University of Southern Queensland

Faculty of Engineering and Surveying

Setting up an Engineering Asset Management System for a Small Local Government Council

A Dissertation submitted by:

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Research Project

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Executive Summary

This research project appreciation looks at the main purposes and benefits of implementing an Asset Management System. This document discusses the new framework that allows councils to accurately and efficiently share information across new borders, especially relevant since the new council amalgamations. Information needs to be shared quickly between council business units to ensure that all staff are able to make the best decision based on all the available information. Thus any system that still relies on paper copies and plans are becoming obsolete. The system that will be used in this project is MapInfo as it is able to perform all the tasks needed by Council.

MapInfo also has other uses that can eliminate certain issues from Local Government such as Empire Building. The current links between finance and engineering has always been diminished due to the Empire building effect and workloads. Systems like MapInfo have the ability to be linked with financial systems ensuring that information stays up-to-date and accurate. Having all the assets in a digital system allows the information to be access from any council business unit and enables engineers to produce documents or tender documents quickly. A sister program to MapInfo is Exponare and this program will be used to link engineering (MapInfo) to finances and other systems. Exponare has an easy to use interface that can be used by any staff member to get asset information, thus enabling the whole council to get access to much more than just the typical engineering information at a click of a button.

This projects focuses on taking this local council from a paper based Engineering Asset management system to a modern digital system that is capable of servicing their needs. The paper system was put into the digital system verified and linked with financial systems to ensure that the system are always up-to-date and eliminate double handling.

The new system was found to be exceptionally effective in reducing the time for taken for day to day activities as staff can access information quicker and from different locations. Due to the power of the new digital system it was well received and is currently widely used not only in the engineering system but also by administration staff in other sections.

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Certification

I certify that the ideas, designs and experimental work, results, analyses and conclusions set out in this dissertation are entirely my own effort, except where otherwise indicated and acknowledged.

I further certify that the work is original and has not been previously submitted for assessment in any other course or institution, except where specifically stated.

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Date

Acknowledgement

Thanks is given gratefully to my supervising staff member, Dr Badri Basnet, who helped and guided me throughout this project and a special thanks needs to be given to Trent Phillips from XY Mapping for the 4 years of phone calls and trouble shooting. I would not have been able to complete this project so successfully without the help from fellow staff from Isaac Regional Council and Trent, so thank you to all for the help.

Thanks are also directed towards my family, friends and my fiancé who helped to motivate and support me throughout the year.

1 – Introduction

Today several small Local Government Councils are still relying on paper drawings and spreadsheets to find information regarding engineering assets. This can be a very time consuming process as it requires the engineer to locate the paper plan and he still may have to look through several printed plans to get the most up to date layout. Then once the plan or plans are found it might still be needed to look through several "As Constructed Drawings" (Ascons) to get further information such as Natural Surface Level, or pipe types and sizes. Small Operational Works in the Shires did not always validate new plans so the original plans were amended by pen or pencil. These amendments faded over time or get smudged as well as the notes pinned to the plans get lost between offices. The spreadsheets related to the drawings information do not get updated all the times.

Addressing building proposals, maintenance issue, new developments or entering assets into spreadsheets it can become a very time consuming procedure and information can easily become doubled up or plans misplaced. On top of the engineering side it gets increasingly harder for the finance sector to stay connected to the engineering sector as the council gets larger and workloads become more overwhelming. This has the implications of the assets not being accurately financially recorded.

The aim of this dissertation is to take Belyando Shire Council/Isaac Regional Council from a paper base Engineering Asset Management System to a Digital Asset Management System. This will be done through utilizing MapInfo as the Engineering Asset System. It is vital that a program like MapInfo is utilized as it allowed any staff member from any computer to access information from anywhere in the council if they have the passwords.

1 - 1 Background

Moranbah is the fastest growing town in Isaac Regional Council. Moranbah was created by the UTAH Development Company to house the miners in the area. Moranbah is in the middle of the Bowen Coal Basin and has approximately 30 mines in just over an hour's drive radius from town. These mines range in size from a few hundred people to several thousand and open cut to underground mining with gas harvesting along with other mining associated activities. There are several other linked industries and quarries in the area that facilitate the mammoth mining industry. With this increase in mines around the town, its population boomed and town infrastructure could not keep up. The UTAH Development Company commenced with "Moranbah" as it is now known just before 1969 and was handed over to Belyando Shire Council shortly after 1972 as the town was quickly getting too big for the mines to manage. The town reached a population of 7,000 in 2000 but it had a "floating population" of approximately 3,000 (Isaac Regional Council). The floating population is made up of "non-permanent" residents. This is due to the lack of accommodation and the requirement to fly-in or fly-out large amount of personnel and project crews. The town's overall population is expected to reach 15,000 before 2012(Isaac Regional Council). This gives the town an impressive growth rate to try and keep up with the population demand.

The Council's infrastructure is getting large enough to need a Digital Asset Management System as they are starting to run into issues regarding inaccurate and insufficient information on drawings and spreadsheets. The previous engineer saw this need and urged the council to invest in MapInfo and the process started. The process came to an abrupt halt as the engineer accepted a job from the mines about 2 months after getting MapInfo. The situation of Moranbah was becoming evident to staff in Moranbah's Council Office but it was not helped by the fact that the original capital of Belyando Shire was in Clermont, over an hour's drive away. Moranbah could not hand over developments to Clermont and Clermont was not always aware of the activities in Moranbah. Development was occurring too often and on such a scale that keeping the town running utilised most of the council (already understaffed) resources, leaving

little to no time for asset management or house keeping. At times they relied solely on financial registers for record of assets from new developments.

Clermont, the original capital of Belyando Shire, is a small town and slow growing and was able to keep up with assets management using the paper systems. This system was tried in Moranbah when staff was based there but this system could not handle a town growing at this rate. As the workloads become overwhelming, asset management were moved down the priority list and keeping the town running is their only concern.

2 – Project Aims

The aim of this research project is to set up an Engineering Asset Management System such as MapInfo for a small Local Government Council. This new system will incorporate all the information from the current paper plans and spreadsheets, thus removing the need for going through filing cabinets for town plans. The data spreadsheet will be linked to the assets that will create a fully visual database. The assets will then be laid out over a town image mimicking the real assets as close as possible. Thus when issues arise the user can zoom/scroll straight to the problem area or street and have a look at the infrastructure in place. An example can be seen in Figure 1 below. Each infrastructure type is located in its own layer similar to AutoCAD. This enables the user to display water mains, sewer mains or any other asset layout that they are using.
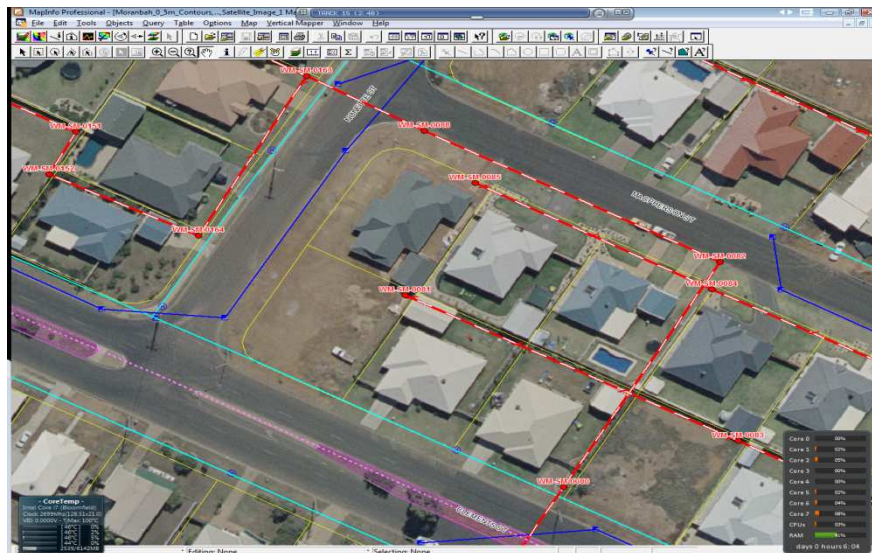
Figure 2: Section of Street indicating infrastructure in the area.

This MapInfo Database will be linked to the Financial Database in order to prevent discrepancies between the finance and engineering departments. This "link" will

ensure that when either department change or update the information, both departments are notified and have access to the up to date information.

Lastly Exponare, is another program that can be used to create a link between the Financial Asset systems and Engineering Asset systems .   It will be used to create links between more system currently employed by the council, thus allowing for more accurate and efficient information sharing between departments within council.

3 – Project Investigation

When this project was started very little was know about what would be required or what would be available to accomplish the tasks. Some ground work and investigation had to be performed before the project work could be started.

3 - 1 Literature Review

Electronic systems or software for managing assets in the GIS (Geographical Information System) world have been around for a period of time but today in Australia there are only two widely used systems for Asset Management. They are ArcGIS and MapInfo (VanDruten 2005). Both systems have become very compatible with each other's data files as more and more information will be shared between them. From Google Groups (GIS) (2009) states ArcGIS is still more widely used as it has been around for longer however MapInfo is quickly gaining credibility and with associated software like Exponare, it is quickly becoming the preferred choice for council starting new systems. VanDruten (2005) states that ArcGIS is more focused on GIS information and can be more accurate than MapInfo and it also allows more add-on programming scripts. He also states that MapInfo is much easier to learn and more powerful when manipulating asset data. VanDruten (2005) calls Exponare the "Ace" (VanDruten, 2005) up Mapinfo's sleeve as it is bound to capture a portion of the market with the ability of linking systems along with it's web interface. When ArcGIS is compares to MapInfo and Exponare, MapInfo has a significant advantage as a asset management system.

MapInfo was founded in 1986 as a Rensselaer Polytechnic Institute's incubator project (Wikipedia, 2009). The aim of the program was to create an easy-to-use software that did not place exceedingly large amount of strain on the user's PC when working with GIS data. Today MapInfo is used worldwide not only for asset management but

farming and any other outdoor industry (Pitney Bowes, 2009). The Design of MapInfo as an easy to use visual interface which allows users to easily navigate to relevant places, combined with the full spreadsheet and database functionality. This system also allows for assets information to be sent straight to Excel if certain assets are to be reviewed or replaced. This allows any user to easily view all information about the assets even if they do not have access to MapInfo or a viewer Program. Pitney Bowes, the owner of MapInfo have widened the horizons of MapInfo so that it can be used by any Personal Digital Assistant (PDA) or phone with windows mobile or equivalent. When combined with its build-in GPS it enables you to track where you are walking, which can also be displayed in real time. Since you can have the full engineering data base in your PDA, you can display the aerial photo and infrastructure and see a beacon of where you are in relations to the assets. In essence it allows you to walk on the Aerial Photo surrounded by assets giving you real time information to quickly understand where the infrastructure is and where you are walking/driving.

(Pitney Bowes 2009, MapInfo 2009 & Wikipedia 2009)

One disadvantage of MapInfo is that there is not much literature available regarding problem shooting in MapInfo other than what is available in MapInfo's help files. This is due to MapInfo being an extremely specialised area.

3 - 2 Asset Information Investigation

A considerable amount time was spent investigating information on past developments in Isaac Regional Council to locate its current infrastructure. The past development were rushed so quick from application to completion that council did not received full asset information or completed Ascon drawings. It was clear to see there were significant discrepancies in council records. This will caused many delays and unforseen issues during the life of this project. Any new accurate data that was based of the existing data could only be as accurate as the old data it was based from. The old survey marks were lost or removed when new development occurred and the pegs were reinstated to a best estimate of the original position.

4 – Assessment of Consequential Effects, Implications and Ethics

A consequential effect that council will incur when setting up a digital asset management system is that the information can very easily be distributed among staff. Exponare will be used to link information going in and out of MapInfo so preventative measures must be taken. Due to this fact, it is of utmost importance to keep policies in place about how this information is used and who can access it. This can be achieved by creating different user accounts and workspaces in Exponare. Furthermore HR procedures will have to be put in place to limit and censor the information send out to the public.

