Resource Estimation and Evaluation

Presenter:
Ian Glacken / Paul Blackney / Rowdy Bristol

The Course:
This practical 5-day course uses a real-life data set to cover the entire resource estimation and evaluation cycle and its requirements - from data collection and quality assurance through to classification. These concepts are reinforced through a large number of practical activities, all of which focus around the same real-life data set. This training course has been drawn from industry best practice and almost thirty years of estimation experience.

The 5th day of the course consolidates all that you have learned by taking you step-by-step through a check-list of the resource estimation and evaluation processes, and also gives you the opportunity to bring your own data along to discuss and get advice on.

Course Outline
- Introduction – flow of tasks, key concepts
- Data quality – QAQC, sampling, database
- Geology – geology and resource evaluation
- Domaining and data preparation – how, why, boundaries, coding, compositing
- Statistics – central tendency, variability, good and bad data sets, declustering, cutting
- Continuity – grade continuity, modelling variograms, moving from the variogram to the estimate
- Estimation – principles, 2D/3D, polygons to kriging, how kriging works, validation
- Post-processing – why, the change of support, recoverable resources
- Classification and reporting – understanding the Codes, types of report
- Risk and uncertainty – one estimate or many, why simulation?

Outcomes
During the course attendees will:
- Understand what affects a good and a bad estimate
- Appreciate the paramount value of data and how to ensure its highest quality
- Understand and apply the principles of sampling and QAQC for quality assurance
- Know how to turn a first class geological model into correct zones for estimation
- Learn how to validate zones and their boundaries against the data and geology
- Understand the critical role of geological and grade continuity
- Cover the key geostatistical methods of grade estimation and compare these with other approaches
- Know what to do when you don't have enough data
- Understand the many ways to validate your work and which are the best
- Appreciate the key criteria for resource classification

<table>
<thead>
<tr>
<th>Resource Estimation and Evaluation</th>
<th>Perth</th>
<th>16-20 Jan</th>
<th>6-10 Mar</th>
<th>22-26 May</th>
<th>21-25 Aug</th>
<th>27 Nov – 1 Dec</th>
</tr>
</thead>
<tbody>
<tr>
<td>Recoverable Resources – getting to the high grade</td>
<td>Perth</td>
<td>21-22 Mar</td>
<td>6-7 Jun</td>
<td>12-13 Sept</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Report Writing for Geologists &amp; Engineers</td>
<td>Perth</td>
<td>19 Feb</td>
<td>23 Mar</td>
<td>29 Jul</td>
<td>14 Sep</td>
<td>14 Nov</td>
</tr>
</tbody>
</table>

5% discount when you book on more than 1 course
The Presenter will be one of the following:

**Ian Glacken**  
BSc (Hons), MSc (Min. Geol), MSc (Geostatistics), FAusIMM(CP), CEng, FAIG  
Ian Glacken is a geologist with postgraduate qualifications in geostatistics, mining geology and computing who has more than 30 years’ worldwide experience in the mining industry. He has worked on mineral projects and given training courses to thousands of attendees on every continent apart from Antarctica. Ian’s skills are in resource evaluation and due diligence reviews, public reporting, training and mentoring, quantitative risk assessment, strategic advice, geostatistics, reconciliation, project management, statutory and competent persons’ reporting and mining geology studies. Ian has a strong mining production background and is a regular auditor for the world’s largest mining companies.

**Paul Blackney**  
BSc (Hons), MAusIMM, MAIG  
Paul Blackney is a geologist with more than 30 years’ technical and operational experience. His skills include resource evaluation, technical audits and reviews, geostatistics, reconciliation, grade control, competent persons reporting and project management. Paul provides worldwide technical training and mentoring in resource estimation, quality control and quality assurance, reconciliation and application of the JORC Code and is highly respected for his focus on the transfer of his knowledge to other geologists.

**Rowdy Bristol**  
BSc (Construction Engineering), AAS (Land Surveying), MSc (Geological Engineering/Geostatistics), Post Grad Dip Computing  
Rowdy is a geologist, engineer, and surveyor with postgraduate qualifications in geostatistics, and computing. Rowdy has more than 21 years’ worldwide experience in the mining industry, and four years’ experience working for a mining consultancy in the United States. Rowdy holds degrees in Geology, Surveying and Engineering, and has worked as a mine geologist, engineer, and surveyor. He has trained geologists, engineers, and surveyors in the use of Surpac Software at underground and open pit mines covering all major commodities. Rowdy’s skills are in resource evaluation, geostatistics, training, mine geology, engineering, and surveying.

Who should attend?  
The course is designed for geologists and mining engineers involved in resource estimation and evaluation. Your level experience will be up to ten years. We assume a reasonable knowledge of geology and familiarity with mathematical concepts, but you do not need to know any geostatistics or matrix algebra!

Attendee Feedback

“The course was really useful”  
“This was an excellent info and refresher on resource evaluation”  
“The course was presented in an easy straightforward manner”  
“The first course where I wasn’t lost on Day 1!”  
“Good structured explanation of core topics – particularly grade continuity and linear estimation”  
“Very informative course, well presented – thumbs up”  
“I really enjoyed having this course with Optiro - I’m looking forward to attending more courses in the near future.”

What do you need to bring? What will we provide?  
You will need to bring your own laptop to the course with Microsoft Office installed. Optiro will provide a course manual, activities and solutions, lunch and refreshments. All attendees receive a Certificate of Attendance.

Optional: If you would like to receive a graded Certificate of Assessment for your attendance of this course, you have the option of writing a post-course open-book exam in your own time. The Certificate of Assessment will form a valuable part of your professional development plan and CV. Please see registration form for more details.

