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Earth Observation Applications for Mining

This document outlines Baseline (broad, cost-efficient) and Premium (high-resolution, advanced) applications of Earth Observation for the mining industry. Effective AOI values are based purely on sensor resolution.

Theme: Mineral Exploration

Baseline Applications

Application	Effective AOI	End Result / Importance
Regional lithological mapping	≥0.25 km²	Identifies rock types and large alteration zones to prioritize exploration areas.
Alteration zone detection	≥0.25 km²	Highlights hydrothermal halos (iron oxides, clays) that often host mineralization.
Structural geology mapping	≥1 km²	Reveals faults and lineaments that control ore emplacement.

Premium Applications

Application	Effective AOI	End Result / Importance
High-resolution mineral mapping	≥0.2 km²	Pinpoints mineralogical signatures (hematite, clays, carbonates) to refine drill targeting.
Rare earth and specialty mineral detection	≥0.25 km²	Identifies REE-bearing clays and alteration zones at exploration scale.
Outcrop and bench validation	≥0.05 km²	Provides sub-meter views of veins, lithological contacts, and artisanal activity.

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Theme: Mine Operations & Planning

Baseline Applications

Application	Effective AOI	End Result / Importance
Open pit monitoring	≥0.25 km²	Tracks pit expansion and geometry for operational planning.
Haul road detection	≥0.25 km²	Monitors haulage efficiency and new access roads.
Land disturbance tracking	≥0.25 km²	Measures clearing and topsoil removal across mining leases.

Premium Applications

Application	Effective AOI	End Result / Importance
Pit wall slope monitoring	≥0.05 km²	Sub-meter mapping of benches and walls to identify instabilities.
Stockpile volumetrics	≥0.05 km²	Enables accurate ore/waste stockpile measurements using stereo imagery.
Mine infrastructure mapping	≥0.05 km²	Provides detailed monitoring of conveyors, crushers, and support facilities.

Theme: Environmental Monitoring

Baseline Applications

Application	Effective AOI	End Result / Importance
Vegetation loss and reclamation	≥0.25 km²	Tracks vegetation clearance and

		rehabilitation success around mines.
Water turbidity monitoring	≥10 km²	Assesses sediment loads and pollution in downstream rivers and lakes.

Premium Applications

Application	Effective AOI	End Result / Importance
Tailings seepage detection	≥0.2 km²	Identifies acid mine drainage or seepage from tailings facilities.
Fine-scale wetland and habitat mapping	≥0.25 km²	Monitors ecological impacts on sensitive habitats near operations.
Dust and air quality hotspot detection	≥25 km²	Maps dust plumes and local pollution events affecting nearby communities.

Theme: Safety & Compliance

Baseline Applications

Application	Effective AOI	End Result / Importance
Subsidence monitoring	≥1 km²	Detects ground deformation from underground mining.
Flood risk monitoring	≥1 km²	Identifies water accumulation around pits and tailings dams.
Illegal mining detection	≥0.25 km²	Reveals unlicensed or informal mining activity.

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Premium Applications

Application	Effective AOI	End Result / Importance
Tailings dam stability	≥1 km²	Combines deformation monitoring and sub-meter checks for cracks and leakage.
Blast impact monitoring	≥0.05 km²	Tracks blast areas and potential impacts on nearby settlements.
Settlement expansion tracking	≥0.05 km²	Monitors growth of worker or informal camps around sites.

Theme: Tailings & Waste Management

Baseline Applications

Application	Effective AOI	End Result / Importance
Tailings pond monitoring	≥0.25 km²	Tracks changes in tailings pond extent and supernatant water levels.
Waste rock dump expansion	≥1 km²	Monitors expansion of dumps to ensure compliance and safety.

Premium Applications

Application	Effective AOI	End Result / Importance
Tailings water quality assessment	≥0.2 km²	Detects chemical contamination signatures in ponds.
Dam integrity monitoring	≥1 km²	Provides early warning of potential dam failures by tracking deformation and cracks.

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Theme: Infrastructure & Logistics

Baseline Applications

Application	Effective AOI	End Result / Importance
Transport corridor monitoring	≥1 km²	Assesses conditions of roads, rail, and pipelines linked to mining sites.
Port facility usage	≥10 km²	Tracks activity levels and ore export logistics at nearby ports.
Energy infrastructure tracking	≥1 km²	Monitors power lines and substations serving mining operations.

Premium Applications

Application	Effective AOI	End Result / Importance
Conveyor belt monitoring	≥0.05 km²	Tracks conveyor system alignment and functionality at mine sites.
Rail stockpile and loading monitoring	≥0.05 km²	Monitors ore loading points and stockyard turnover.
Detailed corridor mapping	≥0.05 km²	Provides fine-scale insights for compliance and logistic planning.