The biggest implication in implementing the electronic asset database system is that staff may become reliant on these products, but it must be remembered that the software can only be as accurate as in the information that is entered into it. When the engineering and other databases are combined, it will automatically highlight any discrepancies between the different registers.

The links that MapInfo and Exponare create to other systems may enable users to get access to privileged information. Not all council have current policies that address this information flow to and from departments.

5 – Methodology Overview

In order to start this project it is important to first obtain the information available. This means that a considerable amount of time will have to be spent sorting through all information that is currently stored at council. Due to project time restrictions there may not be sufficient time to gather all the information before asset locations are imported into AutoCAD. Therefore it is decided to spend more time on creating an Asset Management System that works, even if a few asset information may be missing at first. The missing asset information can always be added at a later date.

Once most of the assets are compiled into AutoCAD to get an overall visual layout of the infrastructure in the town, it will be imported to MapInfo. The focus will be on the township of Moranbah, since it is the quickest growing town in the regional council. Many gaps were found in the infrastructure as the town was build in sections by the UTAH Development Company in response to the housing demand from the surrounding mines.

The visual data is imported into MapInfo by manipulating the AutoCAD file and interpolate the information into its database. The newest digital cadastre database (DCDB) provided by the Department of Natural Resources (DNR) will be used as the base for interpolation. Once the infrastructure was visually imported into MapInfo, it can be linked with the engineering asset registers. Data checks will be performed to ensure the integrity of the data after the completion of importation into MapInfo. The engineering and financial asset registers will then be compared to find any discrepancies and missing assets in order to build an accurate asset register.

At this stage the data will be in MapInfo in a usable format. As more data is found and corrected, it will all be placed into MapInfo for staff to use. Workspaces will be created for quick and easy access for staff.

After importing the data into MapInfo and correcting any discrepancies in the data, a consultant was employed to do the programming and licensing between MapInfo and

other systems. Exponare was used to link these programs in order to ensure engineers can acquire further information when it is needed. This system does allow staff in other departments such that planning, finance, front counter staff can all get hold of engineering information thus streamlining the workplace and reducing man hours.

In a practical terms, you are now able to select any asset to get the information relating to it such as Unique Identifier (UID), NSL, Type, Material, Install Date, Economic Life and who performed the work. This greatly reduces the amount of time that was previously spend on gathering information as you would have needed several plans and spreadsheets to locate this information.

This new link between MapInfo and Exponare provides the user with any information needed by any task. Exponare is also a more user friendly interface that anybody can use with next to no training.

An example of efficiency would be:

> A new house is being built in a street and the builder cut through what looks like a water pipe. The front counter staff receives the call from the builder and can quickly see where the house is, the water pipes in relation to his development, and notify an engineer. The engineer can promptly dispatch a plumber with accurate location of water valves and the pipe. While the engineer is doing this the front counter staff can simply click on the adjacent allotments and get the phone numbers to notify the other property owners that their water will be cut off for a period of time.

This system implemented effectively streamlined a lot of procedures and freed up time for staff to complete more work.

6 – Project Risk Assessment

There are only three types of risks involved with this research project. Firstly, there is the risk of data corruption from linking (AutoCAD to MapInfo) and mass data manipulation or user errors and secondly the privacy of the data being used in this project. The privacy of the data in this digital data bases is covered in the next chapter.

Data corruption could potentially be a colossal disaster that the council may not be able to recover from. Belyando Business Unit (Moranbah) in Isaac Regional Council had a very primitive approach to data protection. Their only real safe guard was to store and keep deleted files for approximately two weeks. Financial files were backed up once a week but only one backup was ever kept. The whole server was backed up once a month but once again only one copy was ever kept. This lead to the problem that if data was corrupted and not noticed by a department in a certain period of time, the corrupted data would be backup over the last working copy of the data.

The second issue relating to data corruption is the speed of the server and bandwidth. Since the server is relatively slow and the bandwidth connecting the two towns Clermont and Moranbah is very limited, it could cause double of information and outdated data base. At times the server reached residential internet speed shared between each office. This reduced productivity for the Moranbah staff and these timely delays cause mass frustration. Staff was printing our information and keep it on their desk or storing files on their desktop. This led to vital information not being available to other staff but also not accounted for. Staff also started to double up on efforts and at one stage there was up to three different asset registers for Belyando Shire Council. When the server backed up the files it is not including these files or amendments. This data would be lost if their workstation crashes.

6 - 1 Safety Procedures

Since the current IT procedures does not provide a sufficient safety net for such work, further safe guard methods will have to be created to protect against data corruption. This will be done using three different safety nets.

Backup before Mass Minipulation

A safety procedure was needed due to the lack of experiences with what was required to be done and not always sure how some data extrapolation or modifications would result. The other issues was that not all data projection maps or visual co-ordinates were always knows. The chance for data loss or corruption was very high when some of the alterations were tried. To modify the data or to try and attempt a better solution, more often than not some modifications were done by trial and error.

To overcome these problems the whole data base was selected and an exact duplicate was made and stored it in a different directory on my computer. The modification or sorting notes would be accompanying the duplicate database. This is for reference to what modification or co-ordinates was used to correct certain data. This later becomes a detail record of what have been done and what has worked effectively.

The manipulated database would be opened to see if the modifications have corrected the data or if the correct link has been created. Below in Figure
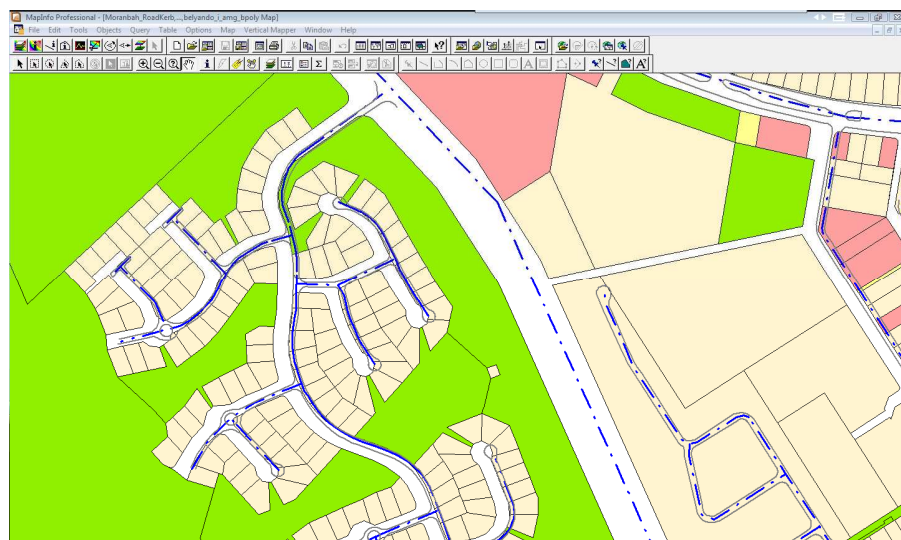

Figure 6.1 - Miss modified Data.

Data Corruption Checks

Not all data corruptions are easy to notice. When the asst registers were combined it was especially hard to know whether the right pipes were linked to the right asset. It would have been impossible to check every asset individually so a system needed to be created to check that the right attributes went to the right assets. This will be done through Excel. For each process there needed to be a method so that it can be checked. The Excel system quickly and effectively checked for any abnormalities. Further checks were done by matching assets between Engineering and Finance registers then visually comparing them with plans. MapInfo can provide the information from the plans essentially and then each asset can be compared to the registers by plan numbers, length, type, material and date installed. This Excel file would then flag any asset that is less than a 97% match to be inspected.   A new Excel files was created for each asset to specifically check for these types of inconsistencies.

Automatic Server Backup

Since the server is programmed to create an automatic backup every month, and this will be stored there for a month before the next backup is made, it could be used as a safety net. So whenever a change had been made and more data added to the database, It would have to pass though the previous step before it will be accepted and backed-up. Not all modifications or data was correct from either the engineering or finance department and an 80% certainty was not even possible. A considerable about of time was spent on sorting information and linking the town infrastructure to try and get close to an 80% certainty of information in the database.

Once I was pleased that the information was not corrupted nor skewed in any way, it was then stored on the server. Through all calculation and checks, the information on the Server was more accurate than before and had passed any check to see if any data was corrupted.

6 - 2 Confidentiality

As mentioned before confidentially was the other risk that will have to be dealt with. As more information became available, some of it was confidential. As mentioned before this system will link up with DNR and other systems such as ProClaim and Finance 1. Both ProClaim and Finance 1 have all information about properties in town such as rates, land value, owners, phone numbers, pets and many of other confidential information.

Before Exponare is employed there will only be confidential information relating to the Engineering Asset Database. This information will only be available to the engineering staff. It can be dealt with easily by setting strict policies for the engineering staff regarding giving information to the public.

Once Exponare is employed throughout the Council the confidential information will vastly increase and the Human Recourse Department must be proactive in creating policies of how to deal with this information. Meetings with the Human Recourse Manager were arranged and he was given a comprehensible overview of how the system will work and how the information can be accessed and passed around. Between HR and IT, policies were put in place to reduce the risk of confidential information getting distributed.

A few policies that were put in place are summarised below:

1) Customer Enquiries: Not allowed to give out any MapInfo or Exponare imagery to any resident unless they own or have been enquiring about buying the property.

2) Customer Enquiries: Not allowed to give out any financial information to any customer unless the customer can prove that they own that property. Even then only limited information can be given out without prior notice or appointment.

3) Council Staff: No council staff may remove or use and confidential information outside of their working duties.

4) Workspaces: Creating workspace for each department, control is exercised over what layers/information is visible to each user.

5) Access Rights: Placing certain files in protected locations on the server so that only specific users can access it.

6) User rights: Creating user accounts that only allows certain users to be able to view information and only a few users can alter information.

The Human Resources Manager agreed that further request can be discussed in meetings at any time to refine the policies put in place. This also allows Council to quickly fix confidential issues if they do arise.

7- Project Challenges

Within each organisation there are always obstacles to change. The first obstacle comes from staff or previous procedures. This project was both fortunate and caught off guard by the initial situation. It was fortunate that there was no previous system in place regarding Engineering Assets. This however meant that not all staff were use to the idea of asset management and were quite reluctant to make use of a process that would take up some of their time. This initial response of staff was evident as the only help that was received at first was from the financial side of the council. They saw that something needed to be done as the council cannot continue using its current system in place. The current system has become affected by the lack of asset management procedures and some inconsistencies were started to be discovered.

Only a few engineers understood how effective this system could be but there was a definite resistance to launch it as it was seen to be too difficult to manage and too time consuming to setup. It was obvious the only way this project could overcome this resistance was by showing the power of the system once it is in place. It was assumed that staff will only work towards the goal if they think it is worthwhile and it will make their work easier. This risk was rewarded towards the end of February 2006 when staff became optimistic about the project.

Another obstacle that was found was that several staff knew how out of date and incomplete the database was. Also due to the town being build so fast on the demand of the mines, not all submitted data has been checked. Some of the inconsistencies in the information were well known to a few staff members in council for instance each mine that build a development used a different surveying bases station. This resulted in several different height AHD (Australian Hight Datum) levels around town. The staff that was aware of this issue were apprehensive that a solution could be found and that any system will be just as inaccurate as the previous. Knowing information such as the different AHD marked sections of data, it can easily be converted back in line with

other information, however if you were not aware of this it could take months to sort through. It was therefore vital to keep staff in the loop and keep them involved in setting up the database. Acquiring this knowledge was not always easy but it needed to be done to overcome other obstacles and show staff how effective the system is.

During my first holiday period in Moranbah, I created a small section of the town in MapInfo and gave it to staff to show how they can use it and how easy they can access information. All staff was impressed and by the end of February they were eager to give it a try. The long serving engineering staff was very valuable with town knowledge but they also were quite persistent not to use it as they knew the shortcoming of their information. They worked with the mentality of "I know our registers are inaccurate at parts and lacking in others so how could yours be any better". My only solution to this mentality was that the new system may also be inaccurate but it would only get better. It had to be made clear that the system is only as accurate as the information getting entered into it but, when it starts to get compared to other registers and visual information it would become more and more accurate. I needed to explain and encourage staff to use the system and notify me of any inaccuracies that were found. Some staff was apprehensive to use the system and constantly put the new database through spot checks where they found inconsistencies. Several inconsistencies were found but over time the inconsistencies became less and less.

