Geographic Information System

Cost/Benefit Assessment Report
M-NCPPC

Submitted to:

Montgomery County Council's
Management and Fiscal Policy Committee

April 12, 1999

INTRODUCTION

A “Benefit Assessment Report” was prepared in November 1997. That report summarized benefits associated with the GIS as of that date. However, because the GIS had not been fully implemented, that report was considered premature and misrepresented what was known to be the real impact of the County’s GIS. In the fall of 1998, the County Council requested that a benefit report be prepared outlining what had been realized with the implementation of the GIS. As part of the guidelines for preparing the report, the Council stated that they did not want a justification of the GIS, but rather what had been realized with the new technology. Consequently, this report was prepared by using the original report’s format. The information has been updated and expanded to reflect the benefits achieved with the County’s GIS.

HISTORY

M-NCPPC has traditionally performed a variety of map and geographic analysis functions. A standard set of property maps has been maintained and updated for years. Each year, a set of planimetric and topographic maps was acquired to update a portion of the County. Numerous maps were produced for the various planning analysis, public information, public hearing, and reporting functions of the Commission.

GIS implementation began in 1989, following the preparation of a feasibility study and a implementation plan. A pilot project (GeoMaP) was conducted in coordination with Montgomery and Prince George’s County Executives and WSSC. Large-scale map database development began in 1992 following an evaluation of the pilot project. The basemap development was completed, on schedule, in July 1997.

Currently, the GIS has been implemented and is operational throughout the County. Many departments and agencies are now using GIS to support their functional operations. M-NCPPC is performing maintenance on the basemaps and developing additional coverages, such as the street address and zoning. The property coverage is updated daily, and a maintenance plan has been developed for the planimetric/topographic coverage.

PREPARATION OF THIS REPORT

The original report was reviewed and comments were incorporated from the GIS users, GIS management, and support personnel at M-NCPPC. As part of the overall maintenance and documentation of the GIS, a number of databases have been developed to track GIS activity. The findings of those databases were also added to this report. It must be emphasized, however, that this report deals only with M-NCPPC’s GIS activity, and so consequently only a portion of the benefits realized by GIS implementation.

MEASUREMENT OF BENEFITS

Benefits may be measured in quantifiable terms of dollar value and/or time saved, or non-quantifiable terms of quality, efficiency, and service. The conventional approach to benefit analysis in the GIS field has been a classical cost/benefit analysis conducted prior to embarking on GIS implementation. Such an analysis was conducted for the five-agency GIS consortium that included M-NCPPC. In that analysis, potential GIS uses were identified and the potential benefits in each of the five areas were estimated or defined. This type of analysis is very useful to the decision-making process regarding GIS implementation, level of implementation, and phasing of implementation.

Very little analysis of benefits has been conducted in the industry following implementation to determine the actual benefits experienced from GIS use. Once justified, most organizations do not require follow-up analyzes of GIS benefits. Without examples of how others calculate or document the post-implementation benefits, the preparation of this report presented a challenge on how exactly to relate M-NCPPC's benefits.

Several challenges exist for post-implementation benefit analysis. GIS is a support tool rather than a line function. GIS operations are imbedded in planning, decision-making, and other processes. The value of GIS to those processes and the contribution of GIS to improved service or decision-making is often difficult to determine.

Reliable quantification of the benefits is often difficult because baseline information on pre-GIS conditions, costs or resource requirements is unavailable. Direct savings are difficult to determine reliably and savings are often actually experienced in other operational areas that use GIS. Because of the nature of GIS and its ability to make many operations practical that were not practical in the prior environment, many of the most valuable benefits are in areas of improved service and performance rather than direct cost savings. These improvements are particularly difficult to quantify.

The GIS is used for data maintenance functions that provide support for many activities in the organization. GIS generates benefits for these background functions through improvements in efficiency, elimination of redundancy, timeliness of data, and availability of data. Again, the role of the GIS is one of background support rather than direct service.

TYPICAL PROBLEMS ENCOUNTERED IN THE PRE-GIS ENVIRONMENT

Many problems have been experienced in accessing maps and geographic information, processing information, and producing maps and report products. Examples of problems encountered at M-NCPPC include:

1. Cannot find correct data when needed
2. Maps and data are out of date, incomplete, inaccurate

3. Different data sets and maps have incompatible formats, definitions, and scale
4. Need to create and maintain redundant data and maps in individual organizational units
5. Number of maps produced is limited by the person-time required
6. Number of alternatives evaluated during a study is limited due to the time and cost required for materials and staff
7. Combining data and maps for a study is time-consuming and difficult
8. Dependent on personal knowledge and memory
9. Products are not standard.

BENEFIT AREAS

GIS offers the potential to solve or minimize the above mentioned problems and to generate many benefits through its flexibility, speed, availability, and processing power. Benefits have been achieved through GIS for a number of M-NCPPC's objectives. They typically fall into five areas:

a. Improvements in existing operations
b. Additional capabilities not available in a non-GIS environment
c. Response to unexpected, non-planned, or emergency situations
d. Intangible improvements
e. Revenues generated through sale of data and products.

