

40893

Evaluate the factors influencing the selection of plant and equipment for surface extraction operations

Kaupae Level	5
Whiwhinga Credit	15
Whāinga Purpose	People credited with this skill standard are able to evaluate and justify the factors influencing the selection of plant and equipment for surface extraction operations. Learners will be able to evaluate geological, geotechnical, topographical, material property factors, production and extraction method factors, design and ergonomic factors; and operational support-related factors. Learners will also be able to analyse economic factors to ensure that plant and equipment selection aligns with operational objectives, safety obligations, and industry good practice. This skill standard may be used in programmes leading to qualifications and micro-credentials at Level 4 or above in extractive operations.

Hua o te ako me Paearu aromatawai | Learning outcomes and assessment criteria

Hua o te ako Learning outcomes	Paearu aromatawai Assessment criteria
1. Evaluate geological, geotechnical, and topographical factors that influence plant and equipment selection for surface extraction operations.	a. Identify and describe the size, geometry, and accessibility of the deposit and how these factors influence plant and equipment needs.
	b. Evaluate the influence of site-specific topography, location, and climate on equipment access and performance.
	c. Describe the effect of stripping ratio and overburden characteristics on plant selection.
2. Evaluate material property factors relevant to plant and equipment selection for surface extraction operations.	a. Describe how hardness, rippability, abrasiveness, and free-diggability of material affect plant suitability.
	b. Evaluate the significance of water content, saturated and sticky materials, in-situ bulk density, swell factor, and fill factor.
	c. Match material properties to appropriate plant types for an efficient and safe extraction.

Hua o te ako Learning outcomes	Paearu aromatawai Assessment criteria
3. Evaluate production requirements and extraction methods that impact the selection of plant and equipment for surface extraction operations.	a. Analyse the production targets and product quality specifications influencing equipment selection.
	b. Evaluate the influence of dilution, ore or product loss, sizing, and fragmentation on equipment choice.
	c. Evaluate production expectations against equipment availability, productivity, maintainability, and reliability.
	d. Assess the suitability of plant and equipment for specific extraction and handling stages, equipment matching for best efficiencies, including loading, hauling, tipping and stockpiling
	e. Compare common extraction methods (e.g., blasting, ripping and pushing, free-digging) and explain how each impacts plant and equipment selection decisions.
4. Evaluate the design and ergonomic factors for plant and equipment for surface extraction operations.	a. Assess equipment design features that support safe working at heights, serviceability, safe access and egress, and operation.
	b. Evaluate ergonomic factors such as operator controls, seating, visibility, and cabin comfort.
	c. Describe design features that support worker health e.g. minimise exposure to dust, noise, vibration, and other hazards.
5. Evaluate support-related factors for selected plant and equipment used for surface extraction operations.	a. Identify the availability of spare parts and support from original equipment manufacturers or local dealers.
	b. Evaluate maintenance infrastructure requirements, including service vehicles, workshops, and storage for parts, fuel and lubricants.
	c. Assess training and competency needs for operators and maintenance personnel.

Hua o te ako Learning outcomes	Paearu aromatawai Assessment criteria
6. Analyse economic factors influencing plant and equipment selection for surface extraction operations.	a. Compare capital and lifecycle operating costs of plant options.
	b. Evaluate unit operating cost (\$/tonne or \$/bcm) in the context of productivity and resource recovery.
	c. Assess return on investment and warranty coverage in relation to project duration and risk.

Pārongo aromatawai me te taumata paearu | Assessment information and grade criteria

Assessment specifications:

Skills must be assessed in the workplace or a simulated environment that reflects workplace conditions and contingencies. This standard may be assessed using a case study, site scenario, or actual workplace application.

All tasks must be carried out in accordance with industry good practices and company procedures where appropriate.

Evidence presented for assessment against this skill standard may include oral, visual, video, written and/or practical activities demonstrated in the workplace.

Plant and equipment such as:

- Excavation: hydraulic excavators, bulldozers, scrapers, dredges, front-end loaders
- Transportation: rigid haul trucks, articulated dump trucks, conveyors, slurry pipelines.

