Quarry Planning and Metrics

QUARRY ACADEMY

Improving Processes. Instilling Expertise.

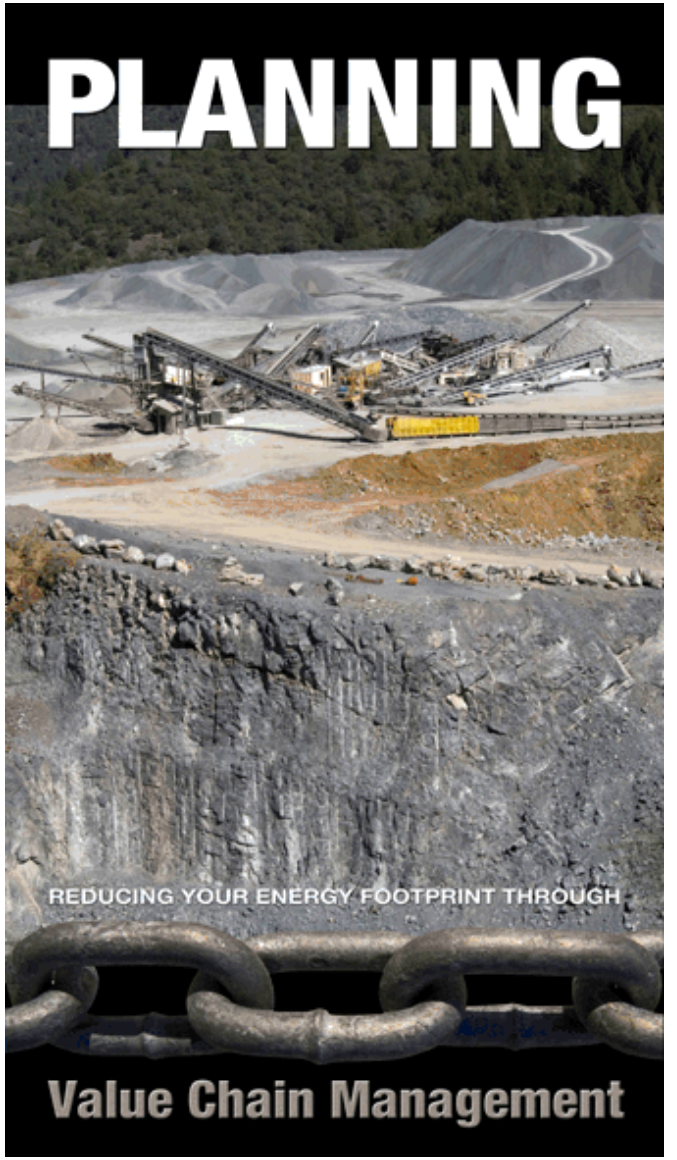
DYNO Dyno Nobel

SANDVIK


• SUSTAINABILITY •
• PROFITABILITY •
• PRODUCTIVITY •
BREAK ROCK
Chemical Crushing
MOVE ROCK
Load and Haul
SIZE ROCK
Mechanical Crushing and Screening
• PLANNING AND METRICS •
• SAFETY CULTURE •

Course Deliverable

- Quarry Property Layout during the permitting process
- Quarry Property Layout during design process
- Quarry Property Layout for the rock deposit
- Annual Mine Planning Review
- Metric Considerations
- Practical New Mine Planning and New Metrics



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Quarry Property Layout during the permitting process

- Regulatory requirements in order to obtain the permit
- Regulatory requirements per state
  - ✓ Permitting process requirements to bring a property online.
  - ✓ Permitting process requires more time, financial support and discipline.
- Negotiations with local government
  - ✓ Over promise or agree to limiting requirements – short sighted
  - ✓ Agreeing to mine only a portion of the property – post mining land use
- Promise or agree to limiting requirements to local community
  - ✓ Blasting times, blast event size or blast events per week
  - ✓ Operational hours of the quarry or crushing plant

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Quarry Property Layout during design process

- Short term and long term production estimates
- Plant design placement with overburden dump and fines retention pond
- Geological understanding of the rock deposit as part of pit design
- Stripping for short term rock processing
  - ✓ Not stripping adequately to meet seasonal production requirements
  - ✓ Not placing the overburden material in correct location
  - ✓ Not ensuring overburden haulage is designed for efficiency
- Quarry planning is about making a deposit profitable while managing the requirements and constraints as a result of the permit process

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Quarry Property Layout for the rock deposit

- **Practically applied production planning**
  - ✓ **Current production activity for short term goals**
  - ✓ **Longer term development requirements and objectives**
- **Understand the rock deposit - design, evaluate, create and manage an excavation sequence that is sustainable and profitable.**

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Practical quarry planning - safety and financial

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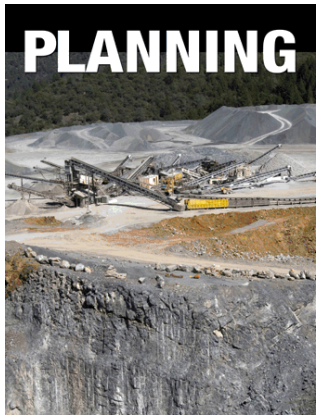
Annual Quarry Plan Review

“It’s hard to get from here to there if you are unclear about here.

