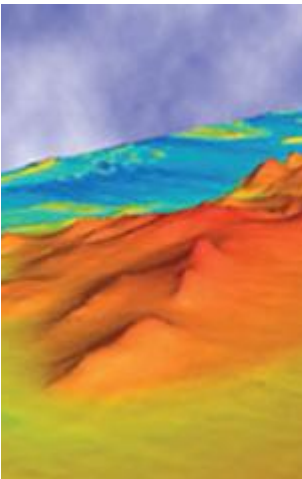
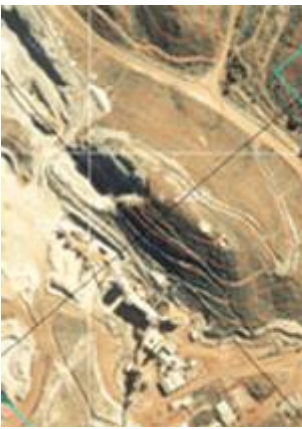




# Spatial Information and Survey Services



**Cardno knows  
how to meet your  
requirements**

## Signature Projects & Key Personnel

Cardno's vision is to be a world leader in the provision of professional services for the improvement of physical and social infrastructure.



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## DEDICATION TO QUALITY

Cardno has developed and maintains a quality system which is applied at the conception, planning, investigation, design, documentation, tender evaluation, procurement and contract administration phases of a project. The quality system is based on the requirements of AS/NZS ISO9001 Quality Systems – Model for Quality Assurance in Design, Development, Production, Installation and Servicing. The quality system, as described in the Company’s Quality Manual and Procedures, has been designed to control the work and confirm the effectiveness of the planning and management of each project in meeting our obligations to client.

### Quality Management System (QMS)

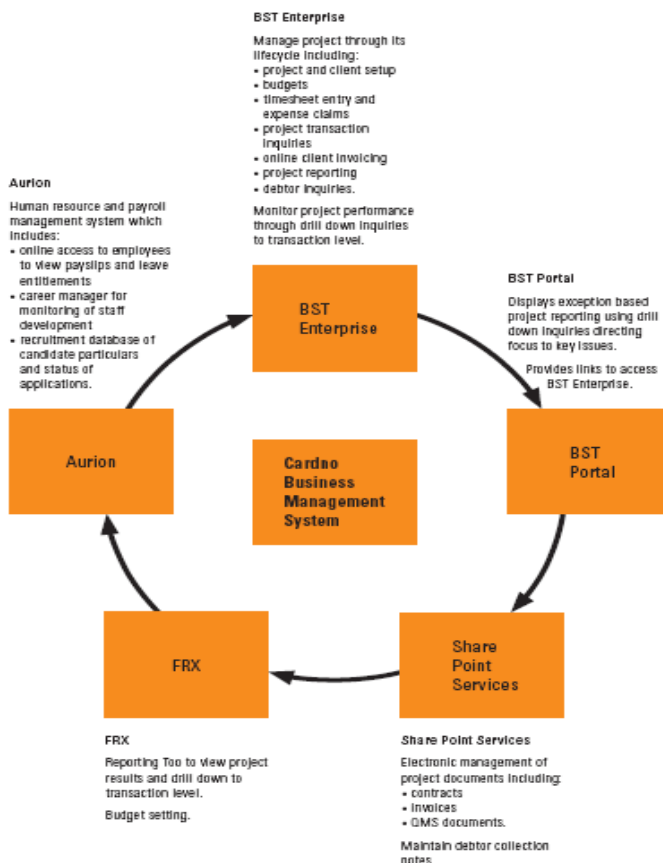
The system provides the foundation for practical implementation of systems to achieve the objectives set out in the project. The Quality Management System complies with the requirements of AS/NZS ISO9001:2000 Quality Management Systems, and covers:

- contract review
- document and data control
- purchasing
- design and process control
- project management

The QMS provides for internal and external audits, emphasising client feedback to ensure projects are delivered on time, to budget, and meet or exceed client expectations.

