESRI suite of GIS software and the Infomaster related products (Infomaster, Landmaster and Eagle) are the two most common complete GIS solutions used by authorities.

Table 4: *GIS and CAD Applications Used by Authorities*

Applications by Vendor	ESRI ArcView/ ArcInfo/ Eview	MapInfo	AutoCAD	Infomaster/ Landmaster/ Eagle	Intergraph/ Microstation	Other	Total
Total Applications	7	6	3	5	5	4	22
Single Vendor Application	5	1	1	3	2	3	15

4.0 DATA MANAGEMENT

Management and access to data is a substantial part of GIS operations. Table 5 presents the six main issues confronting Victorian Water Authorities in relation to data. Clearly all of the authorities recognised their major issue as the accuracy and quality of available data. In most cases, access to timely updates of the cadastre was also a major issue. This result is not surprising, given the fundamental importance of access to reliable data for effective deployment of GIS and in many cases the cadastral boundaries define the water authority clients' property boundaries.

The rural and smaller urban authorities highlighted that access to suitable technical advice and the cost of data management as substantial issues for them.

Table 5: ***Importance of Issues in Managing Data***

MAIN DATA MANAGEMENT ISSUES (from list provided)	Metro Ranking	Large Urban Ranking	Small Urban Ranking	Rural Ranking	Total Ranking
Accuracy/quality of available data	1	1	1	1	1
Access to timely updates of cadastre	2	2	4	2	2
Cost of data management	4	4	2	1	3
Access to technical advice on data management	3	5	3	1	4
Sharing data between agencies	5	3	5	4	5
Access to timely updates of other Vicmap data	6	6	5	3	6
Other	7	7	6	5	7

The primary source of digital base spatial data for authorities is the Land Victoria property data and to a lesser extent their roads and topography datasets (see Appendix 1: Section 3.1). The business specific datasets held by the authorities were identified in the survey, Table 6.

Table 6: ***Other Digital Data Held by Authority by Number***

Other Digital Data Held by Authority (from list provided)	Numbers of Authorities
Assets	**19**
Administrative boundaries	**13**
Aerial photography	**12**
Customer properties	**11**
Scanned plans	**11**
Office/service locations	**6**
Natural resources	**6**
Satellite imagery	**4**
Other	**3**

The results highlight the GIS focus on asset management. Importantly, there is a relatively high use of aerial photography and scanned plans to provide a visual context for the GIS by authorities.
The use of satellite imagery is comparatively low which is most likely due to the relatively low resolution of images of the technology in comparison to aerial photography. Overall, the results show the high level of investment in a range of digital data by the authorities hence the concerns with cost of data management. The survey showed that the majority of authorities (16) maintained

their own digital data (see Appendix 1: Section 3.4).

5.0 FUTURE CHALLENGERS TO MAKING GIS USEFUL

The survey respondents made a number of interesting points regarding the challenges they faced in implementing GIS and ensuring that it was recognised as useful. A selection of these are listed here:

- The GIS has been set-up and used by engineers for engineering purposes so the challenge is to make it useful outside the engineering domain.
- The GIS must meet business objectives. In the past it has only been used as a glorified map so it must become more things to more people.
- As most databases in the authority don't 'talk' to each other, the challenge is bringing the databases together and running validation processes.
- Getting the GIS to as many users as possible, including remote areas where network bandwidth is limited.
- As the user base expands toward low-knowledge users, need to find more intuitive products for these users.
- When moving from well-informed data reviewers to strategic users, helping these people to understand data structures and data rules.
- Completing field data collection and validation.
- Implementing a fully connected network for wastewater and water networks.
- Enabling GIS to integrate with water modelling package and asset management package.
- Deploy information over the intranet and internet.
- Moving into mobile computing with GIS.
- Ensuring that GIS stays integral to the business needs and supports same.