In-house and On-line Courses

All our courses can be presented as in-house training at your office or anywhere in the world. This is a cost-effective training option if you have a group of people wanting training; plus we can tailor the course to your commodity or operation and use your data for the exercises and activities. If your personnel are unable to leave site to attend the public training courses, please contact Diana Titren to discuss the option of live On-line training for your personnel.

Please contact Diana Titren, Training Manager, for more information: dtitren@optiro.com

Registration form on next page
# TRAINING COURSES 2017

PLEASE EMAIL YOUR REGISTRATION TO training@optiro.com

## YOUR DETAILS:

- **Delegate Name:**
- **Position Title:**
- **Company Name:**
- **Address:**
- **Tel:**
- **Fax:**
- **Email:**

## PLEASE SELECT COURSE/S AND DATES YOU WISH TO ATTEND

<table>
<thead>
<tr>
<th>COURSE</th>
<th>JAN</th>
<th>FEB</th>
<th>MAR</th>
<th>APR</th>
<th>MAY</th>
<th>JUN</th>
<th>JUL</th>
<th>AUG</th>
<th>SEP</th>
<th>OCT</th>
<th>NOV</th>
<th>DEC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Essential Excel Skills for Geologists</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Sampling Theory and Best Practice</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Getting The Most Out of QAC Data</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Reconciliation - getting it right the first time</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Resource Estimation and Evaluation</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Recoverable Resources: Getting to the High Grade</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Report Writing for Geologists and Engineers</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Surpac Geology Fundamentals</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Resource Estimation &amp; Evaluation with Surpac</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Mining &amp; Geology Fundamentals for Non-Miners</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Understanding Mineral Processing</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Corporate compliance in resource &amp; reserve reporting</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
</tbody>
</table>

### PAYMENT OPTIONS:

- **Electronic Transfer:**
  - Bank: Westpac Banking Corporation
  - SWIFT Code: WPACAU2S
  - BSB: 036 073
  - Account: 322873

- **Cheque:**
  - Cheque made payable to Optiro Pty Ltd

- **Book and pay online at:**
  - [http://www.optiro.com/training/](http://www.optiro.com/training/)

## Optional:

- **POST-COURSE EXAM TO RECEIVE YOUR CERTIFICATE OF ASSESSMENT**
  - The Certificate of Assessment exam is open-book and can be written in your own time.

### SUB-TOTAL

Please choose ONE of these discounts

- ☐ 5% DISCOUNT if you register on 2 or more courses
- ☐ 15% DISCOUNT for AusIMM members. Your membership number __________

Optional:

Please fill in the amount

- Number of courses ____ @ $350 per Certificate of Assessment exam

### TOTAL

For more information or to reserve a place on a course, please contact: Diana Titren – Training and Marketing Manager

Tel: +61 8 9215 0000

Email: dtitren@optiro.com

Optiro Pty Ltd ABN 63 131 922 739

www.optiro.com
In-house / On-site Courses
All Optiro courses can be presented as in-house training either at our offices or at your mine site. This is often a highly cost-effective way for you to train a small to large group of your personnel. The courses can be customised to suit your commodity and operation, and your personnel can use their own data for the practical work. Learn while they work!

Online Training
If your personnel are unable to leave site to attend the public training courses, please contact Diana Titren to discuss the option of live Online training for your personnel.

Optiro is a specialist resources advisory and consulting group
Our core services are:

GEOLOGY CONSULTING AND ADVISORY
Mine geology and resource definition, analysis and audit leading to resource and mine optimisation.

MINING ENGINEERING CONSULTING AND ADVISORY
Design, study analysis and audit to provide operational strategies and process improvement aimed at optimizing mining operations.

OPERATIONAL OPTIMISATION
Reviews designed to improve sustainable financial outcomes for mining projects.

RISK ASSESSMENT
Probabilistic life of asset risk modelling of mining projects to minimise risk in investment decisions, match investor risk appetite and mitigate ongoing operational risks.

AUDIT AND REVIEW
Including compliance audits, benchmarking reviews, operating and capital cost reviews and quality enhancement reviews.

TRAINING AND MENTORING
Our 2015 Professional Development Training Program is in partnership with The AusIMM. Courses available as both public courses and tailored on-site training.

VALUATION
Mining project valuation services, from exploration through to mining operations.

TRANSACTIONS
Capital strategy and support for capital raising and debt financing, mergers and acquisitions – asset identification, review and due diligence.

BOARD SUPPORT
Business planning, financial and technical guidance.

FINANCIAL MODELLING
Tailored model construction, maintenance and audit services for feasibility studies, project analysis, debt and financing transactions.

OREPACK™ SOFTWARE
The Optiro Resource Estimation package (OREpack) is a suite of software tools that help geologists create better resource estimates. The tools work seamlessly with Surpac to help: optimise kriging parameters; manage multitude of estimation parameters for multiple elements in multiple domains for resource and grade control models; create accurate global and local estimates of recoverable resources at SMU scale from sparse drilling data; optimise drill pattern spacing; and validate block models.

www.optiro.com

CONTACTS
Director of Geology: Ian Glacken - iglacken@optiro.com
Director of Mining Engineering: Andrew Law - alaw@optiro.com
Manager of Training: Diana Titren - dtitren@optiro.com
Manager of OREpack: Rowdy Bristol - rbristol@optiro.com

Optiro Head Office: Level 1, 16 Ord Street, West Perth WA 6005
PO Box 1646, West Perth WA 6872
Tel: +61 8 9215 0000