

ASRD Land Management Branch

SURFACE MATERIALS AUDIT PROGRAM: Volume Verification

A presentation at the ASGA 2012 Annual General Meeting:
January 17th, 2012

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Sand & Gravel Audits Effective September 2011

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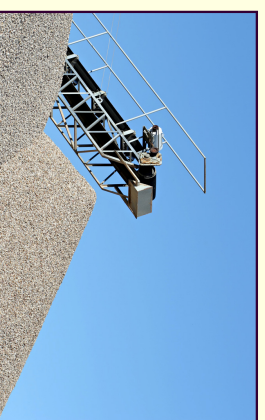
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Presentation Outline

- Background
- Risk based approach to auditing sand and gravel royalty revenue
- Goals of the Audit Program
- Volume Verification Methodologies
- The audit; AOR and evaluation tools
- Backstopping & Support Network
- Implementation
- Milestones
- Conclusion

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Background:

OAG examined SRD's management of self reported revenue & identified requirements

- Improving processes for inspecting aggregate holdings on public land
- Enforcing land reclamation requirements
- Validating self-reported revenue with support systems: to ensure that operators report accurate volumes, and SRD records correct numbers in our financial statements

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Risk-based approach: Consultants (MNP) found risks and made recommendations for SMLs.

Risks

- Potential understatement of revenue due to:
 - Failure of clients to submit their Annual Reports
 - Failure of clients to report (to SRD) correct (spatial) disturbances (and volumes removed) on their Annual Operating Reports (AOR)

Critical Recommendation:

- **Ensure that volumes extracted from active SML dispositions are verified (SMCs not excluded!)**

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Goals of the Audit Program

- To encourage and, if necessary, compel the behavioral changes needed to achieve compliance with SRD legislation.



- To manage an effective audit program as part of the overall regulatory cycle.

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Goals of the Audit Program

- Ensure Albertans receive fair and optimized benefits from the resource
- To conduct our audit activities in an accountable, fair, and transparent way
- Provide assurance to all operators that SRD has a system in place to curtail unfair business advantages.



<http://www.pitvuk.com/nutsuligaivuk/>

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Verification Methodologies

- Method used by an operation depends on the uniqueness of its business configuration
- Each operator will adopt methodologies that best meets her/his business needs



<http://davco.bc.ca/images/miningscale>

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Verification Methodologies

- Each methodology might require a unique pit-plan, expertise, and progression of operations
- Pro-active planning & contingencies to track and (accurately) measure volumes will (understandably) vary



Source: www.polarmin.com/operations-projects/orca-quarry



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Methodologies (examples)

1. Weigh-scale: systematic record keeping, clear and accurate calculations using density factors approved by SRD

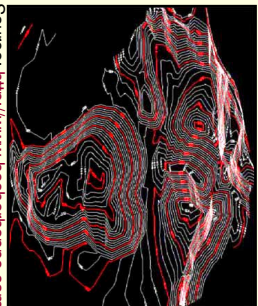
*Tonnage = Volume x Density-Factor**

Tonnage = Area x Thickness x Density-Factor

**Density Factor = Mass of material / Volume of material*

LMB uses 1.2477064 for Gravel & 1.0435779 for Sand

2. Deriving volumes using reference & actual ground surfaces



Source: <http://www.bechtelhoppa.com/>

3. Other methodologies that accurately determine volumes

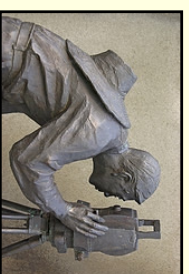
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Volumes from reference & actual surfaces

- Using traditional (conventional) volumetric survey or earthworks methodology, including ground modeling



Source: <http://www.surveyngequipmentandlevels.info/>

- Using survey (geodetic) grade (dual frequency) GPS methodology – Rapid Static or RTK combo, including ground modeling