The Cardno Business Management System allows the firm to consistently track costs, resulting in project managers being highly informed with detailed and current financial information throughout the project. The system is integrated with timesheet, budgeting, client and job register systems to provide real-time cost control and financial information to assist in project monitoring and reporting. The Cardno Business Management System is web based and includes the components displayed below:

Cardno is also an industry leader in the application of Safety-in-Design principles. Under the Queensland Workplace Health and Safety Act 1995 and the recently issued ‘Guide to the workplace health and safety obligations of designers of structures’, designers are required to consider safety design principles throughout the lifecycle of a structure. Under the Act, the client also has obligations. Cardno has developed and adopted schedules to meet these regulations.



## SIGNATURE PROJECTS

The project team has a wealth of relevant management services experience as highlighted in the following examples.

### Boddington Gold Mine Expansion Project

Cardno Spectrum Survey was tasked to provide set out, check and verification surveys of constructed mine plant and infrastructure. This included verification of built structures such as the large primary crusher, ball mills, tanks, conveyors, fuel, reagent and floatation facilities, and the collection and maintenance of data relating to these structures. Five day per week support was provided by two survey crews on site with technical and administrative back office support from our Perth office over a seven month period.

Additional works carried out on site included establishment and validation of the primary control network which contributed to combining all plant areas onto the single grid system, resulting in more efficient management of survey data for the project, which covers an area in excess of 200 hectares.

Located south of Perth, the Newmont and Anglo Ashanti owned Boddington Gold Mine expansion was planned to be complete by late 2008, with the recommencement of mining beginning in 2009.

#### Client

Aker Kvaerner Clough Murray  
Roberts JV

#### Time

2008

#### Agreed and End Fee

\$495,000 at agreed daily rate.

#### Referee Details

Tom Maher  
PO Box 46  
Boddington WA 6390  
Telephone: 08 9883 4207

#### Key Staff

Steve Burrows, Lead Surveyor  
Cardno Spectrum Survey

### South East Queensland Region Water Supply Strategy Study of Alternative Water Resources

For this project, Cardno developed in-house custom GIS analysis software. Using this innovative software, Cardno was able to compute a near-optimal (in terms of piping and pumping costs) network of piping to supply water from the designated sources to the designated demand locations. The software drew on a database of unit costs, digital maps of elevations and geology, and urban density. Costs (piping and pumping) could also be calculated for 'hand-drawn' routes, with appropriate pipe diameters automatically selected and required pump capacities reported. Subsequent to this project, the software was modified for near-optimal route-finding of roads.

The South East Queensland Regional Water Supply Strategy (SEQRWSS) is a project undertaken under a partnership between the Queensland Government and the Council of Mayors of South East Queensland to formulate regional strategies for managing the future water supply needs of South East Queensland. Cardno (Qld) Pty Ltd was engaged to assist with a study under this project, providing:

1. a desktop review of alternative water supply sources to include rainwater, stormwater and wastewater in the study area with an emphasis on opportunities, constraints, sustainable yield and economic viability; and,
2. recommendations and preliminary costing for any other investigations to reduce uncertainty about available information that might be worth considering.

The use of the custom software resulted in a quicker process (hence lower fee claims) and enabled greater confidence in the project outcomes; in comparison to the usual process involving manually picking where to route and join pipes, selecting diameters, and estimating costs.

When the team faced a problem - in the lack of a digital spatial map of geology with the required level of detail (two-depth soil-types) - they simply commissioned a geotechnical engineer with extensive local knowledge and access to historical sample data, illustrating Cardno's ability to face challenges with innovation, common sense and the client's best interests in mind.

#### Client

Department of Natural  
Resources and Water, Qld

#### Time

Oct 2005 – Oct 2006

#### Agreed and End Fee

\$94,000 Agreed rates.