As the information became more and more consistent, all staff became sympathetic to the system being employed. As the system was being used, particular attention was given to outside staff and to illustrate to them how this system could help them in their day to day activities. Doing this took a fair bit of time but their involvement would be vital to get accurate information from real live experiences. Staff started giving me paper notes and hand written alterations of plans that became very useful and the only way of getting this information in a system that everybody can access.

7.1 Empire Building Effect

Each section of council such as finance, engineering, local laws and front counter staff all develop their own work environment over time. This natural workplace behaviour

occurs gradually over time and as the work load increase, managers push for efficiency looking towards more inward focused management as opposed to an overall view. Once management turns inwards any person outside the department that offers advice has a high chance of being seen as trying to intrude on their working empire. This phenomenon is called empire building as each person want to expand their empire instead trying to work together for a better overall solution (Stoker 2006).

Breakdown in communication, such as mentioned above, lead to asset management inadequacies because not all parties involved know about what is actually happening out in the field. An example of this would be if a section of pipe gets replaced with a new pipe, only engineers will know about that unless somebody sees the invoice. The invoice will not always indicate where the section of pipe was replaced and if the whole length of pipe was used. Since the finance sector do not know what section to replace of pipe on the asset register, it is impossible for their record to be complete or match with engineering. This is how more than one asset register gets created from the same partial information.

This situation is an all too familiar situation in the Council. The finance department is located in Clermont and the engineering department is located in Moranbah. With the engineering department being understaffed, very little communication occurred between them regarding asset management. An example of this lack of communication is road maintenance. When a road is resealed, the engineers added value to it and extended the economic life of the road by a few years. The finance department, not sure of what to do, created a new asset with a new life expectancy. This led to the engineering department having the road as one asset with extended economic life, and the finance department having up to 4 or 5 assets for the same section of road and some assets were still being depreciated.

In the future these system must be digital and linked so that information can be sent out quickly while still producing accurate information. This connects the different sections of council and allow them work together even if not so directly. Newly created engineering information can't be put into the asset management system without the

assets being checked by finance. This allows finance to get accurate information and understand what is actually happening on the ground.

These types of forms can be created so that each new asset must be passed through both finance and engineering departments before it is placed into the asset management system. As maintenance occurs and the engineers make changes to the infrastructure, the finance department will get notified to make alteration to their systems. This allows the two departments to together and be up to date with information even when the two sections of council are not closely linked by location or communication.

This link became very important when Belyando Shire Council were amalgamated with Broadsound and Nebo Shire Council. The councils buildings are all in different locations and the systems in use are very different from each other. Very few of the staff knew more than two or three staff from the other councils and communications did not flow effortlessly at first. At the initial combination of all the shire councils each council hold firmly to their own customs and procedures which is why MapInfo and Proclaim provided a good basis for their Asset Management System. It was a new system to all three previously independent councils. When one asset is added or modified the all sections of the Isaac Regional Council is notified. This kept the information up-to-date but helped overcome the empire building effect that previously existed in the individual councils.

8 - Resource Planning

The council already had most of the resources needed to complete the project and it was available for me to use. My computer hardware and a PDA were bought specifically for this project. The software needed to perform the work was available through council.

8.1 Hardware

This project does not require much resources but it does place a reasonable amount of loading on electronics. Once the data manipulation was done it takes only an average everyday personal computer to access it. All council computers would be more than capable to access the information on the database. Currently IT section has plans to upgrade the Servers over then next two years. The new server layouts will be more than sufficient for the for these programs to run smoothly.

It was discovered after the first three months of holiday work at the council, that standard council computers caused errors to data as they ran out of memory and corrupting data due to their hardware's short comings. A new laptop was provided but was send back after three months for overheating. A computer was purchased that is specifically designed for mass data manipulation. Data safety was a big issue as this project required me to work with the Council's only "complete" Asset Register.

The custom Computer system used for this project:

- i7 core (this is a quad core with 8 threads) - Thus the computer treats this CPU has having 8 individual cores. This is compared to a normal computer's 2 cores. This processor @ 3GHz benchmarks as high as most modern servers for data manipulation (CPUBenchmark.net\Highend_Chart 2009) The layout of this i7 cores processors are designed to enhance mass data manipulation and reduce the bottlenecks in the programming.

- 6 GB of DDR 3 triple channel ram (with custom timings) – Ram is the computers Random Access Memory. This memory stores the information the computer is currently using, simular than a hard drive except that it is a lot faster to access the information bits needed. Ram only stores information when the computer is running, thus when the computer crashes or is restarted all the information stored in the ram will be lost. The reason ram is used is due to its speed of accessing the random information needed by programs. Thus random information is loaded from the hard drive to the ram to enable the computer to process much faster. The reason for triple channel and custom timings is to remove the bottle neck effect of data manipulation as the computer system now has three channels to process data appose to the traditional two channels.

- 2 video cards

    1. 1GB 4870 Radeon video card running the main 2 screens. Radeon is known for their multi screen setups and at 1 GB of onboard memory it can easily handle any image or 3D graphs produced on screen.

    2. 1950Pro Radeon for secondary screen(s). This card was mainly used to run Excel Documents. For demonstration it was also linked up to a Data Projector to mimic a third screen. This allowed me to display the third screens image on the back wall of the Engineering office and it was easy to demonstrate issues that came up and needed to be discussed.

- Three Computer Screens. Two widescreen monitors was used so that it was possible to see as much as I can from Excel and MapInfo. The two screens were 22 inches wide to allow a person to view 2 A4 pages side by side on each screen. The third screen is a standard 17 inch screen with the 4:3 aspect ratio so that the dimensions and pictures does not get distorted by programs not designed for widescreen.

- Four 32meg 500GB Barracuda Harddrives. Harddrives (HDD) are the slowest part of any computer, thus since this project required files to be saved often and move larges files frequently, this will speed up this process by using RAID

configurations. RAID is the acronym for Redundant Array of Inexpensive Disks and describes how harddrives can be used in parallel to enable quicker data loading and writing. Two HDD's ran in Raid 0 and the other 2 HDD's ran in Raid 1. Seagate Barracudas were used as they are known to be the quickest 7200rpm HDDs. The Hardrives in Raid 0 mean that your computer treats two HDD's as one, thus you can get faster reading and writing speeds of almost twice as fast as a single HDD. The problem with this is that every file is split into two and half is copied to each HDD. If you loose one HDD, the other is useless as it will only have half of every file and it will appear corrupted. You there loose information of both HDDs if one gets corrupted. To combat this, the other two HDDs are run in RAID 1. This means that they are an exact copy of the two HDDs in RAID 0. Consequently for the system to loose any information, two HDDs will have to be lost or corrupted. If one HDD fails the computer will inform me and restore it on its own or rebuild itself when a new HDD is connected.

Figure 3.1 (FIRST FIGURE FOR CHAPTER 3) illustrates the computer's performance running day to day tasks.   The demonstrates that the computer is capable of handling the task of data manipulation that will be required.
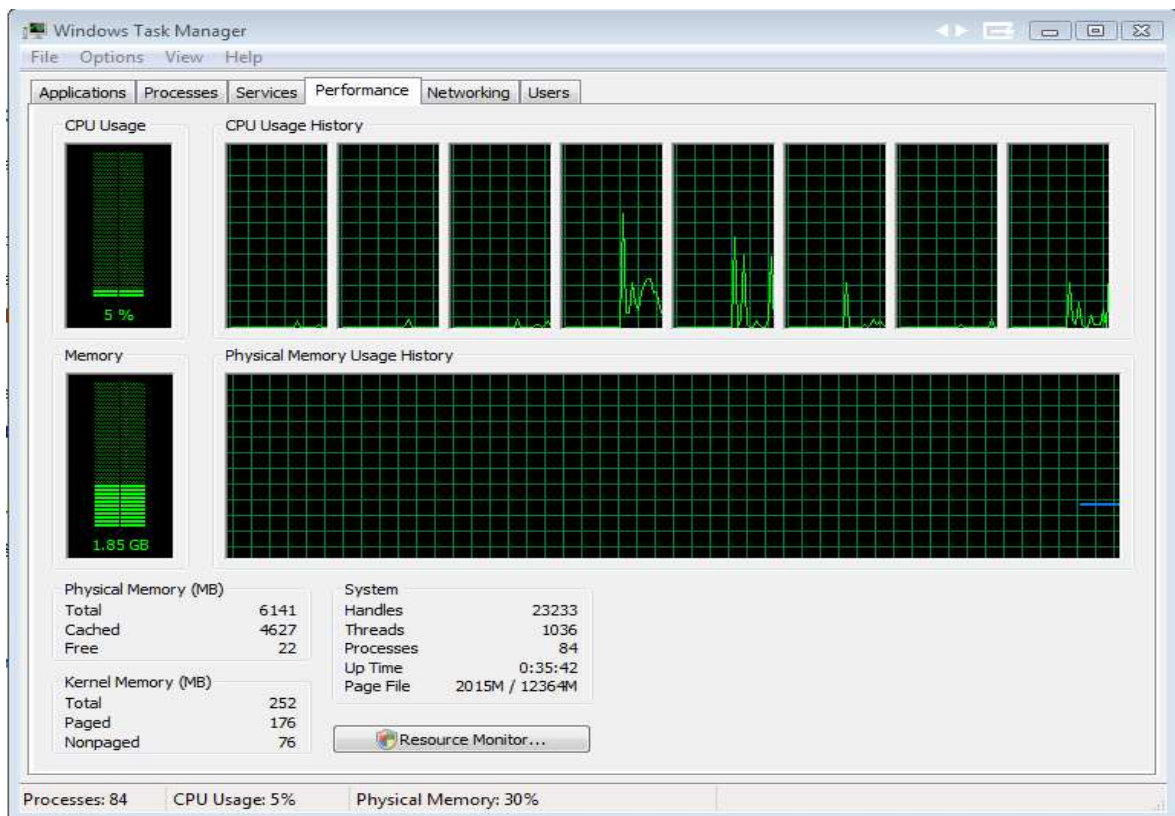
Figure 8.1: Computer performance monitor while working. On average only 5% of computing power was used unless large task were performed such as data manipulation.

The computer setup that was used is shown in Figure 3.2. The screen on the left, is used to display Excel spreadsheets or asset registers. The second screen (bottom right) is used to is used to display MapInfo or Exponare with the asset locations and the third screen is used to display AutoCAD or technical drawings. When the information is displayed in this layout it enables a person to see all the information relevant to a asset or task.
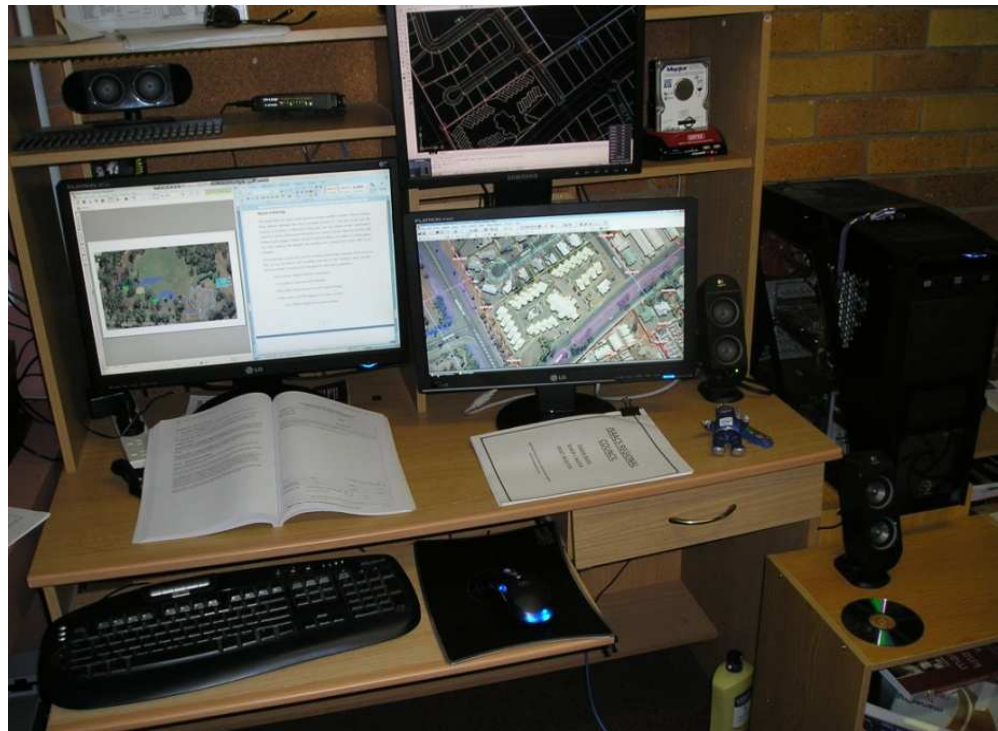
Figure 8.2: Computer setup for the project.