And haven’t thought much about there.”



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Annual Planning Review

- **Designed to understand and use practical quarry plan engineering to improve your operational results while improving your safety and financial outcomes.**
- **Practically applied production planning keeps one eye on current production activity and the other eye on middle / long term development requirements and objectives.**
- **Quarries, in the absence of market volumes that traditionally insured viability, can now benefit from a more disciplined planning effort:**
  - ✓ **Borrows from traditional mine planning programs**
  - ✓ **Borrows from Lean-Six Sigma concepts**

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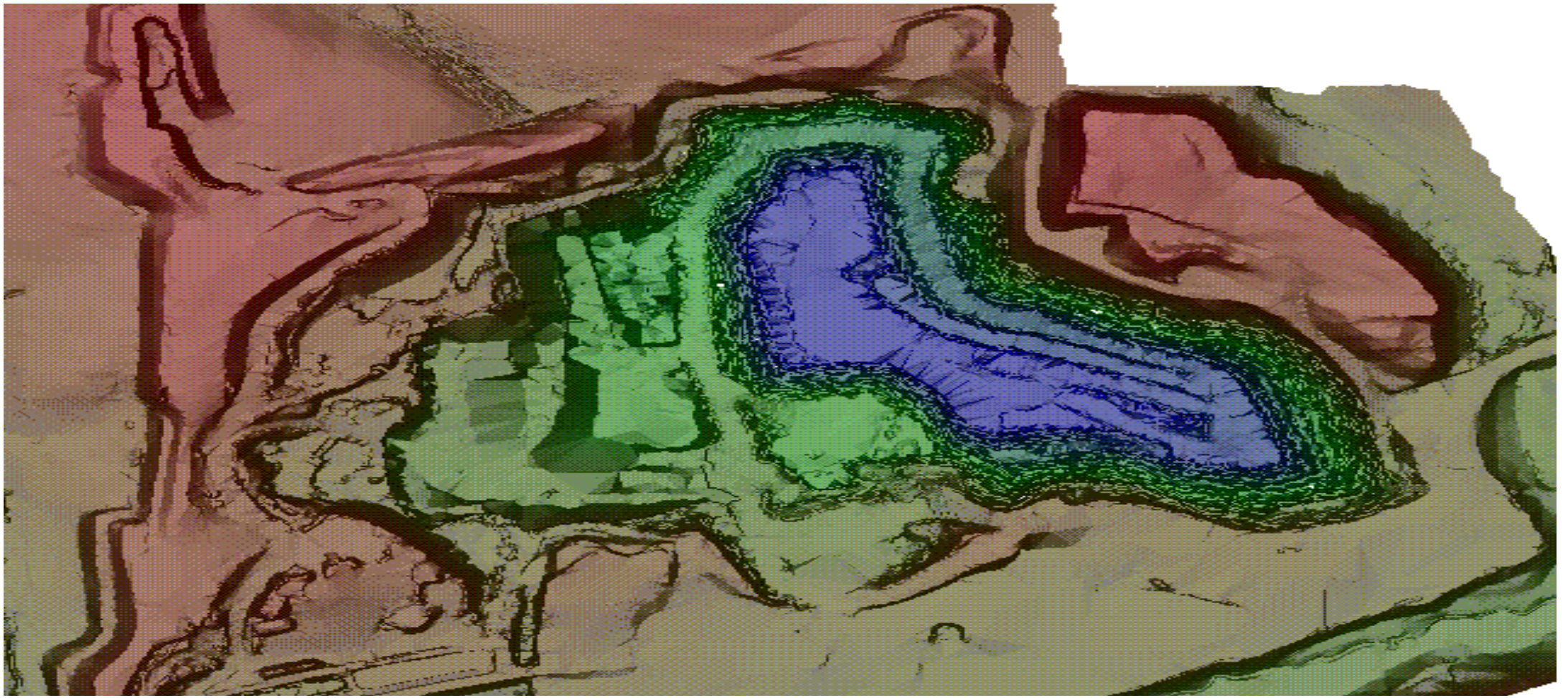
Annual Quarry Plan Review - June 2013



Practical quarry planning is about; understanding exactly your current position and situation, then thinking very carefully about future outcomes and engineering the best process to get there.