Source: <http://m.gdfractindustry.com>

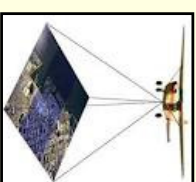
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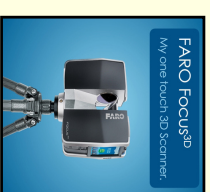
Volumes from reference & actual surfaces

- Photogrammetric: baseline flight data, scale, timing, and temporal changes, including ground modeling or other means



Source: san-io.com

- Laser scanning, including ground modeling of pits or stockpiles



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The Audit | Triggers by AOR

- Whatever methodology, each operator must indicate how volumes removed were derived by demonstrating the following (at a minimum) (not an exclusive list):
 1. Providing verifiable weigh-scale records
 2. Keeping and providing ground survey information that, in the opinion of a professional surveyor, can be used to derive volumes
 3. Strategies and results used to derive volumes, if other objective (verifiable) and technical methods were used

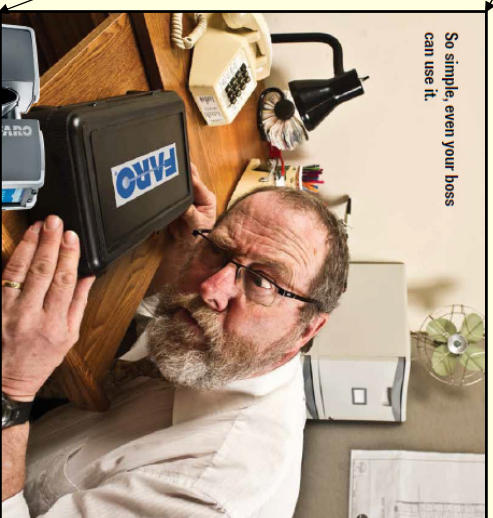
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SRD Audits and Evaluation Tools:

Legislation, science & technology, professional judgment



Source: ALS News June 2011 - Vol: 40-2

Source: www.firstorder.ca

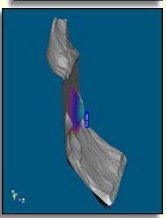
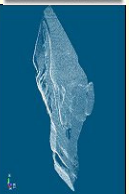
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Tools: Terrestrial Laser Scanner

- A process to verify quantity (volume) removed:
Use of Terrestrial Laser Scanner (Ground LIDAR)



Work-Flow:

Pit scan -> point cloud data -> TIN mesh -> TIN mesh + derived x-sectis -> volume
(TIN Model -> DTM -> VOLUME)

Sources: Terra International: <http://www.faro.com/focus/us>

- Interpretation of test-pit data and land survey information: baseline (reference) topography
- cross-section orientations: using successive end-areas perpendicular to profiles that link test pits, etc.

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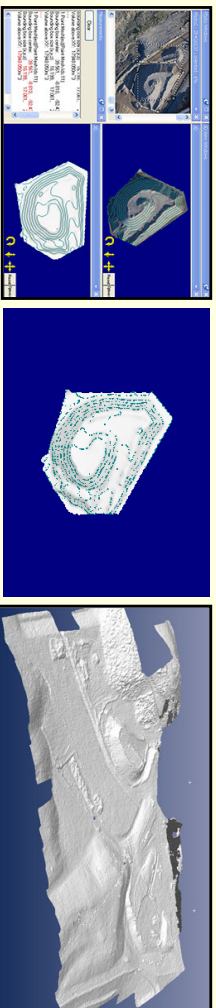
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Tools ... 3D Photogrammetric methodology:
an option under investigation

- PhotoModeler (Vancouver based company)
- 3D modelling & measuring
- Images (overlapped) taken with Digital SLR camera;
ground modeled in 3D PhotoModeler software

- Images from PhotoModeler:

“Stockpile image taken with a Canon EOS 1DS mark II and 50mm Leica lens
from a Cessna 172 aeroplane at approximately 300 metres”