The downside of having this powerful computer was that when it actually runs at peak loads, which occurred regularly as MapInfo were manipulating visual assets or when large Excel spreadsheets were used to find data inconsistencies, it raised the temperature in the office room by 3 degrees. To give an idea of how much power was used by this computer setup, at peak load it costs about 3 cents per minute to run compared to a normal computer using 0.1 cents per minute (Jackson 2008). Luckily with this abundance of computing power the multi cores peak loads do not last long. The Excel spreadsheets linked to asset registers on the council's computer previously took approximately 12 minutes to check data. To give an indication of how much work time was loost to this each day, lets compare it to what you could be doing with that time: It was possible to buy a pie next door, make a cup of coffee and comeback to watch it finish while eating the pie. Importing data into MapInfo, the projection maps and coordinates previously took over 5 minutes to process every time, as it required a lot of processing and it is suspected that this is the reason why the original laptop burned out under the computing loading. This new computer reduced the waiting times to seconds allowing more work to be done quicker. The multi cores was very

advantages when manipulating visual data and it would load each process on a different core, removing the bottle neck effect and it used 6 out of the 8 cores on a few occasions.

8.2 Personal Digital Assistant

The second hardware item the Council purchases for this asset system is a Hewell Packard PDA (Personal Digital Assistant). It can be used as a versatile and powerful tool to perform checks onsite. It is a compact hand help device with a battery life of 2 hours when the GPS is activated. The PDA is shown in Figure 3.3. The PDA had GBM Mobile software that allows it to have a copy of the asset system from MapInfo on the PDA and you were able to see yourself walk around on the PDA screen in real life.

The PDA combines the display of MapInfo and its internal GPS. Any layer from MapInfo can be overlayed to this handheld device and save any GPS location. The best feature of this PDA is that you can be on site and see what is happening then just note it straight on the PDA's screen so that we you get back to the office you connect the USB to it and it will be downloaded on the council's system. This allows you to see the asset on the ground when out on site and move them to the right location on the PDA. The council system will automatically be updated in a couple of seconds when you get back to the office and connect the PDA.

Figure 8.3: PDA with GMB Mobile software compared to the image of MapInfo on the screen behind.

The handheld PDA was recommended and bought for the council through XY Mapping. They also arranged for all the software to be installed as well as a 4GB SD memory card. This memory card stores the information and allowing for it to be plugged straight into a computer with a SD slot. This hand held PDA was used to correct council's asset information system on site and it was lent to other departments to aid them in their filed work. Compliance department were very fond of the device for it allowed them access information when out on site. For example if they were walking down the street and notice a pool without a fence, then by selecting the property on the PDA, whey were able to find out information that they need to know such as if there is a dog registered on the property, name of the owner, phone number and any other information that they need to know.

8.3 Software

There are mainly three software packages that was a necessity for the completion of the project and the other software needed was able to be accessed from the internet as freeware or Shareware. Every year over the holiday period an AutoCAD 3 month Professional trail version was purchased as a licence program was too expensive for Council. In the 2007-2008 holiday break a student version of AutoCAD 2008 was bought as it is stable on a 64-bit computer system. The other software like MapInfo and Exponare was provided and Office 2007 was already on the computer.

MapInfo and Exponare work on a site licence. This means that any computer that is on the server can have access to the program. Once the PC is removed from the server that program has to be removed from the PC. This means that any computer connected to Isaac Regional Council's server can access Exponare to get all the information they require for their tasks.

The PDA used, had special software so that MapInfo can be loaded on to the PDA. GBM Mobile software is the specialty program that allows us to combine MapInfo and real time GPS. This means we are able to have MapInfo in the Field as well as the aid of a GPS. We can also have GPS tracking which allows us to track out movements when walking around on site. Our GPS marks can then be loaded into MapInfo as another layer.

9 - Methodology

It was previously explained the situation that this town was build in and that Council did not have all the locations of all the infrastructure in the town and have barely kept up with the new infrastructure. Most of council's old plans have notes and amendments in some form on them. The engineering and technical staff turnover in this council was hindering my progress as some notes were very cryptic and only a few staff members knew what they actually meant. Most staff that moved to the Moranbah region only stay for a short while before the mines recruit them at a higher income. This meant that a lot of the notes could not be deciphered.

The current asset system was mainly covered by plans and a few AutoCAD drawings. All this information needed to be reconstructed to be able to see what assets can be accounted for and what assets needed to be found.

The steps in this methodology is simple. Firstly locate the assets from plans and any other information available. Once the assets are found reconstruct them in AutoCAD to have the town layout in AutoCAD as complete as possible. Import the Assets from AutoCAD into MapInfo. Sort through the current asset registers to find accurate information relating to those assets. Assign a unique identifier for each asset so that Exponare can be used to link the assets in all assets systems that it appears. This link will ensure that the asset registers can stay up to date because if something is changed about an asset it will automatically change it in every other database.

9.1 Locating Assets from Plans

Locating the assets of a town is a mammoth task and it will require looking at several plans to find the correct location for assets. The first set of plans from the mining accommodation by the UTAH Company was complete and accurate. However the additions to town since the original plans from the UTAH Company and since Moranbah was being handed over to council, most plans are incomplete.

Ascons were printed off and all the plans collected find regarding the section of town that are currently being looked at. The plans are laid out on the floor with the oldest plans at the bottom and then tried to super impose the new plan on top to get an impression of how the infrastructure linked up in that section of town.   Once it was established with confidence and consultation staff with how the infrastructure was linked up, it would be recreated in an AutoCAD file.

9.2 Setting up AutoCAD

AutoCAD was selected to be used for this of its effectiveness and ease to use for creating layers. MapInfo also allows you to be able to draw and create assets quickly but when compared to AutoCAD a program design to do this it left much to be desired. Most of the latest ascon drawings had at least a few digital AutoCAD drawings with them. This meant that the information could be copied and then manipulated of altered in AutoCAD without much hassles.

The AutoCAD file was created from converting the November 2004 DCDB. The DCDB is a Digital Cadastre Database created by DNR. This will be covered in more detail later in this dissertation. The current DCDB that council is using is one of the most up to date systems available and is used to export files from MapInfo to a *.dxf format. This file can then be opened by AutoCAD and was used as the base for locating assets. This AutoCAD file is affectively the blue prints for the town showing all the lot boundaries. Figure 9.1 is an image of the file and the actual file is attached to the dissertation on a CD.
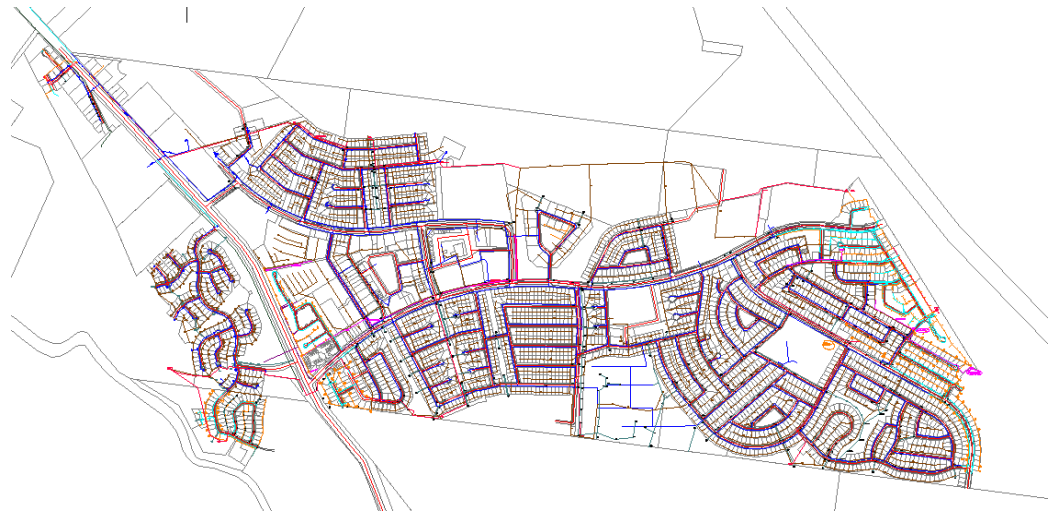
Figure 9.1: Image of the file of the assets in AutoCAD to be imported into MapInfo.

It took several months to compile this file and it was suspected that several assets were still incomplete or had suspicious layouts. Certain plans show stormwater running into a pit but nobody could explain were the water went after the pit. Further more when there were big discrepancies between developments that back onto each other, a site investigation would have been performed if time allowed. Due to the time constraints of the project, his could not be achieved and time was better spent keeping the process moving. The incognisances will have to get addressed as the information gets corrected along the way. It was a safe assumption that the information in this new digital database may still be incorrect or inaccurate at some locations but it will be more accurate than any previous system.

9.3 Transferring Asset Information from AutoCAD to MapInfo

Since the assets have been collected and drawn in AutoCAD we needed to find a way that the files can be imported accurately and easily. This required a set process and all the co-ordinates of the assets needs to be accounted for. Unless specified, AutoCAD works on a flat surface. AutoCAD and other packages such as CivilCAD primarily work of a flat surface unless specified otherwise. Most of the small developments that occur such as 1 into 17 are still designed on a "flat surface". Due to the haste at which

Moranbah was build all development were done on "Flat" AutoCAD drawings. This needs to be kept in mind when AutoCAD files are manipulated to the earth's curvature. All the pipe lengths and locations will change slightly, so the odds are good that no values will stay exactly the same. This will cause a problem when you perform a query and you use the actual value for the asset, for example 3.05 meters it will not return this pipe any more as the pipe may in actual fact be 3.0498 meters.

When importing this amount of information any decimal discrepancy of the actual co-ordinate can cause irreversible mutations. The correct co-ordinates will have to be used otherwise the assets will be located in the wrong locations or their sizes will be mutated.

When assets are surveyed they are usually surveyed to match the property boundaries and it is very important to have the correct property boundaries in place before work starts on importing. These property boundaries are found on a digital file called (DCDB)

Digital Cadastre Database

Digital Cadastre Database (DCDB) is created by the Department of Natural Resources (DNR). This is a digital compilation of Lot and Plans from all the properties in the area. DCDB stands for Digital Cadastre Database. In essence it is a large jigsaw puzzle with all the lots and fitting them in their actual location.

First it is important to understand how the DCDB is constructed by DNR in order to understand how it affects 'out back' towns. Simplifying the process, DNR takes survey plans and "fit" them together thus forming all the lot boundaries. As with any such process this means that when you start you can perfectly fit together the first few plans or puzzle blocks. The more blocks you have the more you spread out and suddenly you notice something doesn't fit. When you get a fair distance from the starting point you will find that the boundaries don't match up perfectly nor are they on the exact locations.