#### Referee Details

Paul Hope  
Natural Resources & Water  
GPO Box 2454 Brisbane Q 4001  
Telephone: (07) 3224 8360  
Email [Paul.Hope@nrw.qld.gov.au](mailto:Paul.Hope@nrw.qld.gov.au)

#### Key Staff

Colin Kemp, Senior Developer/  
Programmer, Management  
Services, Cardno (Qld),  
Brisbane

## Richmond Valley Video GPS Survey

Using vehicle-mounted cameras and differentially-corrected GPS, Cardno carried out a video survey of the roads and road-side signage etc of Richmond Valley (NSW). A thousand kilometres of road were driven, and an asset register produced (2m accuracy) from the video back in the office by use of in-house software. The software was also used to trace pavement defects and line marking off the video into a digital map; as well as to construct spatial regions representing pavement blocks.

To speed up the process, Cardno developed custom software to automatically build spatial regions representing pavement blocks from centrelines and market points annotated with widths

Cardno calculated for each pavement block a condition rating based on the defects which were located within it; and also analysed the GPS track of the vehicle to give each block a speed rating. The benefits to the client are easy-to-use maps of aggregated information which permit ready establishment of works priorities.

**Client**

Richmond Valley Council

**Time**

July – November 2008

**Agreed and End Fee**

\$109,000 (Lump sum)

**Referee Details**

Anthony Magarry  
Richmond Valley Council  
Locked Bag 10  
Casino NSW 2470  
Telephone: 07 02 6660 0221  
Email: [Anthony.magarry@richmondvalley.nsw.gov.au](mailto:Anthony.magarry@richmondvalley.nsw.gov.au)

**Key Staff**

Colin Kemp, Senior Programmer/  
Developer, Management Services,  
Cardno (Qld)

## Aerial Photography - Agency

Cardno Spectrum Survey supplied ground survey services, mapping and orthorectified imagery for over 2600 square km of exploration tenure held by Atlas Iron; an emerging Iron Ore producer with substantial holdings in the Pilbara region of Western Australia. 1:25000 colour photography was sourced from Landgate, controlled and orthorectified. Output was in CAD and Mapinfo formats.

The spatial data was used utilised and interpreted by geology, environment and drainage experts as part of ongoing feasibility studies for the various prospects.

Further detailed ground surveys were undertaken to defined ore body, road and plant layout sites as part of the Definitive Feasibility Study for Atlas' Pardoo DSO (direct shipping iron ore) project. Atlas Iron shipped its first commercial iron ore from Pardoo in December 2008 and continues to advance its Abydos and Wodgina projects.

The client's initial scope was geology focused only but through consultation with other project stakeholders we were able to communicate the benefits of the deliverables to other elements of the project. As result, Cardno assisted Atlas avoid duplication of expenses while contributing to other elements of the feasibility study, essentially at zero cost to the client.

**Client**

Atlas Iron

**Time**

2004 - 2009 - ongoing

**Agreed and End Fee**

\$245,000

**Referee Details**

On request

**Key Staff**

Darren Wilkinson, Project  
Manager, Cardno Spectrum  
Survey

## Mt Ousley Bulli Pass Drainage

The RTA engaged Cardno to undertake a field GPS and photographic survey of all of their stormwater assets along Mt Ousley Road (MR95) and Bulli Pass (SH1). Each culvert was inspected and its condition and hydraulic parameters recorded directly in ESRI format. The data was assessed using a database that calculated upgrade or replacement pipe sizes, costs and prioritised (using the RTA's weightings) the upgrade of each culvert.

The team enacted on values of innovation through the combination of GPS and Mobile GIS capabilities to improve asset information data capture process and analysis of results.

GIS provided an ideal platform for the establishment of a culvert and stormwater drainage asset database on this project. This framework is applicable to all similar projects and provides an efficient means of capturing, analysing, querying and displaying data. The project extended the capabilities of Excel and GIS and integrated the two using VBA.