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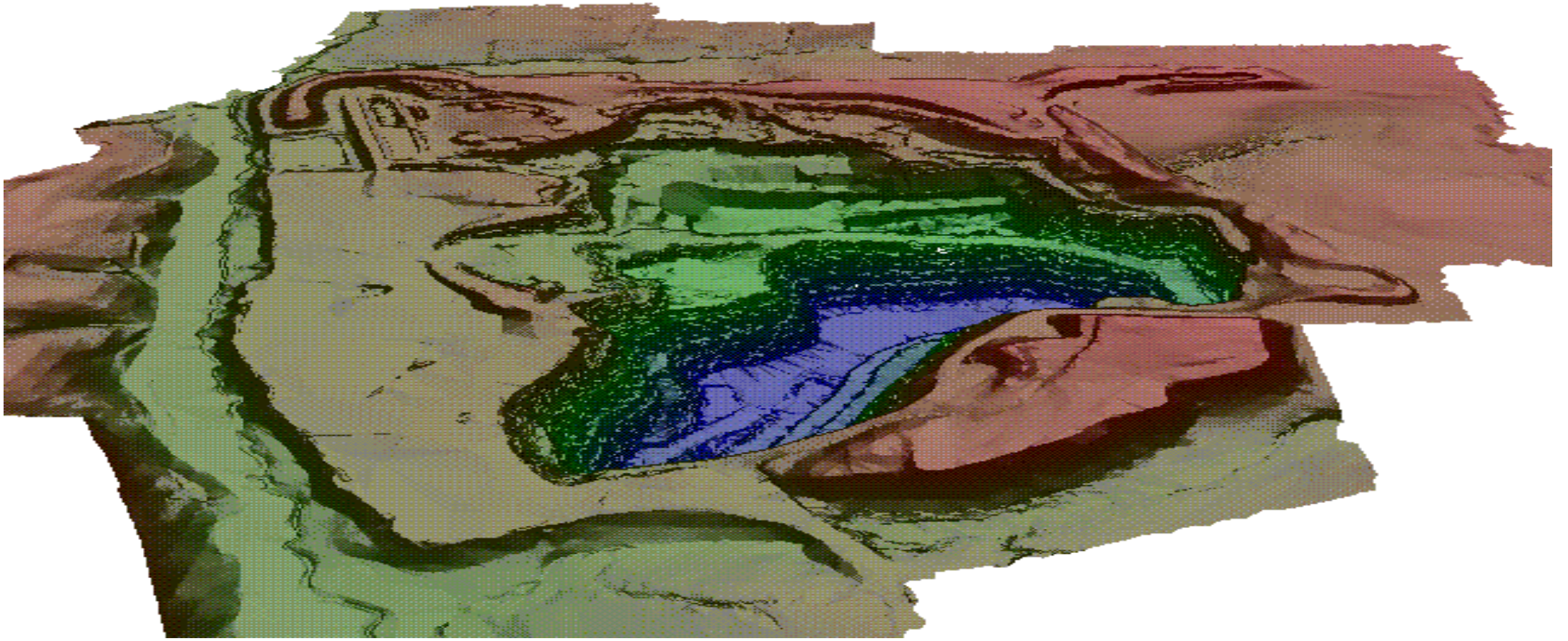
Side View of Multi-Bench Quarry - June 2013



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Bench 1 – 767,750 Tons

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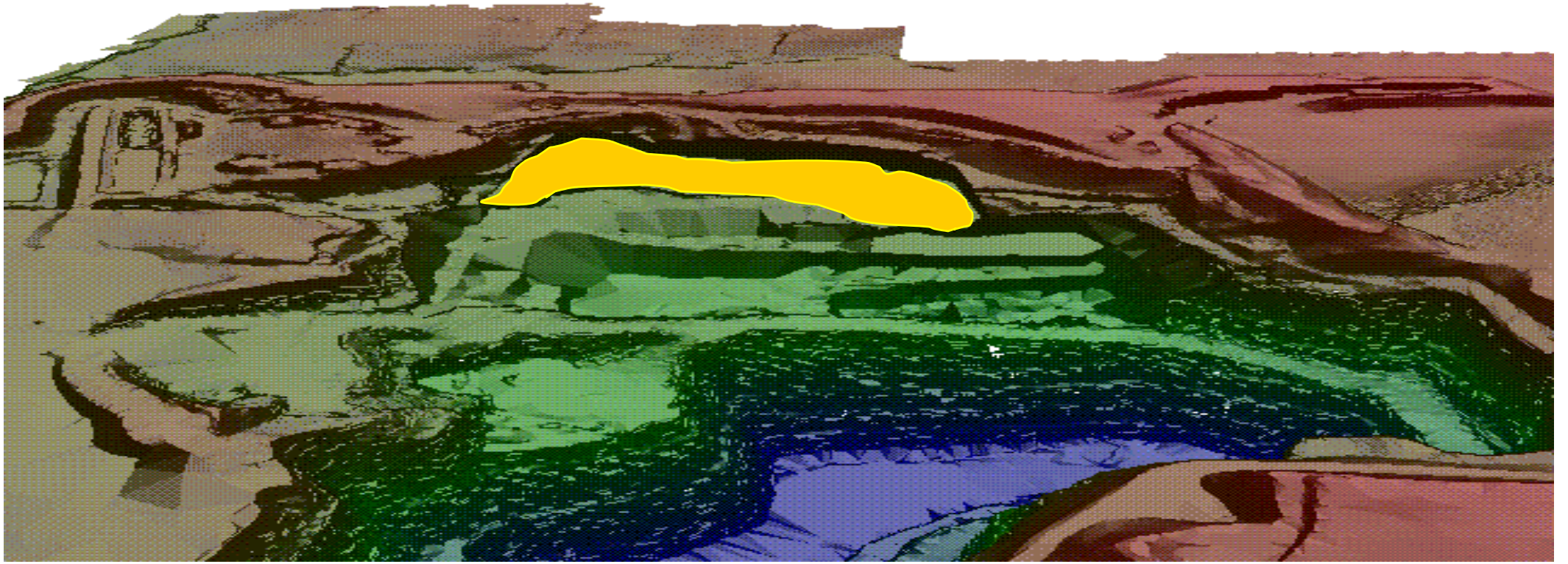