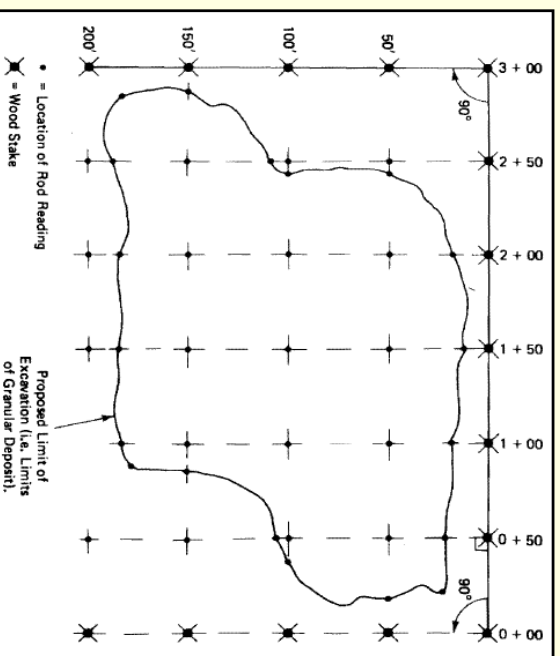
Source: <http://www.photomodeler.com/products/scanner/stockpiles.htm>

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Tools ... an illustration of a systematic test-pit grid (to obtain
a representative estimate of reserves)



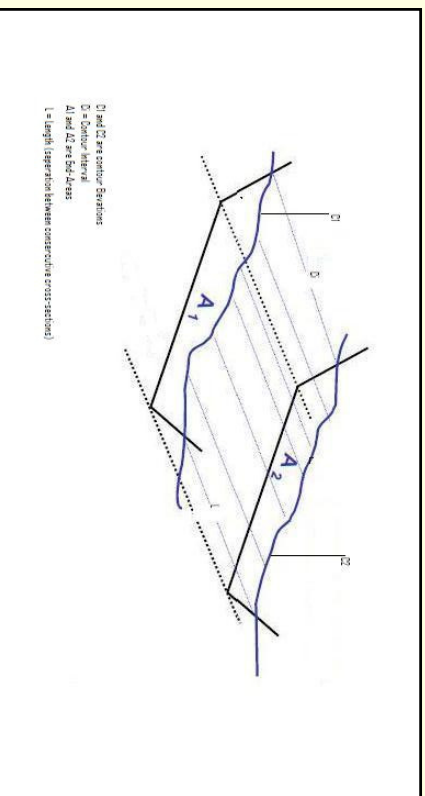
Pit Baseline Survey: Surveying with Construction Applications - Barry F. Kavanagh

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Tools ... an illustration of end-area cross-sections



(Adapted from CECW-CE USCE: 11101-1-1005 manual)

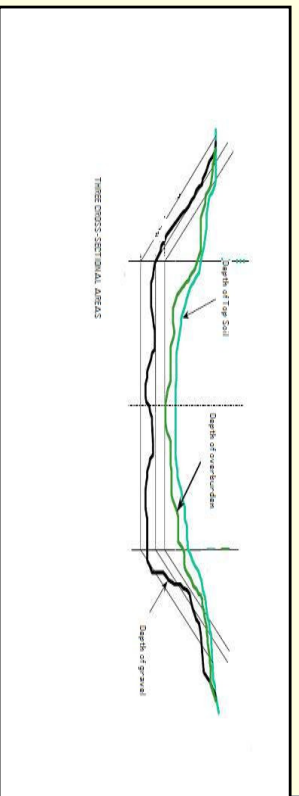
- End-Areas of two consecutive cross-sections to facilitate volume calculation of completed phases of excavation: various approaches to end-area calculations – CAD, formulae, coordinates, Planimeter, etc.

