SMARA Reclamation Standards Review

Focused Discussion

- SMARA Section § 3704.1 - Performance Standards for Reclamation and Section § 2711 Extraction of Minerals Essential to Well-Being of the State and the Needs of Society

Presentation Outline

- Review major earthmoving features for open pit metal mines
- What are the environmental issues and how can we mitigate them?
- Section § 3704.1 has consequences that are potentially unintended and adverse
- Recommendations to mitigate consequences

Major Earthmoving Features

- Mine “Pits”
- Heap Leach Pads
- Milled Tailings Impoundments and Retaining Dams
- Overburden and Waste Rock Stockpiles

Mine Pits

Open Pits

Sidehill / Open Pit Excavations

Mine Pits – Environmental Concerns

- Exposed ore/host rock may leach naturally occurring metals, salts, and/or produce acid rock drainage (ARD)
- Pit Lakes
  - Too much water
  - Water quality (pH, elevated salts and metals)
- Visual Impacts of Pit Highwalls
- Reclamation of Pits (or lack thereof)

While these issues are relevant for some metal mines, they are not issues for <u>all</u> metal mines.

Characterization of ore/waste rock is performed as part of the planning and permit process to determine potential for ARD of remnant pit highwalls and waste dumps

Mine Pits – Backfilling

Environmental Mitigations Provided by Backfilling:

- Cover exposed ore/host rock susceptible to “leaching”
- Prevent pit lakes
- Potentially facilitates beneficial use following reclamation

In many cases, these mitigations can be effectively accomplished by only partial backfill (well short of the original ground surface) and in some instances may not be necessary at all

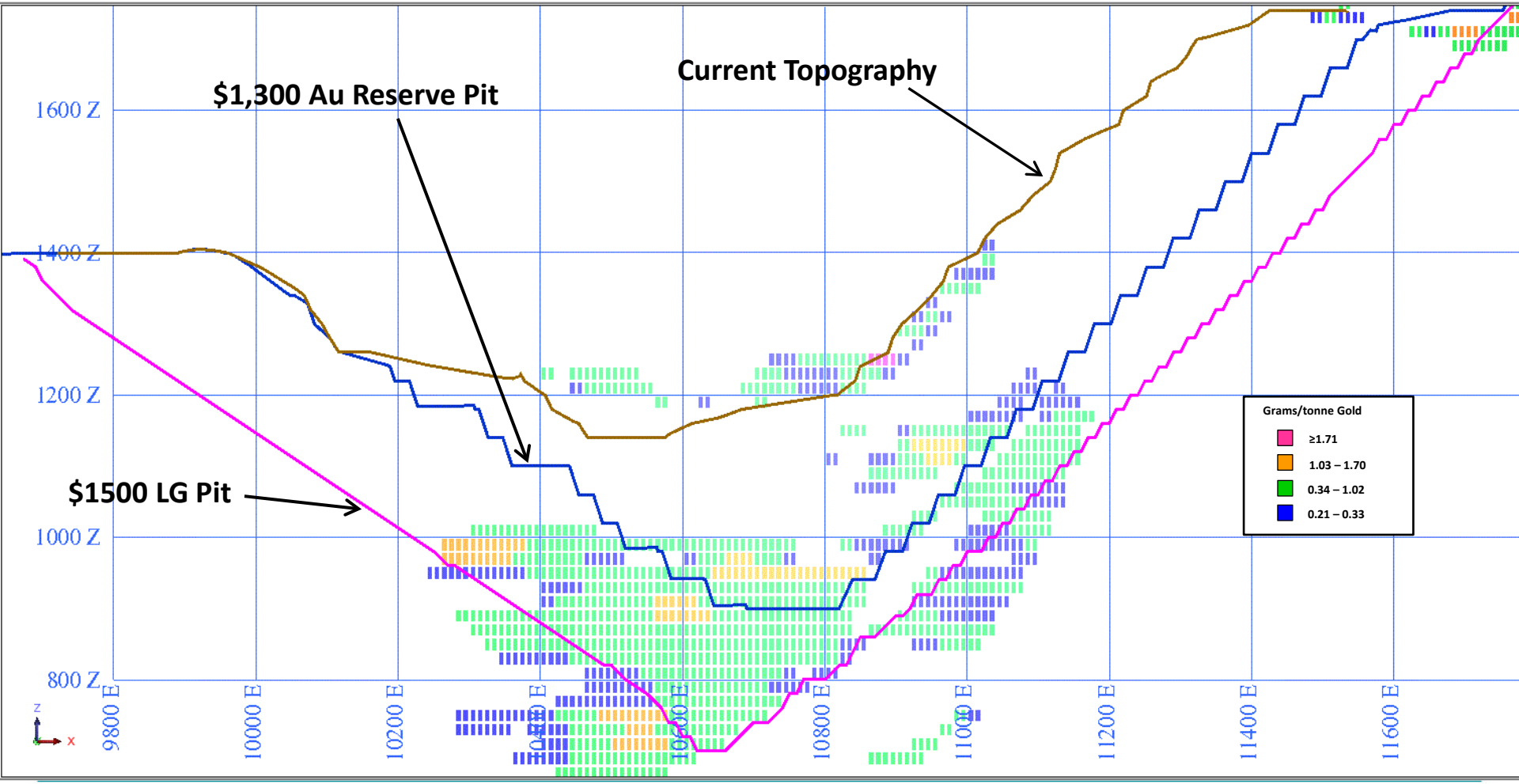
Mine Pits – Backfilling

Consequences of Current Regulations:

- Results in unnecessary greenhouse gas and other adverse air emissions associated with double handling of materials
- Some backfill material may be classified as Group A or Group B wastes under CCR Title 27, which require environmental containment systems. Construction of containment systems within pits may not be feasible or environmentally protective
- Backfilling pits "Sterilizes" future unmined ore resources and limits the continued economic mining of minerals and effectively discourages the production of minerals in conflict with SMARA, Section 2711 (b) and 2712 (b)
- Backfilling with mining wastes can impact groundwater quality
- Reduces mining economics and discourages capital investment
- Potentially eliminates protected habitat for avian species on pit highwalls

Future Ore "Reserves" Limited by Backfilling

***Typical Gold Resource Model Showing* Reserve Expansion Potential Beyond Current Pit Limits**



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Heap Leach Pads

Heap Leach Pads

Heap leach pads are founded on engineered, composite (clay/geomembrane) liner systems:

- Provide for containment and collection of process solutions to protect the environment and maximize metal recovery
- The crushed ore (rock) stacked and leached on the lined pads are typically classified as a Group B mine waste per CCR Title 27

Heap Leach Pads – Environmental Concerns

- Upon closure, heap leach pads (waste piles) are rinsed with recycled water until the spent ore is neutralized and may be reclassified as Group C materials
- The heap is then regraded and capped to minimize infiltration and control erosion of the cover system
- Group A and B materials are monitored and maintained after closure per CCR Title 27

These standard closure steps can effectively mitigate environmental issues and maintains the heap materials on an engineered liner system

Heap Leach Pads – Pit Backfill with Spent Ore

Consequences of Current Regulations

- Unnecessary greenhouse gas emissions and other air impacts (NOx and dust)
- If material is unsuitable for pit backfill, results in a significant increase in surface area disturbance to reclaim to 25' of original ground surface
- Uncertain environmental impacts associated with spreading neutralized and spent ore from the heap
  - Can heap leach materials be adequately flushed to result in no water quality impacts once it is spread over existing ground?
  - Will this require new containment systems over a much larger area to be constructed for environmental protection?
- Reduces mining economics and impairs capital investment

These materials should be left within their original containment systems. Focus on standards that promote post-closure use and long-term stability of the reclaimed heap

Tailings Impoundments

Tailings Impoundments – Environmental Concerns & Facts

- Tailings are commonly classified as Group A or B wastes under CCR Title 27. Accordingly, they are normally constructed with containment systems
- Tailings can consist of wet slurry tailings with solids contents ranging from 25-45% or may be filtered to create “dry stacks” or “paste” tailings which are more amenable to backfilling
- Tailings are often by-products of higher grade ores that are not amenable to heap leaching
- Upon closure, the excess free water is normally removed, surface regraded, and capped
- As Group A and B waste units, they are monitored and maintained after closure per CCR Title 27

These standard closure steps effectively mitigate environmental issues and maintains the tailings within engineered containment systems

Tailings Impoundments – Backfilling and Reclamation Issues

Consequences of Current Regulations

- Unnecessary greenhouse gas emissions and air impacts (NOx and dust)
- Backfilling is not practical with slurry tailings unless the tailings are amenable to filtering to a dry or “paste” condition that would permit backfill into the pit or underground mine workings
- A wet slurry tailings impoundment would need a much larger footprint to stay within 25 feet of original ground topography
- Reduces mining economics and impairs capital investment
- May initiate a new point source for metal leaching
- Mitigating potential environmental impacts associated with spreading tailings requires new containment systems over larger areas (which is most likely infeasible)

These materials should be left within their original containment systems. Complying with current backfilling regulations is infeasible and/or creates potentially adverse environmental conditions

Waste Rock Piles (Reclaimed Example)

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Waste Rock Piles – Environmental Concerns

- Waste rock/overburden may be classified as Group A, Group B, or Group C mine wastes under CCR Title 27
- Upon closure, Group A and B waste rock/overburden materials are regraded and capped
- Group A and B materials are monitored and maintained after closure per CCR Title 27
- Group C materials do not require post-closure monitoring nor are special containment systems required

These standard closure steps can effectively mitigate environmental issues. Group A and B materials should remain on an engineered liner system.

Waste Rock Piles – Regrading/Pit Backfilling

Consequences of Current Regulations

- Unnecessary greenhouse gas emissions and other air impacts (NOx and dust)
- Significant increases in surface area disturbance if waste material is unsuitable for pit backfill or the volume of mined materials exceeds available pit capacity (~30-40% swell factor)
- May initiate a new point source for metal leaching
- Reduces mining economics and impairs capital investment

Group A and B materials should be left within their original containment systems. Focus on standards that promote post-closure use and long-term stability of the reclaimed waste rock piles

Summary

Recommendations for mitigating consequences that may be unintended and which create potentially adverse environmental conditions:

- Modify Pit Backfill Requirements
  - Partially backfill pits if critically required to provide environmental protection
  - Maintain access to mineable resource for future generations
- Maintain Group A and B mining wastes within the original containment systems
- Permit Group C mining wastes to be reclaimed in-place if partial or complete pit backfilling is not economical or “sterilizes” potential reserves
- Modify the reclamation and grading requirements to allow a flexible approach to mine development, operations, rehabilitation and closure to balance environmental protection with socio-economic needs of the State of California