The RTA Concluded that this GIS framework for asset management and analysis of culverts should be adopted for all other regions of NSW within the RTA.

### Client

Roads and Traffic Authority (RTA)  
Southern Region

### Time

2006  
Project ran as per client's  
agreed timeframe

### Agreed and End Fee

\$45,000

### Referee Details

Robyn Lyster  
Level 4  
90 Crown Street  
Wollongong, NSW, 2500  
[Robyn\\_Lyster@rta.nsw.gov.au](mailto:Robyn_Lyster@rta.nsw.gov.au)

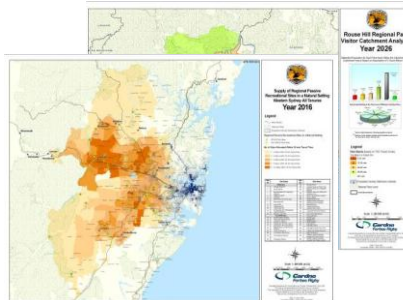
### Key Staff

Peter Shoemark, Group CADD &  
GIS Coordinator, Cardno Forbes &  
Rigby

## NATREC Data Analysis and Mapping

Working for NWS National Parks and Wildlife Services, Cardno Forbes Rigby was responsible for spatial data analysis and mapping to identify existing and projected visitation needs for NPWS sites and identified off-park sites in Western Sydney. The project achieved a number of key objectives to:

- Assess supply and model visitor demand for the stated Western Sydney Parks;
- Determine the visitor catchment for each identified park and describe the demographic and socioeconomic makeup of these visitors;
- Model and spatially represent supply and current visitor demand for identified parks; and
- Forecast and spatially represent trends in visitor demands.



The team innovatively combined the spatial network analysis with demographic studies. The results were presented in an easy to interpret and high quality spatial format, with explanatory notes attached. Data presentation was principally spatial. The project informed the preparation of the Park and Wildlife Division's Central Branch – Western Sydney Recreation Study and the Branch Visitation Management Plan.

Forecast and spatially represented trends in visitor demands for the identified parks every five years from 2007 to 2031

### Client

National Parks and Wildlife  
Services

### Time

Project ran as per clients  
timeframe

### Agreed and End Fee

\$ 35,000

### Referee Details

Jeanette Stannard,  
Level 1, 10 Valentine Ave,  
Parramatta, NSW.  
Ph: (02) 9895 7725.  
E: [jeanette.stannard@environment.nsw.gov.au](mailto:jeanette.stannard@environment.nsw.gov.au)

### Key Staff

Peter Shoemark, Group CADD &  
GIS Coordinator, Cardno Forbes &  
Rigby

Liz Knapman, GIS Analyst

**KEY STAFF**

**Steve Burrows**



Steve has in excess of 30 years experience the government and private sectors, covering a broad range of hydrographic surveys, mapping and charting, as well as land based engineering and geodetic surveys.

Projects include mapping and charting for the Royal Australian Navy, hydrographic surveys for facilities in Australia and Oman and several construction projects for the mining, urban and industrial development and civil infrastructure industries.

His current role is primarily land based surveys for asset management and design, and engineering construction.

**SIGNIFICANT PROJECTS**

- Boddington Gold Mine expansion - audit and setout surveys for mining infrastructure and earthworks
- Iron Ore Project - ground surveys, aerial photography and mapping for route selection and flood studies, as part of a mining definitive feasibility study.