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Tools: cross-sections



(Adapted from CECW-CE USCE: 11101-1-1005 manual)

- Example of a typical x-section cut perpendicular to 3 profiles running along 3 equidistant gridlines that connect test pits, on a systematic grid
- Note importance of test depth to each soil layer to facilitate calculation of volumes for each profile, in the absence of supporting weigh-scale information

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Tools . . . continued

- Relating areas disturbed to declared volumes, and to approved CRBP
- A process to reconcile royalty payable with volume removed by auditing the operator's financial statements and source documents
- Use of Compliance and Enforcement tools, along with above outlined tools and processes

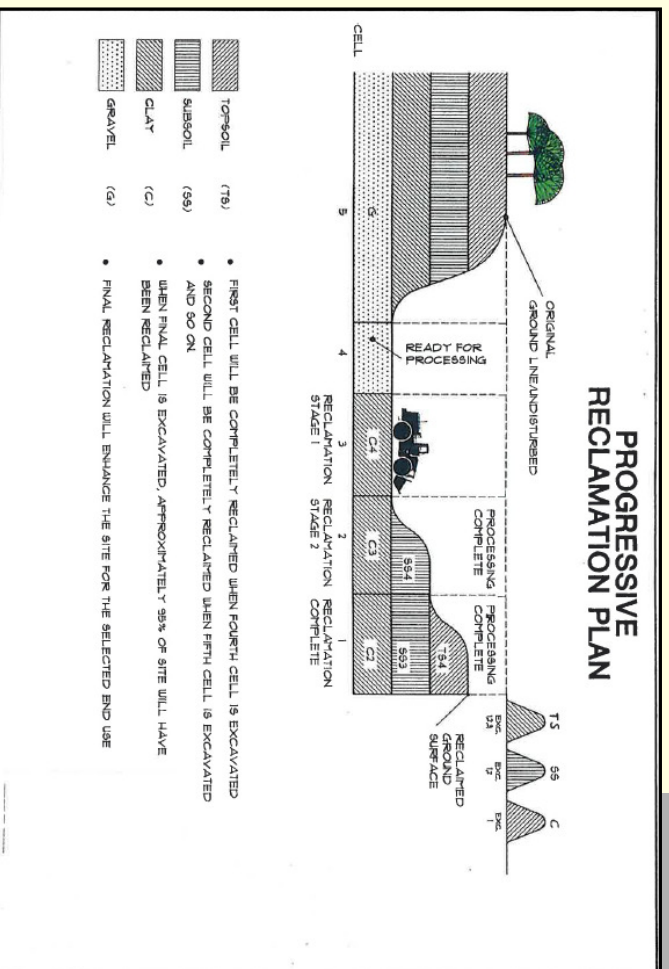
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Even reclamation plans are best interpreted and appreciated in x-section:

Courtesy of Brock Helm (ASGA)



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Backstopping and Support Network

- Working together with and alongside other SRD departments
- Consulting with and receiving input from operators to identify and address emerging or recurrent concerns
- Incorporating expertise from various SRD staff and from industry - to meet the goals of the aggregate policy, in relation to SRD's broader objectives
- Benchmarking for continual improvement

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Implementation

- Conducting field and in-office audits
- Information sharing among units (LMB, PMB and C/E): Audits, inspections, information reviews, AR, AOR
- Fostering reciprocal and responsive service level understandings within SRD, and with Operators; conducting business concurrently to identify gaps
- Conducting joint discussions on strategies, policy improvement and education
- Developing and shaping policy using a structured approach and clearly-defined problems

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Milestones

- Terrestrial Laser Scanner (Ground LIDAR): a possibility
- A plan for verifying volumes removed: in progress
- Developing, improving, and instituting internal controls: in progress
- Annual audit work plan: completed.
- Program rollout: in progress
- Communication: Operators already notified
- Target date for first compliance audit: 1 completed Oct. 2011
- Developing and shaping policy: as necessary

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Conclusion

■ Questions??



Source: Business Cartoons - <http://www.businesscartoons.co.uk>

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