EXPLANATION OF BENEFIT CHARTS

The following charts contain specific information on the factors determined to be the most useful in evaluating benefits with GIS at M-NCPPC. The grouping of GIS function types between the various charts further demonstrates its value since the groupings illustrate the wide range of possibilities with GIS.

Each GIS function chart details two broad aspects of benefit assessment. First, are the two columns entitled 'Typical Problems' and 'Benefit Areas'. The letters and numbers in these columns correspond to those detailed in the previous section. As stated above, these are of the non-quantifiable type, in which dollar amounts are difficult, if not, impossible to estimate. The remaining columns contain tabular data, in terms of work hours and cost, used to quantify the pre- and post-implementation of GIS. The various calculations that were done to achieve the results in the 'Difference' and the 'Annual Amount' columns clearly present the benefit of GIS. It must be stressed, at this point, that the hourly rate of $38 was used in these cost factors, while the industry's fees range from $90 - 130 an hour. Also, the number in 'Times Performed Yearly' reflects how often that function was done or what would have been beneficial. The sheer time required for producing some of these products would restrict them being accomplished at all. With the GIS, the frequency in accomplishing some of these functions is greatly increased.

Table 1a - GIS Analysis groups and summarizes some of the benefits that have been realized due to the analytical capability of GIS. It is the capability of spatial analysis that is the core of any GIS. The ability to analyze and compare areas in the County, with uniform data, provides a decision-making tool which was almost impossible before the GIS.

TABLE 1a

GIS ANALYSIS

	Typical Problems	Benefit Areas	Hours w/o GIS	Hours with GIS	Difference	Cost Savings	Times Performed Yearly	Annual Amount
Analysis								
Smart Growth	1,3,5,6,7	a,b,c	1,800	40	1,760	$ 66,880	1	$ 66,880
Adult Entertainment	1,2,3,6,7	b,c	320	20	300	11,400	1	11,400
Gun Store	1,2,3,6,7	b,c	320	40	280	10,640	1	10,640
Commercial/ Industrial Property	1,2,3,4,9	a,b,e	40	4	36	1,368	4	5,472
Forest Conservation From Site Plans	2,7	a,b	24	4	20	750	1	780

Table 1b - GIS Production groups and summarizes some of the benefits that have been realized due to the ability to prepare and produce maps in a more timely manner. Previously, it could take weeks or months to produce a certain map, while with the GIS not only is it faster, but different options can now be tried with the saving of preparation time.

TABLE 1b

GIS PRODUCTION

	Typical Problems	Benefit Areas	Hours w/o GIS	Hours with GIS	Difference	Cost Savings	Times Performed Yearly	Annual Amount
Production								
General Maps	2,5,6	a,b,c,e	80	2	78	$ 2,964	20	$59,280
Planners' Maps	5	a,b,c	24	. 5	23.5	893	60	53,580
Mailing Lists	2,4	e	16	4	12	456	25	11,400
Master Plans	3,5,6	a,b,d	32	2	30	1,140	20	22,800
Community Association Maps	3,6,7	d,e	360	9	351	13,338	1	13,338
Environmental	3,4,7,9	a,b,c,d	80	8	72	2,736	10	27,360
Park's	4,5,6,7	b,e	240	6	234	8,892	4	35,568
Park Planning	4,5,6,7	b,e	240	40	200	7,600	2	15,200
Pipeline	2,3,4,5,7	a,e	480	8	472	17,936	1	17,936

Table 1c - GIS Projects groups and summarizes some of the benefits that have been realized with on-going projects. The GIS data can be collected over a period of time and then used to produce the results.

TABLE 1c

GIS PROJECTS

	Typical Problems	Benefit Areas	Hours w/o GIS	Hours with GIS	Difference	Cost Savings	Times Performed Yearly	Annual Amount
Projects								
Vacant Commercial Land	6,7	b,d,e	200	40	160	$ 6,080	2	$12,160
Tabulate Zoning Areas	1,9	a,b	1,400	80	1,320	50,160	1	50,160
Impervious Area Measurement	3,5,6,7,9	a,b,c	600	40	560	21,280	1	21,280
Slopes	5	a,b	660	8	652	24,776	1	24,776
Preliminary and Site Plans	4,5	a,b	300	20	280	10,640	1	10,640
Park Police Grid	6	a,b	160	40	120	4,560	1	4,560

Table 1d - GIS Special Map Programming groups and summarizes some of the benefits that have been realized due to the ability of programming special mapping projects with the GIS. Once a program is written, it can be used whenever a map in this groups needs to be produced. In the Hours with GIS column, the number in parenthesis indicates how much time is required with that program. The maps produced in this group are all "special" types of maps that would have been quite difficult (i.e., legislative district) or impossible (the conference maps) to produce without GIS. In this group the Casual User and MapMaker would have been impossiible without GIS. However, these are examples in which M-NCPPC's participation at conferences helped enhanced the County's image and highlights our GIS accomplishments.