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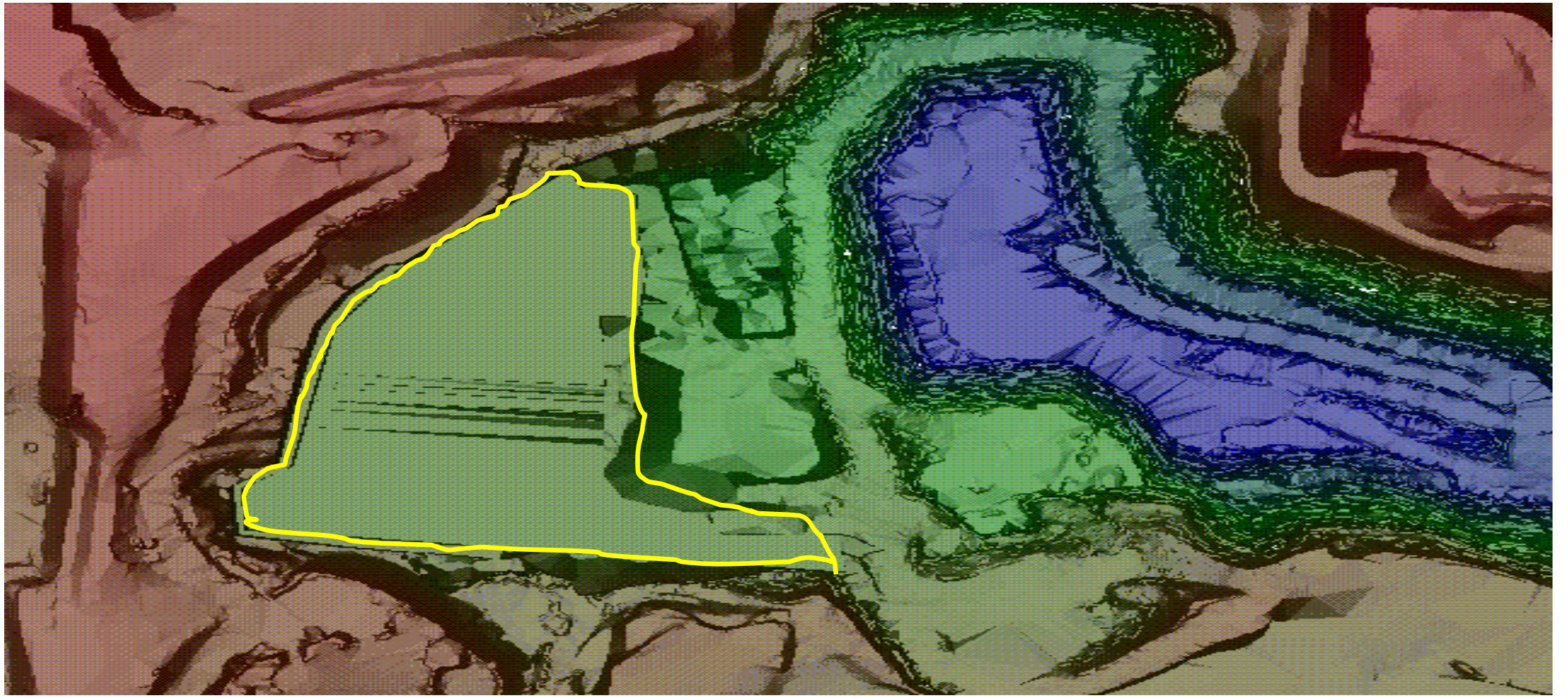
Bench 2 – 780,300 Tons