DNR starts their rectification process over larger town and Cities and works from there out. This means that in the middle of Mackay, Brisbane or Hervey Bay the lot boundaries will be perfectly match to the actual boundaries. From there they will move out and build their lot and plan puzzle. When the outer edge such as Moranbah

is reached the DCDB may not be as accurate anymore. This is very true for this town and the surrounding mining towns.

DNR knows that their DCDB has limitations of accuracy and Councils can gain State or Federal funding to have their towns or areas accurately surveyed to correct the DCDB. Even with funding this is an extremely expensive exercise. Only a few larger Cities such as Sydney, Perth, Hobart have done this and only to their most populated areas. Smaller Cities such as Hervey Bay make use of a less expensive option where by several points are accurately mapped and then use computer manipulation to correct the lots in the surveyed area to align with the actual positions. Both of these measures are budgeted well outside Belyando Shire Council or Isaac Regional Council's budget even when the shire size tripled after amalgamations. The most had to be made from what information was gather from DNR.

There is not a large city or town in the immediate surroundings of Moranbah which means that the point that DNR picks to correct the lots boundary from would be a large distance from Moranbah. This means that every DCDB that we receive from DNR will vary by a few meters. Also if the first DCDB is 2 meters of to the left does not mean that the next one will be as well. Every time DNR releases a new DCDB they have made changes to it to correct it. This may mean that they have used another town in the area as a reference and they are now trying to correct all the lots between different points. This means that when Moranbah is in the middle of the two points, it receives the new DCDB and the boundary locations may be 1.5 meters south of the actual locations.

Figure 3.5 illustrate the results over the last six years from the DCDB. It can be noted that each lots is still exactly the same size but the layouts location however changes as each rectification cause a minuet alteration somewhere in the process. The bottom DCDB (black lines) has been moved to match the boundaries' actual location and have also been coloured according to land titles. Each year's DCDB boundary location is indicated by a different colour.

Figure 9.2: DCDB's from 2002 to 2008 showing different boundary locations.

This has caused major delays in progressing data as the co-ordinates have to be rematched each time a new DCDB is used. The co-ordinates for each DCDB must be exact as even 1mm caused sufficient change and change infrastructure locations. This will cause pipes not link up and queries cannot be run successfully.

Knowing how much each DCDB can vary it was decided that each new DCDB will be moved to best fit the current DCDB. Once it has been aligned with the current DCDB the new DCDB will replace the current DCDB.

It would be impossible for council to keep using an old DCDB as this town is growing at such a rate that when the DCDB is released it is out of date by the end of the month. It was in Council's best interest to deal with the changes from each DCDB as the property information was worth getting on to our system. This process of aligning the DCDB did consume a lot of time over the years.

Projection Maps

Projection Maps is what takes the flat drawings and project them against the earth's curvature. It makes the flat AutoCAD drawings fit the real work situation of a curved

surface. Thus once a new projection map has been created DNR will use that as the base for their DCDB. All the lot and plans will be fitted to this new curvature.

These projection maps created a new problem as they changed to projection surface which means that nothing will line up again. Since each asset will not be the actual size nor in the exact position the sewer pipes may not meet at a manhole or even connect with each other. The same occurs in each asset layer. When a new DCDB is received that was based on a new projection map it is not always obvious that it is different until the assets are imported over the DCDB. It does become very obvious when assets or objects are imported into MapInfo over the new DCDB as the user can quickly see abnormalities about assets sizes or locations. All the assets are several meters from their proposed location and most often are modified in size. You can use all the right co-ordinates but it will still be poorly transformed.

Figure 3.6 illustrate the 2008 DCDB in the background and the 2006 DCDB in wire frame. The 2008 has been shaded according to land titles. You can see that there is a considerable difference between the 2008 and 2006 DCDB but it is not clear that each DCDB has a different projections map. To illustrate this point the green island from the 2008 DCDB will be projected with the correct co-ordinates but with the 2006 projection map. It is clear to see that the shape has changed a little and it is located far from the intended location.
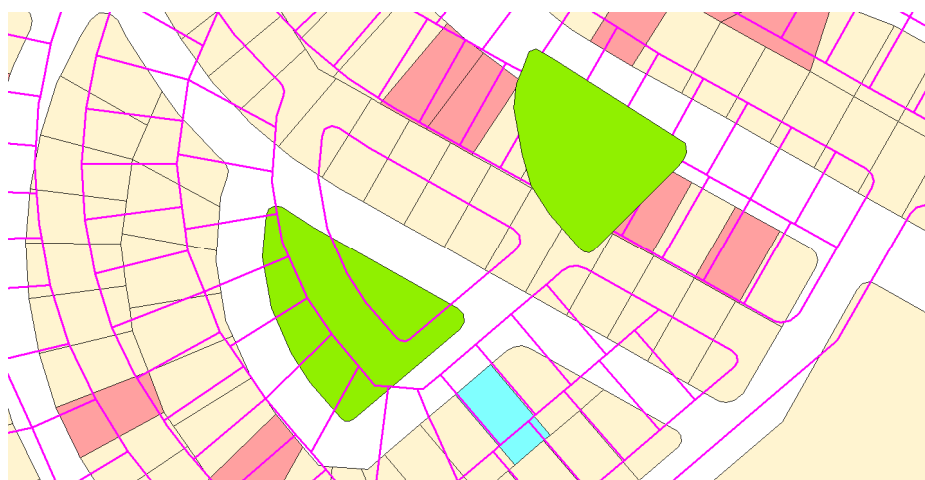

Figure 9.3: Illustration of 2006 and 2008 Projection Maps.

9.4 Asset Resgisters

It is important to understand why council needs to maintain two asset registers. There is a fundamental difference between the Engineering Asset Register and the Financial Asset Register. It is the fundamental principle of what the two asset registers are based on that sets them apart. The financial asset register looks at what is currently there and assign a value to it. Thus the financial asset register provided council with the actual value of all the assets at a certain point in time. The engineering asset register considers the economic life of the asset and its replacement value. To demonstrate the different an example is given below:

> Consider a pump with an economic life of 20 years. After 20 years the pump is most likely still functioning well but has to be replaced because it may fail in the near future. The pump may still be worth a lot of money after 20 years as council may refurbish it or sell it. The financial register takes this into consideration and assigns a depreciation value accordingly. The engineering asset register will value the pump at $0 after 20 years, this is because over the last 20 years they have depreciated its full value. Thus there is enough money allocated in their budget to replace the pump after 20 years.

This example demonstrates why it is very important for councils to maintain both registers and why there are considerable financial differences between the registers. It is important to maintain the engineering asset register as the financial asset register would not have provided sufficient money to be able to replace the assets when required.

Both these registers have to be used to create a complete asset management system for both departments to use. It would also identify which assets have not been recorded into the register. It is irresponsible to think that finance can maintain their asset register without help from Engineering but also impossible from Engineering to balance the financial books.

Financial Asset Register

When this project was started Belyando Shire Council was in the process of changing financial systems from Proclaim to Fiancé 1. Therefore there were two different financial systems still in use that had to be accounted for when creating the Asset Register for the finance department.

When these two registers where imported in to Excel it was found that both registers were incomplete. Certain subdivisions were found on one financial register and not on the other. It was found that when the systems where being swapped over some staff were updating the old register and some staff were adding to the new financial register. This meant that both registers must be combined to acquire the most complete finance asset register.

Engineering

The engineering asset register was kept and updated in Clermont a town two hours drive from Moranbah. This had the implications that small civil work did not get updated on the register and large developments were not always recorded correctly. There was not set format or procedure to record the assets on the register, thus all assets were entered into the register as seen fit by the staff at the time. This meant that no assets had unique identifications number (UID) to be able to identify them. This asset register was also loaded into Excel.

Discrepancies Between Asset Registers

Each one of the three asset registers were loaded into its own Excel file. This was done so that the registers can easily be sought through using Excel search commands. A fourth Excel file was created that can read and sort through the asset registers and record the results. The Excel file was written to allow for easily identification of any asset and information regarding the asset in question. For example an asset was identified in MapInfo and to find the information regarding that asset it was entered into the Excel file, then a search was done to find all the information matching that asset from the engineering and finance registers. This was done so that a UID can be assigned to the asset and the asset can be linked in all the systems that contains that asset. This will be done at a later stage.

The assets that could not be matched or where not found in either engineering or finance registers were then placed onto a separate list. This list was then given to finance so that they can update their financial registers. The engineering registers were updated and entered as they were found. The new UID for each asset was included as it was needed for Exponare to function properly.

9.5 Building an Engineering Asset Management System

There was several problems and process involved in building the Asset Data Base in MapInfo. This dissertation will simply the problems and solutions that was found to during the process.

The following problems or challenges where found in setting up the Asset Management System, the DCDB; importing assets; and quality control such as spot checks.

DCDB

As already mentioned there are issues with each new DCDB received, however there needed to be a process that can eliminate problems while simplifying the process. New co-ordinates have to be recalculated each time a new DCDB was received. To simplify this process, the DCDB was exported from MapInfo to AutoCAD and the most western, northern, eastern and southern co-ordinates are matched up. This simplified the process as the AutoCAD file is exactly the same size as the DCBD file.

In order to address this problem, a benchmark needed to be established. This benchmark needed to be something that the DCDB could be compared to learn what the correct or inaccurate.

Aerial Potography

One of the first things that Council did when this project was started was to have aerial photos taken of the area. XY Mapping consulted with GHD on Council's behalf to create a detailed aerial photo to be used as a MapInfo layer. Council have been assured by XY-Mapping that the topography is very accurate for the area as all the surrounding mines have high quality systems to map their mining operations. The

mines use the same system to calculate how much earth is moved on a weekly basis and their survey points have been clearly marked for aerial use. This was a very expensive exercise but it has greatly benefited the efficiency of the Council and aided in the project.

For day to day activities the MapInfo layer can be displayed in the background, this will be shown in the later in this dissertation.

Contours

Along with the Aerial photography spot heights were also done. From the spot heights XY-Mapping derived contours for the town. This can also be used to understand the flow of stormwater through the town and several other infrastructure systems in town. The asset registers also include natural surface levels (NSL) for certain assets and then this can be checked against the contours.

Importing Assets

As previously mentioned there were difficulty with importing assets from AutoCAD but another issues relating to the data in AutoCAD became apparent. The issue was the orientation of certain ascon Drawings. The ascon drawings were drawn correctly but not to the true north. It is not apparent at first but upon importing the assets in to MapInfo assets did not link up. It is these small discrepancies from the submitted drawings or survey plans that did not get noticed at first but became very prominent when interpolating the data to the earth's curvature. This may be due to the large distances that the assets are spaced over.

This issue was overcome by creating a ascon standard for any new drawing that will be submitted to council prior to plan seal. This will be expalain in more detail later in this dissertation.

Spot Checks

Spot checks were performed to check if the location of assets were accurate. The topography allows us to look for visual assets and we can check the DCDB to the lot boundaries and see what accuracy we can achieve. For an example, a quick check is performed for stormwater pits and sewer manholes and is illustrated by Figure 3.7.

The purple arrow indicates that the stormwater pits lines up correctly. The green arrows in the bottom of the figure indicate that the sewer manhole is out by approximately 2 meters. Information such as natural surface levels can also be checked against the contour levels.

Figure 9.4: Aerial photo with the locations of stormwater pits and sewer manholes to perform spot checks. The arrows indicate the actual and data base locations of the assets.