6.0 EXTENT OF USE OF GIS WITHIN AUTHORITIES

The breadth of use were identified for each authority GIS or CAD and classified in one of three categories:

- Restricted (use limited to a number of GIS specialists)
- Partial (available for use by limited number of staff, typically one or two sections)
- Corporate-Wide (available for use across the organisation)

Table 7: *Use of GIS and CAD Software*

Use Category	Restricted	Partial	Corporate-Wide	Not Applicable
Number of Authorities	6	7	9	1
Implemented/ Upgraded since 1999 – Number	5	4	7	-
Percent	31%	25%	44%	-

The figures in Table 7 include authorities currently using GIS as well as those in the process of specifying or developing their GIS. The survey results highlight that 40% of authorities have already implemented or are going to implement some form of Corporate-Wide GIS. Since 1999, the largest number of upgrades, implementations or planned installations have been focussed on corporate-wide GIS (44%). The three major metropolitan authorities have had their corporate systems in place for sometime. However, the trend now is for medium and smaller sized authorities to implement GIS organisation wide. The percentage moving to corporate or enterprise-wide GIS is similar to a GITA survey of the water utilities in the USA that found that 47% (of the survey participants) were implementing GIS on an enterprise-wide basis (GITA, The Geospatial Technology Report 2001).

7.0 GIS IS COMING OUT OF THE CLOSET

In the 1990s, GIS was seen very much as the domain of the technical experts, "probably belongs in Engineering". Typically GIS was used by a few people 'out the back' of the organisation. Although the technology long-held the promise of improving the operation of the business, it was not really accessible to many people. In addition, in many cases, especially in rural areas, the base GIS data was either not available or unreliable. The main focus of the GIS stakeholders, like Land Victoria, in the 1990s was the capture and improvement of base government data like cadastre (property boundaries) and road networks, datasets that are fundamental to implementing effective GIS in water authorities.

In the 2000s, base data is now readily available and it is feasible to deploy GIS corporate wide especially using web-based technology. However, it's only financially justifiable if it is going to improve the efficiency and effectiveness of services. The survey clearly shows that the cost of implementing GIS was the highest concern for authorities so the decision to move to corporate wide GIS must be compelling.

Each authority is responsible for managing and accounting for millions of dollars worth of dispersed assets and improving operational delivery through customer service contracts. The move towards corporate-wide GIS by the Victorian water authorities indicates that they recognise the potential for this technology to assist them in these critical areas. A well-planned deployment of GIS will enable authorities to identify the extent and condition of assets, better plan works activities and interact with customers.

8.0 IMPLEMENTING A CORPORATE GIS

The implementation of a corporate GIS, that is technology that is going to be effective for the range of business perspectives and interests across an authority, is no mean feat.

As noted by a survey respondent, the challenge is to ensure that the GIS meets business objectives and becomes more than a glorified map production tool. The critical element is to make sure that

the information requirements of the authority are well understood and that the GIS is designed to be an integral component of the corporate data infrastructure and information services, and not an auxiliary system tacked on the side.

The typical implementation of a corporate GIS involves:

- Defining the organisation's information requirements for spatial data and related links to business systems to develop a 'data model'.
- Converting existing digital or paper mapping into intelligent information.
- Ideally deploying a functionally powerful and easy-to-use GIS that requires minimal customisation to be useful to the authority thereby keeping down upfront and ongoing support costs.
- Integrating the GIS with existing business systems.
- Training staff according to their type of use of GIS eg. from technical administrators to business query users.
- Implementing a strategy to ensure that the technology, data and users are well supported.

9.0 CONCLUSION

In summary, GIS technology is deployed into all of the major metropolitan and urban water authorities and increasingly into the remaining urban and rural authorities. The major reason for implementing GIS was to assist the management of assets. The major common issues facing authorities was the cost of software and availability of technical support, and the quality of available digital data.

The full potential for harnessing GIS technology to assist operational effectiveness comes from implementation of corporate GIS that enables everyone from front-desk staff, engineers and managers to potentially access the latest details and locations for assets, complaints and customers. At the time of the survey, 40% of water authorities have, or are in the process of, implementing a corporate-wide GIS. A corporate GIS moves access to the technology out of the backroom, the domain of the specialists, to make it available to all staff. The challenge to implementing an effective corporate solution is to ensure that the GIS is designed and operated to meet business needs and is readily accessible and useable by staff across the authority.

10.0 ACKNOWLEDGMENTS

Spatial Vision would like to thank the respondents from the each of the water authorities for their time and input. A special thanks to Peter McRae from South Gippsland Water for his feedback on concepts.

12.0 REFERENCE

The Geospatial Technology Report 2001 - A survey of Organisations Implementing Geospatial Information Technologies (2001), Geospatial Information & Technology Association (GITA), Aurora, USA.