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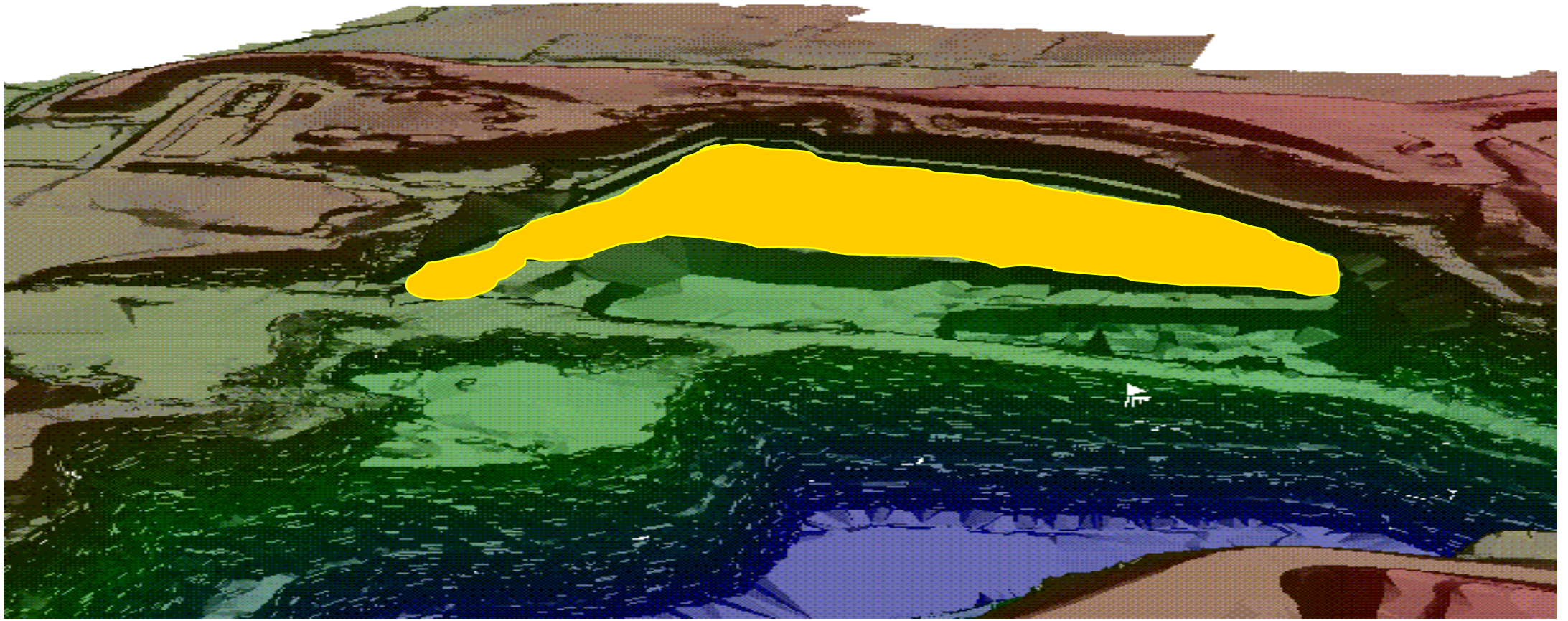