9.6 Setting up Exponare to create a "Live - Link"

Exponare is a program that can link computer systems such as MapInfo and Finance 1. Exponare does not create a new database but pulls information from other databases and displays it as one large database. It can also notify or update other databases. This is only possible when each asset has a UID that can be used to link information. For example, a property has a unique reference (Lot and Plan number) that Exponare will run through the different systems to find this UID and provide information to the user about this property. Exponare will pull information from DNR such as owner names and then get property details from the engineering database and lastly the phone

number, rates for the house from another databases system. With Exponare, all the required information about a property is provided in one search. Figure 9.4 is a screen shot of Exponare displaying all the information for the selected property.
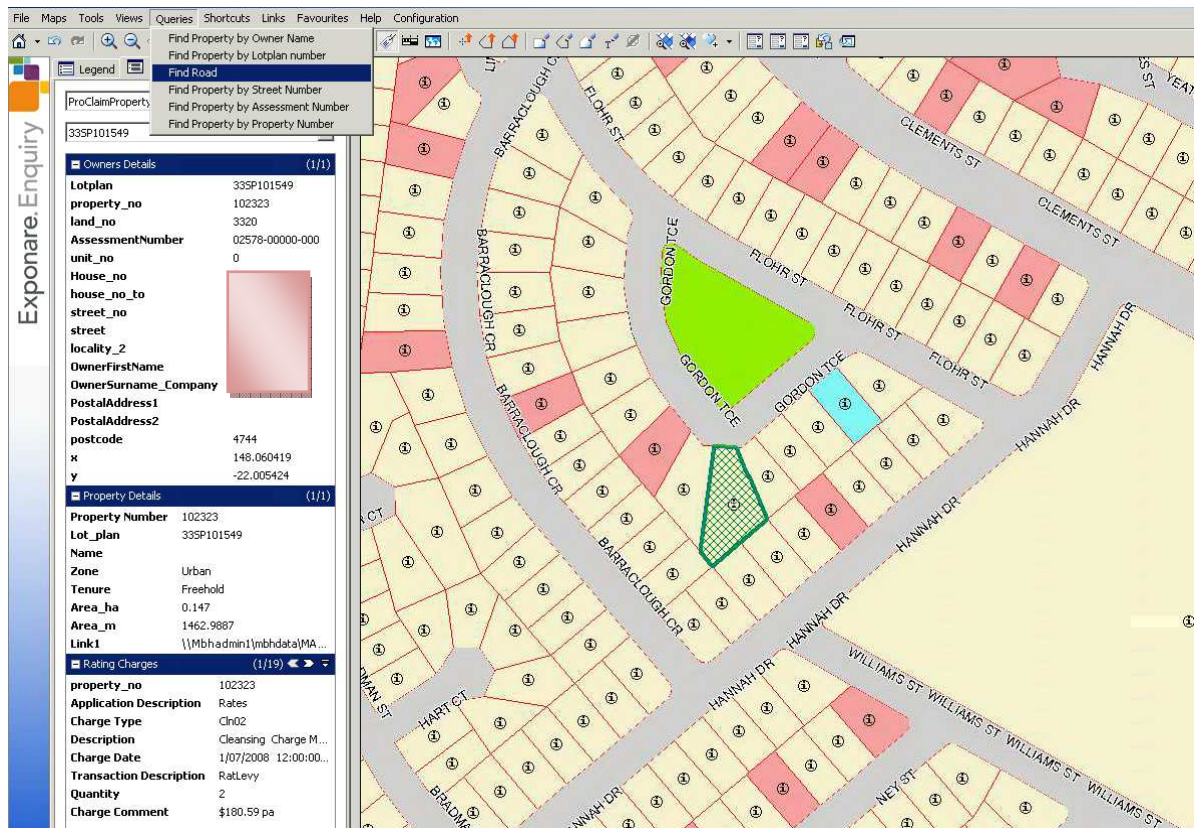

Figure 9.4: Screen shot of Exponare showing all information for the selected property.

Exponare is a user friendly program to access information but it does require a considerable amount of programming to set it up. This is due to Exponare being more versatile than most programs as it can be altered by users to better meet their needs. Exponare need to access the databases within different programs and since each program is written differently it must be altered and programmed to be able to access these databases. Exponare is also a visual database similar to MapInfo but is allows the user to perform more powerful queries. The queries are purposely made to imitate most database queries to reduce the time it takes new staff to learn the program.

Licencing

In order to access the databases behind programs bypassing their designed interface, security alterations to programs had to be made to enable Exponare to access the information. These programs such as Finance 1 or ProClaim are designed to only allow users access to information if the user uses the programs designed user interface. This is done as a safety feature for these type of software programs to deny any program access to the database behind the firewall. This type of programming is typical as it is blocks out any hacker or Trojan that tries to get access to information. To be able to get Exponare through this firewall the programming of the financial systems needed to be amended slightly. To do this, access has to be gained to the copyrighted programming software protecting each programs database. Council had to buy a licence for the current financial systems or any other computer system to be able to read the database behind the designed user interface. The licence allowed council to make slight reading alteration to the copyrighted software. Essentially the new updates tells the program that Exponare is a remote user so that the financial systems allows Exponare to retrieve and save information. Along with this licence they had to release limited information about the security parameters for the program so that these changes can be made and the program to function as it was designed to function.

The final aims of accessing the data management system were discussed and then a method had to be created to reach those goals. Each assets or information field that was needed was carefully identified then a draft was created of how Council would like to access the information in Exponare. Knowing this parameter, XY Mapping has done the programming for this link whilst not violating council's limited licensing agreement.

It was a lengthy process to acquire a licence to be able to slightly modify copyrighted software. The legal and licensing requirements did consume a considerable amount of time to analyse and comply with the restrictions. If any of the legal obligations were breached, council will loose all access to their software packages immediately without any financial compensation. This will result in council having no financial system and no financial data. Council would also be left with enormous fines for any alteration to the copyrighted software packages. XY Mapping has done all the alterations to the programs since it was very advanced programming but also had the huge legal

implications if done incorrectly. Once all the links between the different programs are created any authorised staff member can access the required information through Exponare.

10 - Accessing Information

Since Exponare has access to such a large amount of information it is vital to sort through what information can be accessed and by whom. For confidential reasons council needed to control who has access to this system and information. The system had to ensure that the right information reached the right staff member so that the best informed decisions are made every time. The two goals did contradict each other as trying to control information had a high likelihood of preventing information from being accessed when required. A further implication was put on the process as it must reach the intended goal while reducing the amount of bandwidth required by Exponare. Reducing the amount of bandwidth required is important as to not slow down the council's other programs also using the council servers or network.

10.1 Informtion Access

Each section in council does require information that can only be retrieved from another section. For example, the building section will need engineering information to adequately evaluate buildings and the planning section will also need engineering data to successfully plan for the towns future. It was important to liaise with staff from each section to be able to understand what information they require to make informed decisions and how they plan to use that information. It was clear from consulting with the staff on what information they require to access and how they would like to access it. It was important to ensure that staff know what they were looking for in Exponare and how they can retrieve the information they require as well as know the limitations of using this information. This is important to eliminate staff making decision that are out of their scope for example, front counter staff are not allowed to make decisions or give advice to the general public without an engineer or more qualified staff member looking over what is actually being asked or the implications of it.

One month was spent leasing with staff to understand what information each section would like access to make better decisions.

10.2 Confidential Permissions

Confidentiality became a major issue as more staff could access more information very quickly. At first there were no HR procedures in place to deal with this. A considerable amount of time was spent consulting with the HR department about setting up procedures of how to treat the information and limit information sent out to the public.

10.3 Reducing Bandwidth Requirements

With Exponare access information from different programs it can slow down the council's server by using too much bandwidth. Along with XY-Mapping a lot of time was spent to reduce the amount of bandwidth needed by Exponare. This was required to allow Exponare run quicker from remote locations. It was important to reduce the amount of bandwidth Exponare uses as the less it used, the more bandwidth was available to increase the intranet speed for other applications to use. Increasing the intranet speed is important as Isaac Regional Council covers such a large area and over half the staff are located hours apart but all need to access the same information.

The only way to reduce the bandwidth was to use the survey from the section above and eliminate information fields that were not required by certain staff or departments. For example an engineer working on water reticulation does not necessarily require detail information about road, kerb and channel or stormwater. This allowed us to reduce the amount of information that Exponare searches for and therefore reducing the amount of information that get send to the remote personal computers by default.

It was decided that each section in council would keep their password but we were to create a different workspace for each section in a department. For example, there is

only one engineering password but there are several workspaces in that user account. If we consider an engineer that is working on sewer infrastructure he would log on under the engineering user and password and load the sewer workspace. If the sewer workspace required contours, which takes a lot of processing, it does not appear until the user selects it as well as any other assets required. This work space would also only load the visual information regarding water and stormwater as they do not directly impact work regarding sewer infrastructure but often it is necessary to determine their location. With no asset database information such as diameter or type it reduce the information that might be loaded unnecessarily. This missing information will only be loaded in this workspace if the user specifically selects it. When another workspace is opened the screen will remain focusing on the same topography location but load the next workspace's information. For example if raw water workspace was selected it would load any asset to do with water but will only display relevant information unless specifically selected by the user.
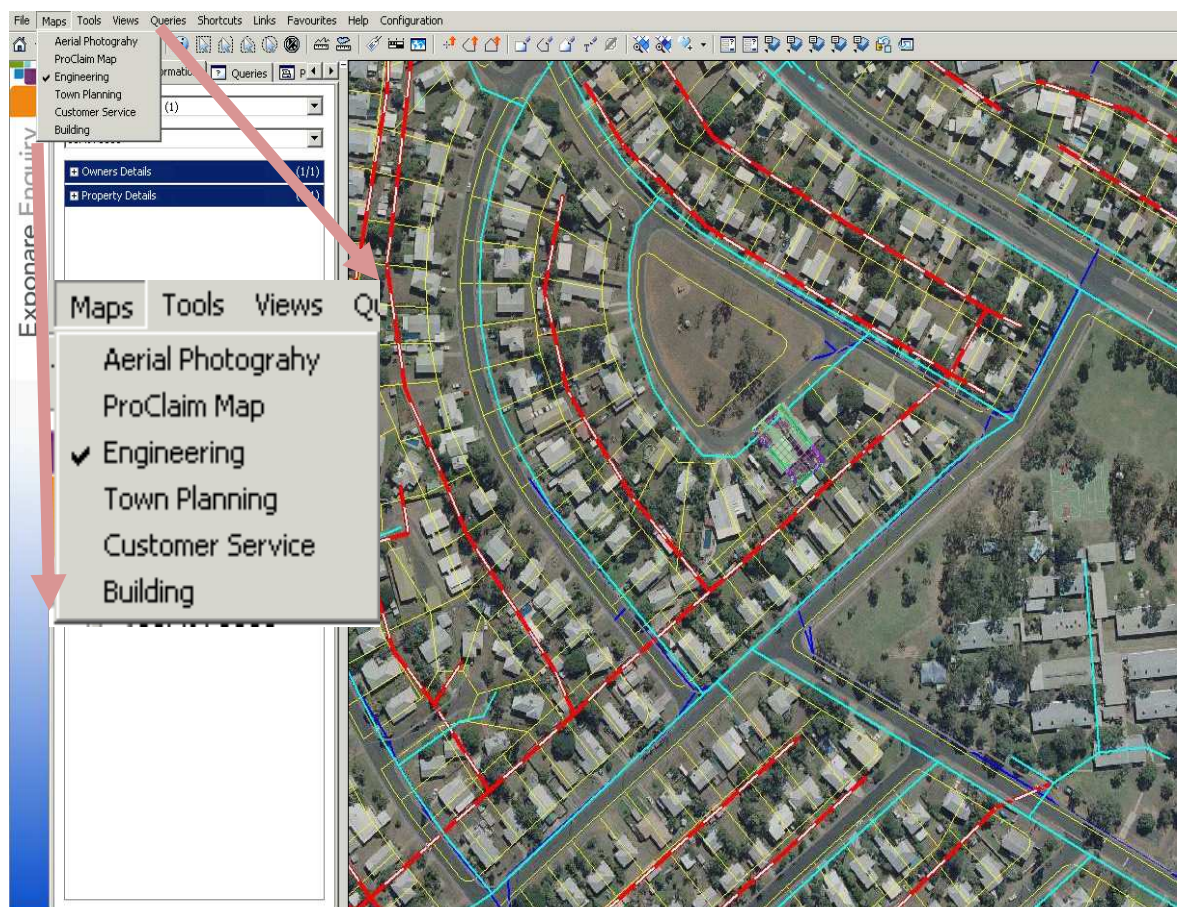

Figure 10.1: Screen shot of Exponare showing the Engineering Workspace.