**QUALIFICATIONS**

- High Cert Surveying
- Cert Land and Engineering Survey Drafting

**CURRENT POSITION**

- Surveyor
- Joined Cardno August 2008 (Company Merger)

**PROFESSIONAL AFFILIATIONS AND APPOINTMENTS**

- Member Spatial Sciences Institute

**OTHER TRAINING OR SPECIALIST KNOWLEDGE**

- Mapping & Charting
- Land Based Surveys for Asset Management & Design

**CONTACT DETAILS**

Cardno Spectrum Survey  
Balcatta, WA.  
Ph: 08 9240 4444  
E: [Stephen.burrows@cardno.com.au](mailto:Stephen.burrows@cardno.com.au)

**Colin Kemp**



Colin has worked with Cardno for over 13 years on a wide variety of projects and across a number of disciplines. In his main role as a Senior GIS and Database Specialist, Colin has been involved in innumerable projects for Local Government Authorities and private concerns, making use of his particular skills in software engineering, GIS (ie spatial data) analysis & presentation, data management, internet technologies, and Database application development. His work on the Queensland Innovation Award-winning Maroochy Population Model was followed up by developing the more-advanced Integrated Planning Model in subsequent years. More recently, Colin has been Project Manager on a number of projects in South-East Queensland, and has developed and refined the software, electronics, and documentation for Cardno's successful 'DRIVE' video- GPS- and GIS- linked survey system. This system permits 'real time' georeferenced surveys from cars, trains, quad-bikes and helicopters; while its desktop component enables automatic chainage calculation and accurate spatial locating of items from the captured footage and interoperates with multiple GIS environments (desktop and thin-client internet).

**SIGNIFICANT PROJECTS**

- The DRIVE integrated Database, GPS, and digital video data capture and management system
- South East Queensland Region Water Supply Strategy Study of Alternative Water Resources- development of the 'WADE' pipeline route finder and cost (pumping plus piping) calculator for strategic pipelines
- Residential Land Suitability and Infrastructure Delivery Analysis for Maroochy Shire Council
- The Maroochy Population Model and the Ipswich City Council Integrated Population Models- development of GIS-based planning and infrastructure tools for estimation of current and future resident population and EPs on a per-parcel basis

**QUALIFICATIONS**

- Bachelor of Science (Computer Science) *Hons*

**CURRENT POSITION**

- Senior GIS/Database Specialist
- DRIVE Asset Data Capture
- Joined Cardno November 1995

**OTHER TRAINING OR SPECIALIST KNOWLEDGE**

- Programming
- Program Management
- Database Design and Management
- Software Design

**CONTACT DETAILS**

Management Services  
Cardno (Qld) Pty Ltd  
Brisbane  
Ph: 07 3369 9822  
E: [colin.kemp@cardno.com.au](mailto:colin.kemp@cardno.com.au)

### Darren Wilkinson



Darren's 25 years of experience spans the government and private sectors, chiefly in the mapping disciplines of photogrammetry, orthophotography, geodetic surveys and project management. He has performed in a number of technical, training and management roles.

Technical management of mapping projects including standard topographical mapping for Defence, periodic surveys and general mapping and orthophoto production for State government departments, mining and resource industry. He

has extensive experience in design and execution of aerial photography projects for mapping and orthophotography including large-scale exploration and mining related projects throughout Australia, Central Asia, Eastern Europe and SE Asia. Among his tasks as Operations Manager he coordinates all ground and aerial surveys, prioritises and schedules personnel and resources, and liaises with clients and co-consultants. He is also actively involved in estimating, strategic planning and development of the business.

#### SIGNIFICANT PROJECTS

- Gold Fields St Ives, Western Australia– regional photography, ground control and mapping to support continuing mining and environmental reporting.
- Atlas Iron, Western Australia- regional photography, engineering surveys and mapping for various Pilbara projects
- RMGC, Romania- establish and manage in country tender process for engineering surveys. Aerial photography and mapping for a significant gold project

#### QUALIFICATIONS

- Diploma Cartography
- Adv Cert. Photogrammetry

#### CURRENT POSITION

- Principal, Cardno Spectrum Survey
- Operations Manager
- Joined Cardno August 2008 (Merger)

#### PROFESSIONAL AFFILIATIONS AND APPOINTMENTS

- Foundation Member Spatial Sciences Institute
- AIMM

#### OTHER TRAINING OR SPECIALIST KNOWLEDGE

- Cert Vocational Instruction
- Grad Cert Business Administration

#### CONTACT DETAILS

Cardno Spectrum Survey  
Balcatta, WA.