TABLE 1d

GIS SPECIAL MAP PROGRAMMING

	Typical Problems	Benefit Areas	Hours w/o GIS	Hours with GIS	Difference	Cost Savings	Times Performed Yearly	Annual Amount
Special Map Programming								
Legislative District Maps	5	b,c,d	480	100 (20)	380	$14,440	1	$ 14,440
Council Member Maps	5	b,c,d	480	100 (20)	380	14,440	1	14,440
GIS Conference	5	b,c,d	Impossible	80 (20)	80	3,040	1	3,040
MACo Conference	5	b,c,d	Impossible	80 (20)	80	3,040	1	3,040
Casual User	5,9	a,d	120	1	119	4,522	1	4,522
MapMaker	5,9	e	120	1	119	4,522	1	4,522

Table 1e - GIS Studies groups and summarizes some of the benefits that have been realized when using the GIS for studies on a geographic area. Each of the studies listed had to combine different aspects or coverages before the study could be undertaken. For example, the ICC study needed to know a variety of information before scenarios could be developed. The GIS proved to be a time saving tool when these studies were undertaken.

TABLE 1e

GIS STUDIES

	Typical Problems	Benefit Areas	Hours w/o GIS	Hours with GIS	Difference	Cost Savings	Times Performed Yearly	Annual Amount
Studies								
ICC	7,9	a,b,c	Impossible	80	80	$ 3,040	1	$ 3,040
Census	2,3,4,5,6	a,b	360	80	280	10,640	1	10,640
Transportation Policy Report	5,7,9	a,b	300	40	260	9,880	1	9,880
Site Characteristics	1,6,7	a,b,e	1,200	320	880	33,440	1	33,440
Forest Conservation Prioritization	1,9	a,b	900	40	860	32,680	1	32,680

SUMMARY OF GIS FUNCTION CHARTS

The following chart summarizes the monetary results from the previous tables (Tables 1a-1e) on GIS functions.

	Estimated Typical Annual Amount
Analysis	$ 95,172
Production	256,462
Projects	123,576
Special Map Programming	44,004
Studies	89,680
Total	**$519,214**

ADDITIONAL COST / BENEFIT SAVINGS

In addition to the totals above, there are other benefits that should be included in any study. Tables 2 and 3 have figures that quantify other benefits.

Table 2 summarizes GIS data product sales for the fiscal years 1996 to 1998. These figures not only represent revenue but more importantly the demand that the GIS data has generated. Without developing any comprehensive sales marketing strategy the GIS data, standing on its own repetition, has developed enough interest and respect that buying it makes good business sense. In a relatively short period of time, sales have steadily increased. The use of the County's data enhances both the private and public sector with the result being data consistency.

TABLE 2

GIS DATA PRODUCTS SALES

	FY98	**FY99**
GIS Data Products	$36,191	$44,439*

* That figure represents GIS sales from July 1st through April 1st. Using that figure, GIS sales prediction for FY99 is $59,251.

Table 3 summarizes the number of employees trained in ArcView, Casual User, and MapMaker. Not only have the employees been using the GIS data but as the numbers below indicate, they are becoming a more knowledgeable workforce, thus increasing their individual value to M-NCPPC. Furthermore, fees are charged for training those individuals outside M-NCPPC and those fees are used in the maintenance process

TABLE 3

TRAINING

	ArcView	**Casual User**	**MapMaker**
M-NCPPC	110	36	100
City of Gaithersburg*	8	4	1
Department of Permitting Services*	8		
County Council Staff	3	3	3

* Both the City of Gaithersburg and the Department of Permitting Services have each scheduled additional training with M-NCPPC for members of their staff.

Table 4 demonstrates that in less than a year and a half the number of GIS users at M-NCPPC has increased almost eight times over. This increase in the level of users in such a short time reaffirms the conclusions made in the original feasibility study – the GIS database will be used extensively within an organization.

TABLE 4

GIS USERS

Organization	**Current**	**Original Report**
Transportation	8	1
Parks	20	5
Environment	15	4
Research	18	4
Development Review	20	1
County-Based Planning	40	3
Total	**122**	**16**

FUTURE SAVINGS / BENEFITS

M-NCPPC is just beginning to realize that the savings / benefits of the GIS are not only quite varied, but can also be unexpected. Some of these benefits were anticipated while others are a “pleasant” surprise. One such surprise, is the saving of file space and work hours needed to file copies of the basemaps. Now that current copies of the basemaps are readily accessible, maintaining a file of the maps is unnecessary. This frees staff up to do other tasks, but also frees up floor space in an already crowded building.

There are two upcoming projects that will also have a savings / benefit for the County due to the GIS. First of all there is the design and implementation of the new development review system. This project cannot be discussed without the mention of GIS and the necessity that this new review system be linked to its database. Tying the geographic aspect and development plans together from the very start of any project holds a value that can’t be calculated. With the GIS and the new development review system working together those parties involved that process will benefit every day.

CONCLUSION OF THE COST / BENEFIT ASSESSMENT AT M-NCPPC

GIS has proven to be a valuable tool for the persons and organizational units at M-NCPPC. All available information indicates that it is in actual practice achieving what was expected of it in the original feasibility study almost 10 years ago. Furthermore, M-NCPPC has proven that the implementation of GIS is a technology that can mature and adapt to the current trends in the industry (i.e., 3D) and continue to serve the County.