Figure 10.1 is the typical engineering workspace layout. There is no confidential property information or any rate information available in this layout. They do however have topography and full engineering details on infrastructure. As seen in the top left screen there are workspaces for several different sections in council. Typically each section will only have access to one user account and a basic default workspace designed for quick loading. User can modify their workspace as they become more familiar with the system.

11 - User and Maintenance Procedures

The reason this council found it self in such a predicament is because of the lack of maintenance on their asset management system. From staff feedback it was determined that the previous asset system was neglected due to time restraints and lack of a maintenance structure. This emphasises the importance of having strict procedures for performing maintenance on an asset management system. No matter how hectic work requirements do become if insufficient time is spend on asset management, this council will be having the same issues in 5 years time. From the knowledge gathered over the project period, it was evident that the maintenance procedures needed to be clear, in a strict structure and be able to be performed quickly.

Current staff identified that the existing maintenance procedures was unclear and too complex to employ. The staff did not understand the new system. It was evident that if the maintenance procedures were not clearly defined, new staff may not be sure on the procedures and this could lead to incorrect data entry or assets not getting recorded into the engineering or finance asset register. By clearly identifying what is required for maintenance procedures, the maintenance process will be simplified. A manual was drafted on the maintenance procedures and all the staff involved expressed their acceptance of the new processes. A maintenance task was given for staff to complete themselves to ensure that the maintenance procedure is fully understood. Staff was satisfied with the simplicity of the procedures after performing a maintenance task.

Due to the intensive time requirements the current developments in the area are placing on staff, it was likely that staff will fall back into their previous routine. The new procedures needed to be placed into a strict maintenance structure. This is to enforce that all staff are required to set time aside to deal with administrative duties and perform maintenance. If all staff took a little time each week to do administrative

duties, the maintenance system would stay up to date and it would stay current. It was decided that each staff member in the engineering department had to spend 30 minutes a week on administrative duties. The project engineer and three administrative officers had to spend 1 hour a week on administrative duties focusing especially on asset management. This allowed the staff to set time aside but since all staff has to perform administrative duties, it allowed the engineering department to have 30 minutes on Thursday afternoons to ask each other question and sort though work that would not normally get done.

The maintenance procedures could be divided into four main areas, namely a procedure for the engineering department, a procedure for replacing current assets and lastly a procedure for entering new assets.

11.1 Engineering Procedures

Most information that engineers work with is on AutoCAD and this is the most commonly used drawing program used by consultants. Most consultants no do not have access to MapInfo or ArcGIS and this requires council to be able to get the information from MapInfo to AutoCAD before sending it out. Due to none of the staff having had training in MapInfo, it is would required to develop a manual for getting information in and out of MapInfo into AutoCAD.

Sending information as an AutoCAD file was the preferred way to send information to prevent untrained staff sending MapInfo layers with confidential information attached to that specific layer. This would be impossible to send confidential information in an AutoCAD file as this process only creates the visual information that the consultants use. The first manual was created to show step by step illustrations of how to export a MapInfo layer into AutoCAD. A second manual was created to illustrate how to take AutoCAD files and project them into MapInfo with the current projection map.

After three months of staff using these manuals a few notes were added and the manuals were updated. It was found that the two manuals were sufficient for their

needs. The two manuals are attached in Appendix A and a digital copy is provided on CD.

XY-Mapping also created a Geo-code that will morph the assets to suit the new DCDB every time a new DCDB is used. This works only for assets already in the system on the superseded DCDB. What a Geo-code does is it takes the positions of the assets in relation to points on the DCDB and then when the new DCDB is uploaded it adjusts the assets to be in the same location in relation to the DCDB.

11.2 Asset Replacement Procedures

Since the town is a relatively new town, it did not have the need for asset replacement programs as of yet. The first replacement pipes in town was done in November 2007 and since half the town was build in the period of a few years, it would be an accurate assumption that several assets will need to be replacement in the near future. In the past all asset replacement budgeting was done through the finance department and as mentioned earlier, this will have a disastrous affects on the engineering budget. This will result in not enough money being set aside to replace the assets in the near future.

It was vital to quickly address this lack of budgeting to avoid dire side effects of ill planning. The current asset management system can be used as a basis to plan for asset replacements and budgeting. Both Exponare and MapInfo can be used to perform queries to highlight (or print to an Excel spreadsheet) the assets that has to be replaced in a certain period of time. These programs can also produce the budgeting amounts needed to replace those assets identified. This will give a good indication of the budgeting requirements for asset maintenance over the specified period.

Two weeks was set aside to work with the current Works Engineer whom is overseeing maintenance for the town to fully understand how these programs can be used as a tool to aid him in his works. These type of information queries was used to plan for a short term 5 year budget to kick start the replacement budget.

11.3 Asset Data Entry Procedures

During data entry it is very easy to make mistakes or leave information fields empty that could lead to inconsistencies or at worst a corrupt system. XY Mapping had a solution previously employed in Hervey Bay City Council whereby they created forms in both MapInfo and Exponare for data entry. These forms were customised for Isaacs Regional Council's needs. How these forms were created was by displaying the new asset on screen and asking the user to enter the information regarding that asset. The program will prompt the user if the UID's does not match the required format and does not allow the user to save the asset until all fields have been filled in. Once the new asset is created finance will be notified automatically with the UID for the new assets. From the UID, finance can easily access the asset information and add it to their system. This procedure does not leave much room for error and was deemed as the easiest solution to avoid inconsistencies or corrupting the system.

Figure 16.3 is an example of a form for a new sewer line. The left hand side of Figure 16.3 is an empty form and on the right is the completed form. Field 15 is automatically generated and sent to the finance department once the asset is saved. Once the finance department have completed their data entry, field 15 is deleted from the new assets.

The forms are small as most other information can be called in automatically from the ascons drawings. This will be explained in the next section.

Figure 11.1: Example of data entry forms.

11.4 New Asset Procedures

Due to the rapid rate of developments in this town, the council is flooded with ascon information. This used to be a major problem as it took staff weeks to check and certify the information. With the council being understaffed, staff usually ran out of time and the new assets were never entered into the engineering asset register. This process could be significantly sped up by setting a strict standard for the format of how ascon drawings and data are accepted by the council.

Each council that were amalgamated to form the Isaac Regional Council had its own asset management system with its own headings and ascon drawings submission standards. A report was written to be taken to each council in order to standardise the format and information in each asset register. Assets are generally split into Active and Passive assets. Active assets are assets such as cars, pumps, machinery or other similar assets performing similar tasks. Passive assets are assets such as valves, pipes, gully pits, manholes and all other such passive assets. Only the passive assets were accepted during the time of the project. A summary report is attached in Appendix B as the full report contained sensitive information about councils or their processes. The active asset report was highly recommended but was not accepted due to the project's timeframe.

A spreadsheet was produced from the passive asset's report that contained all the passive asset's information fields. Each type of asset such as sewer gravity mains, water mains or valves has its own table. These spreadsheets set the standard of information that had to be provided for new assets. The spreadsheet had to be filled in by the developer with their ascon data. This provided council with the information in the best and quickest format to import it into MapInfo. This strict procedure also reduced the amount of incomplete information that was submitted by developer as they can easily see what information needed to be provided for each type of asset. Figure 16.4 provides an example of the spreadsheet required to be filled in with as constructed information. Some of the information required on the spreadsheet is

Figure 11.2: Example of ascon spreadsheet required from the developer.

12 – Results

The results for this project were all positive and even exceeded the expectations of the staff that are now currently using the asset management system. It was a long and difficult process to achieve an accurate workable asset management system. A working asset management system was achieved with relative accurate data compared to the previous system.

Implementing the asset management system led to council staff being more efficient in performing tasks as well as improved the accuracy of the data available. The system also needed to be easy to use so it will be accepted by staff and continued to be used and maintained.

12 - 1 Efficiency

The asset management system sped up the efficiency of day to day activities and reduced most of the tasks from a few hours to a couple minutes. Certain tasks that were previously involved looking up plans and going through notes to find information regarding a particular asset, became a simple process of selecting the asset and all the information regarding that asset was instantly available. The new system also has very powerful capabilities to be able to perform queries such as maintenance. Being able to perform queries such as maintenance allows council create a relatively accurate budget for a specified maintenance period. This is a much more efficient way of setting up the budget regarding maintenance than what was previously employed

12 - 2 Accuracy of Assets

The current system has surpassed both my and staff's expectations regarding the accuracy of the system. Comparing asset registers from engineering and finance has

proved to be very well reflective of each other now. The PDA has been used to prove that the current infrastructure layout on MapInfo is very accurate with what is found on site. It has also been made clear with staff's administrative duties, the more they use and update the system, the more accurate it will become.

It is not council's responsibility to provide accurate information to sub contractors as they are required to perform their own surveys, however several contractors use the information provided by council as they deem it accurate enough to calculate quotes and perform small operational works that does not require development approvals. This is a good indication that the current asset management system has accurate data that council can rely on it for its day to day activities.

12 - 3 User Friendliness

Previously there was no user friendly engineering asset management system as it was plans and hand written notes that had to be searched through to obtain information. If the staff member did not know who to ask for what information, it was unlikely that a solution will be reached. Council's new asset management system is a system that any staff member can use with minimal training. They will be able to get access to any information they require for their work. This was one of the objectives to create an asset management system that will be easy to use for any staff member with minimal training.

12 - 4 Staff's Acceptance

The resistance of staff to accepting the new system was quite unexpected. The staff's resistance was an important issue that needed to be overcome during this project. This project was performed under pressure due to the time constraints and to prove its usefulness in the hope that staff will support it. Currently all the staff are using the system and the hard copy files and plans have been send to storage. Council is confident that what is available on MapInfo is more accurate and up-to-date even in the old sections of town. Staff's acceptance of the system and the assistance that the

system provides their day to day activities will ensure that this it is used well into the future and kept maintained.

13 - Discussions

When the project started it was not known how much work was actually involved in gathering the information and the inconsistencies in the asset information. The first three months of project work was unproductive as each section of infrastructure that was looked at, several inconsistencies was found. Identifying the missing or incorrect assets consumed more time than what it would have taken load the information into MapInfo and then noticing the inconsistencies. After careful consideration and leasing with senior staff there was no easy way around solving this problem. These inconsistencies all had to be check one by one and no computer system could be used to sort through them. These inconsistencies had to be checked before information is loaded into MapInfo.

The initial lack of support from the staff was a most surprising setback but a vital hurdle that needed to be overcome. It was expected that the staff would have welcomed a new system that promises to be very beneficial especially in day to day activities. This initial resistance to the system was understandable as the staff did not think it was possible to create an accurate system from the current data. The surprising part of the staff's resistance was their unwillingness to change even if the change was for the better. Staff was not happy with the current system but they were willing to continue with it. The current system was inadequate, inaccurate and incomplete yet they continued to use it for its familiarity. They were not willing to try a new system as they thought it to be too complex and involved without giving it a trail run.

The first part of the resistance was trusting the information and this was address by subjecting the data to several spot checks. Staff was encouraged to find inaccuracies in the current system then compare it to the new system. This setback was mainly solved when the town's on-call plumber was called out to find a sewer manhole as there was

issues with the sewer line upstream. The plumber was very vocal in expressing his frustration of the current system and that he spent half a day digging and did not find the manhole. This provided the opportunity for the new system to validate its accuracy, especially as that section of town was recently checked and imported into MapInfo. MapInfo showed that the manhole was in a garden bed in the east corner of a property lot. The natural surface level and contours did not compare so it was assume that the difference between the two levels will be the depth the manhole cover is under ground. A few days later the plumber was back in the office full of praise as the manhole was not exactly where it was shown on MapInfo but it was still in the garden bed and approximately 2 meters underground. After this incident, staff was fully supportive of this system as the manhole might not been found without it.