Ph: 08 9240 4444

E: [Darren.wilkinson@cardno.com.au](mailto:Darren.wilkinson@cardno.com.au)

### Peter Shoemark



Peter has in excess of 25 years in the Engineering and IT fields with a particular focus on GIS and CAD. He has worked for several major international companies and gained broad spectrum experience at high levels over that time that contribute to his work ethics, enthusiasm and efficiency.

Peter is a key driver of GIS and CAD solutions in the Cardno group. He currently holds simultaneous professional certification in GIS (GISP-AP) through the Spatial Sciences Institute – ACT, and IT (CMACS-PCP) through the Australian Computer Society. Peter also now sits on the SSI Professional Certification Approvals Panel. He is a long standing member of the Australian Oracle Users Group (AUSOUG) and has extensive experience in Oracle Spatial and Aspatial data management and integration.

Peter is the Cardno Group CADD Coordinator and GIS Discipline Leader, both roles reflecting his skill sets within the Cardno business.

#### SIGNIFICANT PROJECTS

- Project overview and finalisation of 3D CAD/GIS model of Wollongong CBD covering 15sq/kms and incorporating 2,700 buildings and subsequent sale of the model to Wollongong City Council.
- Fire Management Strategy (FMS) Type II mapping for NPWS Sydney, Blue Mountains and Sydney South Regions
- Verified and consolidated the tracks and trails within the Central Branch National Parks for the Corporate Asset Management System

#### QUALIFICATIONS

- Dip Sys Admin
- Certified MACS-PCP
- Certified GISP-AP

#### CURRENT POSITION

- Group CADD Coordinator
- GIS Discipline Leader, Principal
- Joined Cardno November 2001

#### PROFESSIONAL AFFILIATIONS AND APPOINTMENTS

- AUGI
- Aus Comp Society
- Spatial Sciences Institute

#### SPECIALIST KNOWLEDGE

- CAD GIS 3D Modelling
- Data Management

#### CONTACT DETAILS

Cardno Forbes Rigby  
Wollongong, NSW

Ph: 02 4228 4133

E: [peter.shoemark@cardno.com.au](mailto:peter.shoemark@cardno.com.au)

## Liz Fulton



Liz Fulton is a Senior GIS Analyst with Cardno Forbes Rigby with 8 years experience in GIS and Remote Sensing across a variety of applications. She has developed extensive experience in spatial data manipulation, analysis on raster and vector data formats, cartography, database modelling and implementation and application development. Whilst working for State and Local government Liz has had exposure to generating cadastral fabric using Survey Analyst and relational property databases.

Liz has a working knowledge of numerous GIS packages and their associated databases, including ESRI ArcGIS and ArcServer, MapInfo, GenaMap and ENVI.

Liz has completed numerous spatial data remodelling on large scale data storage systems using ArcSDE with Microsoft SQL Server 2000 and 2005. She has implemented many Spatial Data Storage, Maintenance and Quality Control Policies.

Along with these skills she is also responsible for the IT component of Cardno Forbes Rigby including Networks, PC Hardware and Software and IT Help Desk

### SIGNIFICANT PROJECTS

- Dunmore/Oak Flats Inspection Surveys, using ArcPad and Microsoft Access, to develop reporting methodology and Integrate with project GIS for reporting.
- DECC Wetlands and Mapping including capturing catchment areas, data management and analytical model design.
- Dendrobium Landscape Impact Assessment and Subsidence Management Plan (SMP) site analysis such as slope, soil landscapes, vegetation communities, fire severity, and at risk swamps.
- Illawarra Healthy Cities Project, site geocoding and demographic analysis
- Designed Intranet (EView) and Intranet (GeoSamba) Spatial Data Viewers for Emergency Management and Operations Centre for NSW.