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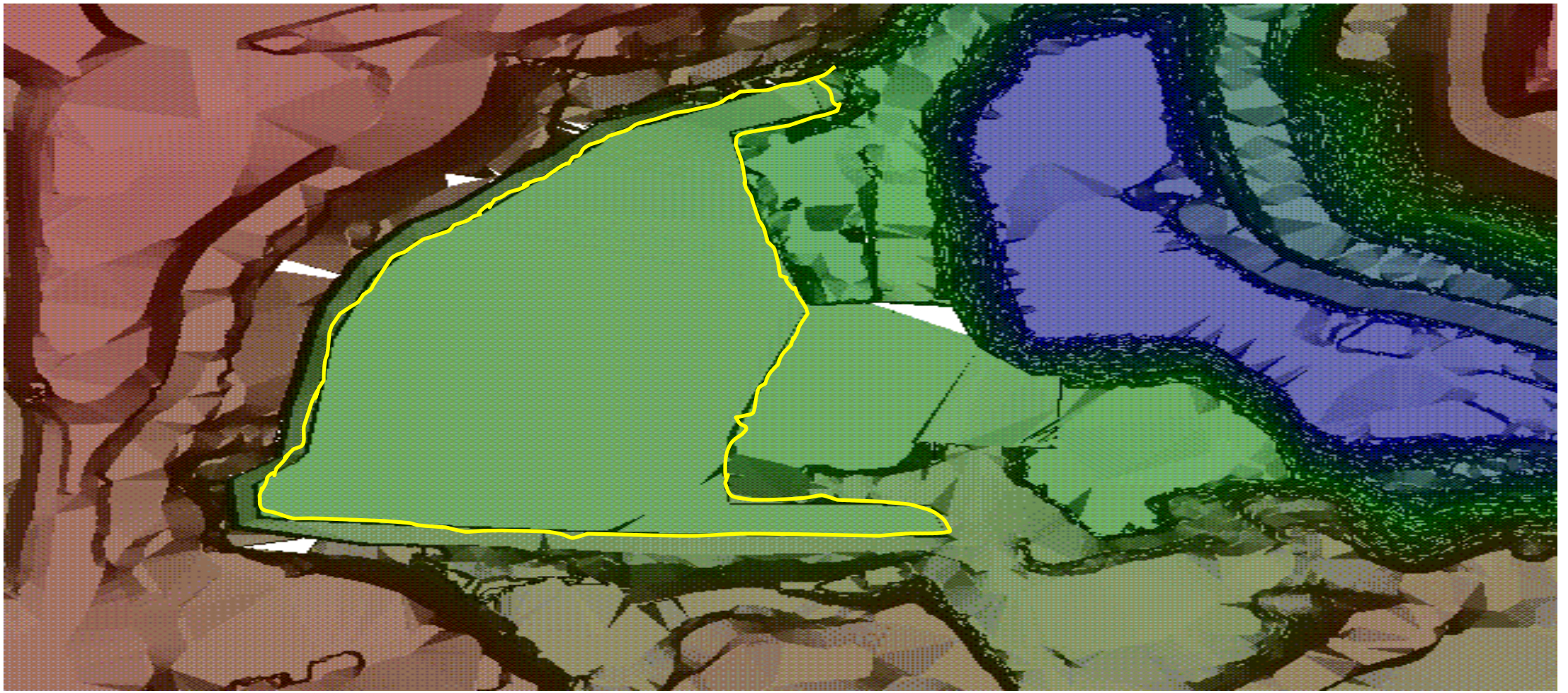
Bench 3 – 1,810,300 Tons



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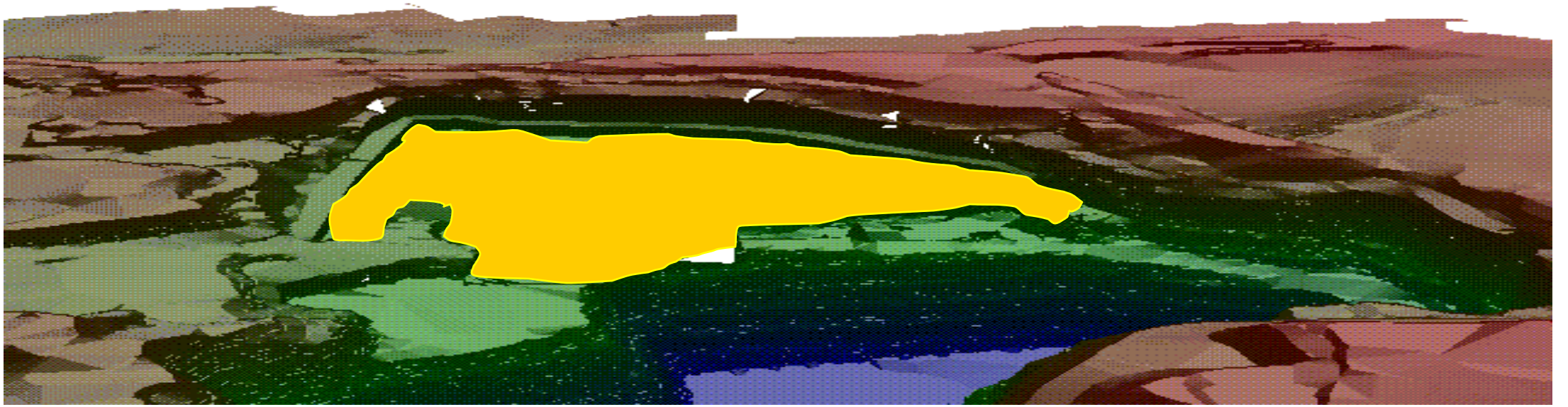
Bench 3 – 1,810,300 Tons