 The only setback to still overcome was how to simplify each process making it easy for staff to learn and use, knowing that once the system was used they continue to use it. A considerable amount of time was spent with staff and a manual was created to assist staff in using the new system. Staff had to ultimately convince themselves that they should be using the new system. Some staff started using the system after being shown what the system was capable of achieving while other staff had to be eased in over several months. Once staff built a trust in the system, they were no longer resistant to the new system being implemented.

Software licensing was likely to be a hold up in the process especially since Isaac Regional Council is such a small council, the process was much more complicated. When XY Mapping applied of the licensing they were declined as Pitney Bowens, the owners of MapInfo and Exponare, did not recognised Isaac Regional Council as a government department. After weeks of correspondence sent back and forth, the issue was resolved as Pitney Bowens still had Belyando Shire Council and therefore could not find Isaac Regional Council's registration. Once Isaac Regional Council's had licences to start work there was another setback. Pitney Bowens responded stating that Nebo Shire Council, Dysart Shire Council and Broadsound Shire Council did not have permission to access Isaac Regional Council's licences. It took 1 week of amalgamation documents and other correspondence to demonstrate that Nebo Shire

Council, Dysart Shire Council, Broadsound Shire Council and Belyando Shire Council form the Isaac Regional Council since the amalgamation.

This process was repeated for the financial systems as each Council had different licences for different financial systems. Most of this work was done by XY Mapping with legal advice obtained from council's legal representatives.

14 - Recommendations

The current system is complete in its package but in order to make better use of the power in the software package, it is recommended to select a few staff with a good computer understanding to undergo advanced training by XY Mapping. XY Mapping can tailor a training program for the specific council needs and train the staff accordingly.

The second recommendation is only plausible if the engineering budget allows for it, however due to the size of the area that Isaac Regional Council is covers and the relatively small population paying rates it may not be viable. It is recommended that council has either aerial photographs flow or to purchase high resolution satellite images for the whole Isaac Regional Council district area. The images can be placed into a MapInfo layer and can provide important information to council staff regarding rural properties or creeks that can greatly speed up engineering tasks. If an understanding of the location is achieved before the employee go on site, it can greatly benefit the employee as they can be more prepared.

The last recommendation applies to two engineers within council, the Project and Design Engineer. The last recommendation is a software addition to MapInfo called Vertical Mapper. Vertical Mapper can be bought through XY Mapping with a government discount but still cost approximately $3,500 per licence. It is therefore recommended to only purchases two licences for the two engineers as they would benefit the most from having it. Vertical Mapper can analyse either spot heights or contours to create a 3D surface. This process is quite demanding on the computer hardware and should not be used on a basic computer. Once the 3D maps are created, it can be used by any other pc with Vertical Mapper installed on it. The 3D maps can be viewed by any MapInfo package but will not be able to be manipulated.

Figure 19.1 illustrate Moranbah created on a 3D grid from the existing contours. The height variations are exaggerated by a factor of 5 to enhance the contours.
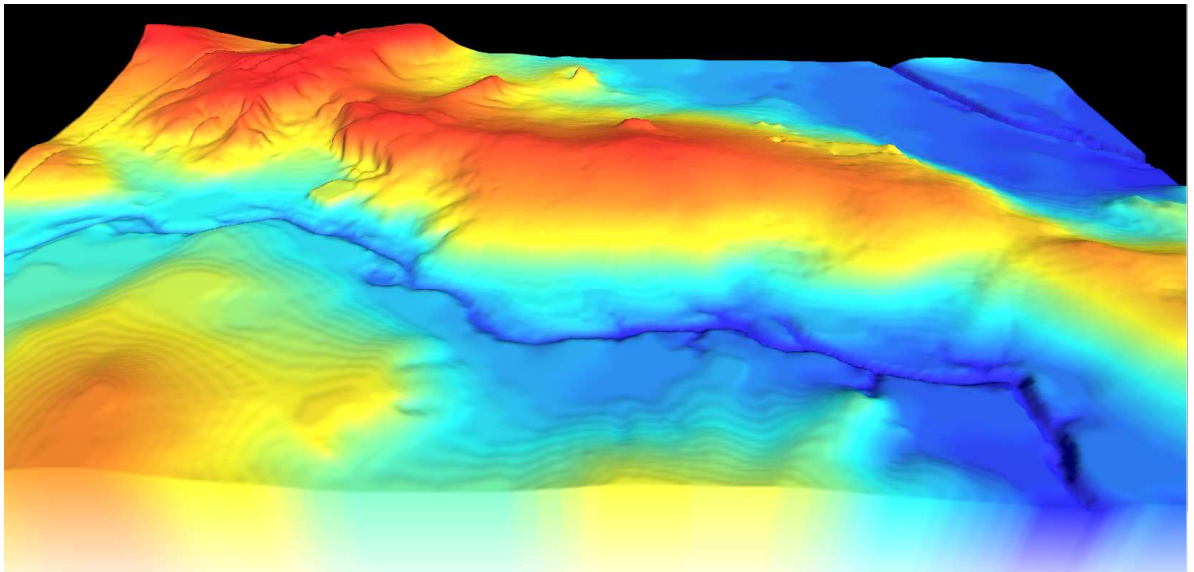
Figure 14.1: Moranbah in 3D with contours amplified by a factor of 5.

have Vertical Mapper installed. The image clearly indicates the two creeks running along the town and the colours have been set to show the flooding height as light blue.

As well as the visual aids Vertical Mapper can also be used to provide cross sections of particular assets. Figure 14.1 illustrate is the proposed sewer line that was sent out to tender for a quote. The cross section was created within a couple of minutes and it allowed contractors to easily see what is required and council's engineers can get numbers to use in their daily works or design.
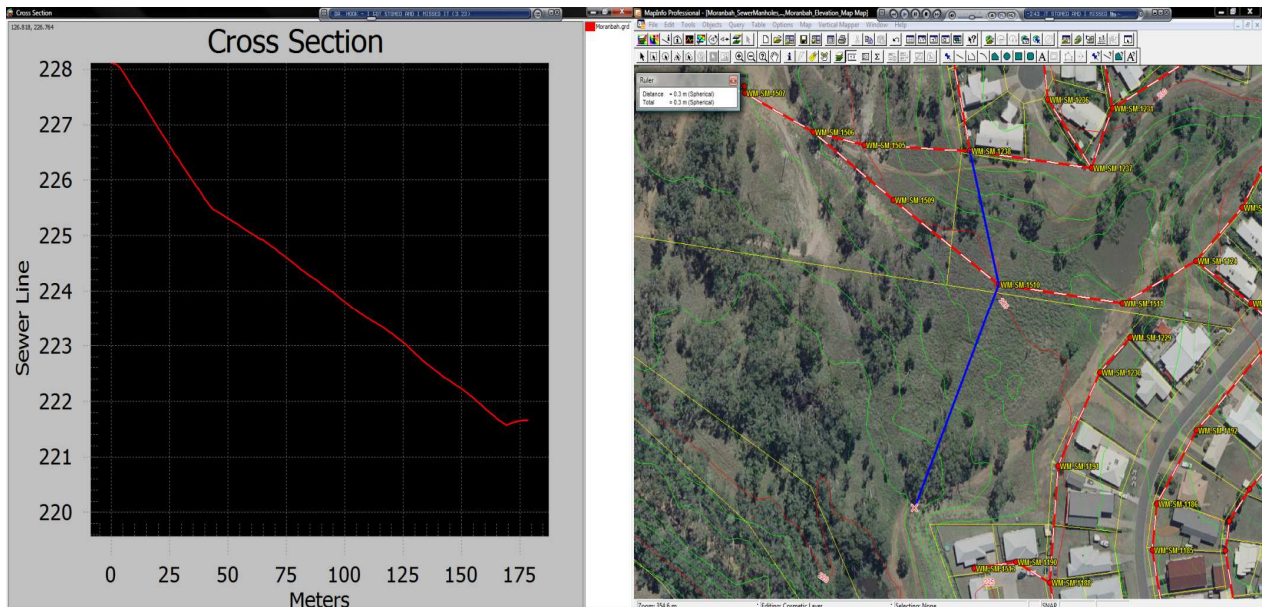
Figure 14.2: The cross section for the proposed sewer indicated by the blue line

The proposed sewer line in Figure 14.2 is indicated in blue and the cross section on the left in red. The cross section is as accurate as the contours on which it is based on. In this image the contours are based 25cm. If budgeting restriction allows it would be recommended to purchase a licence for the Drainage Engineer as it will be useful for flow calculations or stormwater designs.

15 - Conclusions

This project changed a small local council from a paper based engineering system to a digital asset management system. In changing the asset management system of the council, it was found that the current system had several discrepancies and inconsistencies. Most discrepancies and inconsistencies occurred due to the manner in which the town was initially developed and the amount of rapid development that has occurred since. Moranbah started as a mining accommodation settlement and has quickly grown to the largest town in Isaac Regional Council. The council was understaffed from the beginning and with the rapid development that took place, sufficient asset information was never obtained.

It was vital to get a working asset management system in place, however the information will not be complete and will have to be updated as more and accurate information was found. The staff resistance at first to the new system slowed down the progress but was overcome when the current system yielded no solution and the new system was able to provide accurate information to solve problems. Staff supported the new asset management system after the system demonstrated its usefulness and accuracy.

A solution to the problem of moving information in and out of MapInfo every time a new DCDB was issued was a complicated task. The DCDB changed by several meters each time and the different projection maps used created minor but problematic changes to the asset management system. Each projection map required new co-ordinates to be used and the information in MapInfo had to be changed by creating a new AutoCad file and then importing the information back into MapInfo. XY Mapping found a solution by programming given points into MapInfo and then using a geo-code to match the points and place the DCDB in the same location every time. Consequently avoiding need to update the co-ordinates every time a new DCDB is issued.

All these solutions helped to create a powerful asset management system (MapInfo) that was sufficient for the current and future needs of the engineering department. MapInfo however did not solve the lack of communication between the finance and engineering department regarding the assets. This problem needed to be address to keep both the engineering and finance department using the correct asset information. This problem was solved through using Exponare.

Exponare provided a solution for the remaining issues that was experienced at council. Exponare created a link between all the computer systems using the UID's and this ensured that all systems was kept up to date and using the same information. If a staff member changed an assets or added new assets to the engineering asset register, the finance department will automatically get notified to update their records and vice versa. Exponare also allowed more system to be linked together and as a result information in council could be accessed more efficiently. The amount of bandwidth that Exponare uses as well as the programs user friendliness accompanied by a visual database interface, created the optimum solution for an effective asset management system for the whole council.

Staff commented about the efficiency of the new system and how it is assisting their day-to-day activities. With staff using the system on a daily basis implies that they are confident with it and will also be able to maintain the asset management system. Isaac Regional Council has successfully moved from a paper based engineering asset management system to a powerful digital engineering asset management system that is being used throughout the whole council.

16 - References

MapInfo 2009, MapInfo Profesional, MapInfo Product Support, viewed 7th May 2009, <http://www.mapinfo.com.au/location/integration?txtTopNav=c26813cc0 3467f00dev-vcm100001a031dc7____&txtLeftNav=962b136cc2867f00dev-vcm100001a031dc7____>

Jackson, P 2008, 'Power vs Power Consumption', *PCSuite,* Issue 112, No 4, London.

Pitney Bowes 2009, MapInfo, viewed 6th May 2009, <http://www.mapinfo.com/>

Google-Groups 2009, 'MapInfo and ArcGIS - Strengths and Weaknesses', *Google Groups Forums*, viewed 7th May 2009, Google, <http://groups.google.com/group/mapinfo-l/browse_thread/thread/de5bc44eb490f6cf?hl=en>

Phillips, T, XY Mapping, Hervey Bay 2004 - 2009

VanDruten, B 2005, 'MI-L ArcGIS vs MapInfo', *Directions Magazine*, viewed 7th May 2009, <http://lists.directionsmag.com/discussion/read.php?f=7&i=43212&loc=0 &t=43212>

Wikipedia 2009, 'MapInfo - Bitney Bowes', viewed 7th May 2009.