### QUALIFICATIONS

- Master (GIS & Remote Sens)
- Bachelor (Spatial Info Sys)

### CURRENT POSITION

- Senior GIS Analyst
- Local IT Coordinator
- Joined Cardno June 2007

### PROFESSIONAL AFFILIATIONS AND APPOINTMENTS

- ACS
- SSI-CP

### OTHER TRAINING OR SPECIALIST KNOWLEDGE

- GIS and Remote Sensing

### CONTACT DETAILS

Cardno Forbes Rigby  
Wollongong, NSW  
Ph: 02 4228 4133  
E: [liz.fulton@cardno.com.au](mailto:liz.fulton@cardno.com.au)

## Alison Oost



Alison Oost has over 17 years experience in Geographic Information System Mapping, specialising in local government projects. She is a skilled MapBasic practitioner with an excellent aesthetic sense that allows her to consistently present complex technical data in a visually appealing and easily comprehended way. Alison's familiarity with MapInfo means she is able to use shortcuts and specialist functions to expedite project outcomes.

She offers a comprehensive skill set including Data modelling, database design, application design and development, data creation, data analysis and interpretation as well as Spatial analysis, training and development of Data Capture Standards and QA for Clients throughout QLD .

### SIGNIFICANT PROJECTS

For the coastal regions surrounding Brisbane, Alison undertook indepth use of Terrain models using several different software packages to extract the differing Storm Surge levels for up to 10,000 years inclusive of the effects of greenhouse. The resulting Graphical portrayal of this data aided the project significantly and formed an integral part of the overall analysis for this significant storm tide study.

Alison has been involved with the process of building population models to project demand for services. The process requires detailed analysis and modelling of existing and future growth scenarios.

### QUALIFICATIONS

- Assoc Dip Bus (Computing)

### CURRENT POSITION

- GIS Specialist
- 15 Years Experience
- Joined Cardno August 2006

### PROFESSIONAL AFFILIATIONS AND APPOINTMENTS

- GIS Advisor for the Central Coast Revegetation Initiative Management Committee (1997-99)

### CONTACT DETAILS

Water Supply & Sewerage  
Cardno (Qld) Pty Ltd  
Brisbane  
Ph: 07 3369 9822  
E: [alison.oost@cardno.com.au](mailto:alison.oost@cardno.com.au)

## Les Wright



Les Wright started with Cardno in March 2008 as a GIS officer during this time Les has preformed complex queries on datasets to form the bases of High Quality Map Production (MapInfo) on a number of significant projects. Les has also setup Digital Terrain Models(DTM) using Vertical Mapper and 12D.

Prior to working at Cardno Les was a member of the *Australian Defence Force* serving as a *Geomatic Technician* where he was employed for a four year period from March '03 to March '07. During this time he was trained at the Army's "Geomatic Engineering Wing" (GEW) at Moorebank in Sydney after which he was then posted to the "1st Topographical Survey Squadron" at Enoggera here in Brisbane as a *Geomatic Technician*. It was during this time he was required to hold a "Secret" level classification for the purpose of dealing with sensitive data, and is very aware of the requirements of handling "classified" data.

### SIGNIFICANT PROJECTS

Typical of projects undertaken by Les is the detailed analysis of Digital Terrain Models (DTM) for potential Reservoir Sites for Logan City Council. The outcome was to graphically portray the areas of serviceability for each of the potential Reservoir Sites and narrow down the possible parcels of land required.

### QUALIFICATIONS

- Dip App
- Cert III SIS

### CURRENT POSITION

- GIS Specialist
- 5 Years Experience
- Joined Cardno March 2008

### PROFESSIONAL AFFILIATIONS AND APPOINTMENTS

- Secret level classification with the Australian Defence Force

### CONTACT DETAILS

Water Supply & Sewerage  
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Ph: 07 3369 9822  
E: [les.wright@cardno.com.au](mailto:les.wright@cardno.com.au)