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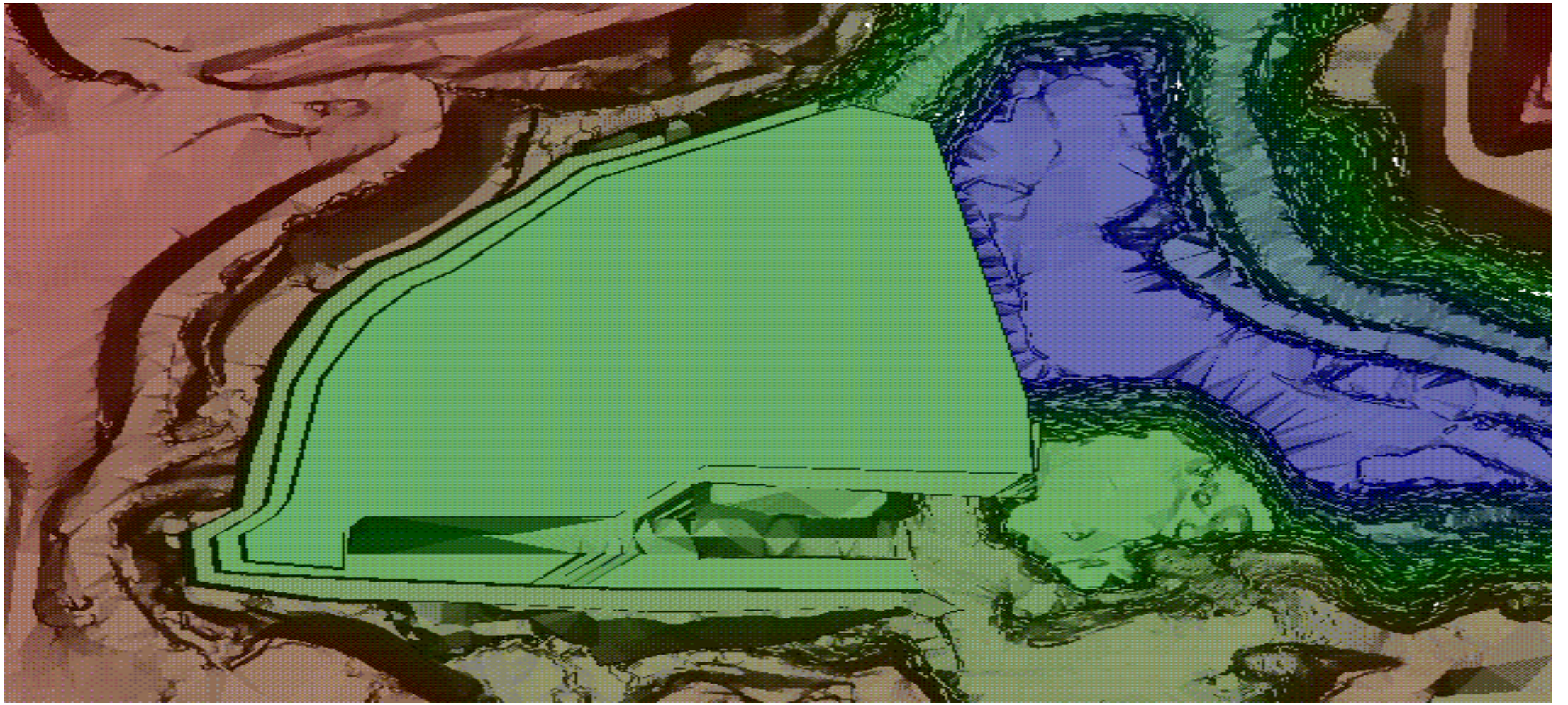
Bench 4 – 1,733,400 Tons



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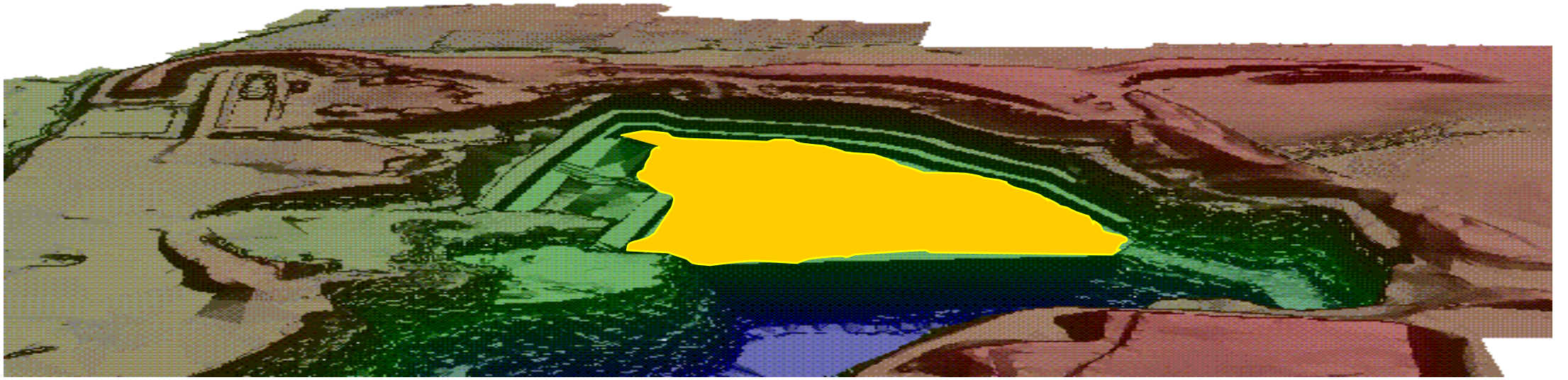
Bench 4 – 1,733,400 Tons

Mineable Reserves Available – 5,088,000 Tons



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Metric Considerations

- Implement Survey and Elevation Control programs
- Become Engaged with Drill and Blast Designs
  - ✓ Don’t just accept the current drilling practices
  - ✓ Don’t just accept the current blasting practices
  - ✓ Don’t adjust the blast pattern after the boreholes have been drilled
- Monitor the Drill and Blast Pattern Outcome
  - ✓ Pattern layout
  - ✓ Seismograph results
  - ✓ Blast video analysis
  - ✓ Size gradation such as oversize %, fines %, excess back break, or micro fracturing
  - ✓ Diggability, cycle times, or fuel costs per finished ton
- Apply Lean-Six Sigma tools that are fundamental to program management:
  - ✓ base lining, data control, process monitoring, information sharing

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Planning Reduces Operational Costs

Traditional Planning

Lean-Six Sigma Based Planning

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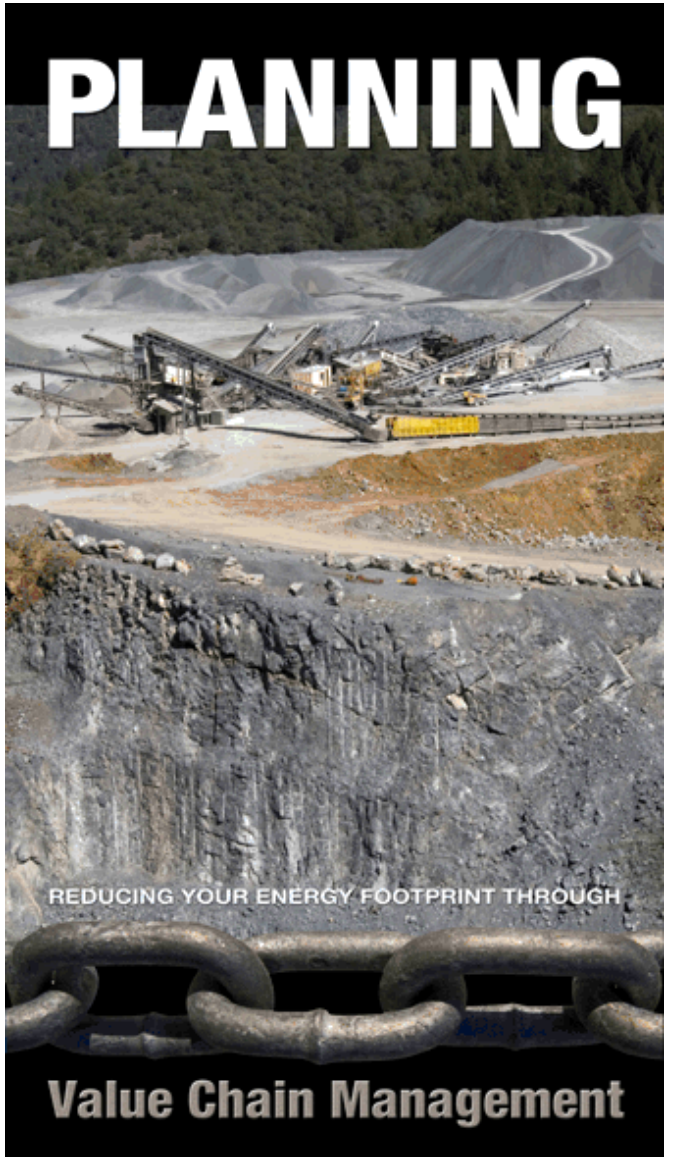
Practical New Quarry Planning

- Today permits for new mines are nearly impossible to get, mines face manpower shortages, and political agendas are working against the industry. In this kind of environment, the industry cannot afford to hold onto old perspectives that compromise value.
- What are some improvement tactics that your company avoids because of the culture?
- How much of what you do is rooted in the “old normal”?
- It’s time for a new way of thinking that releases traditional barriers and incorporates new strategies for change.
  - ✓ Planning for short term and long term production needs
  - ✓ Incorporate a practical quarry planning program using available technology tools



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Practical New Quarry Metrics

- **Planning and metrics allow you to improve earnings from the rock deposits currently in production.**
- **Evaluate your current Metrics used to track your quarry production and profits.**
  - ✓ **Quarries tend to create waste as a consequence of the production process.**
  - ✓ **Quarries tend to waste some profitable reserves.**
  - ✓ **Objective should be drive waste to minimum and place as much of the blasted rock in the finished product piles.**
- **There is a need and benefit of a planning and management programs to improve profits and increase the minable life of the deposit.**
- **Our objective is to find and establish what the new working standards are and then make them sustainable.**
- **How do you operate a world class quarry without a good mine plan?**

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