Ngā momo whiwhinga | Grades available

Achieved.

Ihirangi waitohu | Indicative content

Geological, Geotechnical, and Topographical Considerations

- Deposit geometry (thickness, extent, shape)
- Stripping ratio and overburden characteristics
- Site access and location-specific challenges
- Climate, rainfall, and seasonal variation impacts
- Slope stability, benching, and terrain gradients.

Material Properties

- Rock and soil types (e.g., sedimentary, igneous, weathered zones)
- Hardness, abrasiveness, and fragmentation characteristics
- Free-diggability and rippability
- Density (in-situ, loose and recompacted), swell factor, fill factor
- Water content, saturated and sticky material and its effect on materials handling and safety.

Production and Extraction Requirements

- Production expectations:
 - Environmental approval, mineral permits and consent compliances
 - Output targets, recovery rates, and scheduling
 - Product quality specifications and consistency
 - Influence of fragmentation on downstream handling
 - Dilution control, ore/product loss, and sizing requirements.
- Extraction method considerations
 - Drilling and blasting: fragmentation control, flyrock risk, influence on loader/excavator selection
 - Ripping: suitability for weathered or weak rock; requires dozers or ripper-equipped excavators
 - Free-digging: minimal pre-treatment; favours high-efficiency excavators/loaders
 - Excavating pit walls: perimeter blasting techniques, GPS level control
 - Method selection based on rock type, geometry of the deposit, geological structure, material properties and safety requirements
 - Excavating in water e.g. river gravel and sand, high clay content
- Integration with equipment
 - Equipment sizing and matching based on extraction method and best efficiency (e.g., drill-and-blast followed by truck and excavator/wheel loader vs. scraper systems for soft materials)
 - Cycle times, haul distances, dump/tip location and rehandling considerations
 - Influence of fragmentation size on loader bucket fill, crusher and conveyor compatibility, and screening efficiency
- Operational performance
 - Maintainability, reliability, and equipment availability
 - Plant utilisation optimisation to meet production schedules.

Equipment Functions and Matching

- Types and functions of excavation equipment (excavators, wheel loaders, scrapers, bulldozers, dredges)
- Haulage systems (trucks, conveyors, pipelines)
- Tipping, stockpiling, and ancillary equipment (dozers, graders, water trucks, service trucks, stackers)
- Equipment matching (e.g., bucket size to truck size for optimal cycle times).

Design, Safety, and Ergonomics

- Machine design for safe maintenance and operation (guarding, ladders, handrails, platforms)
- Ergonomic design (operator comfort, control layout, visibility)
- Dust, noise, and vibration control measures
- Working at heights and emergency egress
- Compliance with design-related safety standards (e.g., MDG15, AS/NZS 4024).

Support Infrastructure and Maintenance

- Spare parts availability and OEM support logistics
- On-site maintenance facilities (workshops, fuel and lubricant storage, service trucks)
- Operator and maintenance technician training needs and competency documentation
- Equipment pre-start and servicing procedures.

Economic Evaluation and Decision-Making

- Capital cost vs operating cost over lifecycle
- Equipment efficiency (fuel use, tonnes moved per hour, downtime)
- Warranty terms and coverage limits
- Cost per tonne calculations and budgeting
- Return on investment (ROI) and whole-of-life cost models.

Rauemi | Resources

Legislation and Regulations

- Health and Safety at Work Act 2015 (HSWA); <https://www.worksafe.govt.nz/laws-and-regulations/acts/hswa/>.
- Health and Safety at Work (Mining Operations and Quarrying Operations) Regulations 2016; <https://www.legislation.govt.nz/regulation/public/2016/0017/latest/whole.html>.
- Health and Safety at Work (General Risk and Workplace Management) Regulations 2016; <https://www.legislation.govt.nz/regulation/public/2016/0013/latest/whole.html>.
- Resource Management Act 1991 (RMA); <https://www.legislation.govt.nz/act/public/1991/0069/latest/DLM230265.html>.
- WorkSafe NZ – Approved Code of Practice for Health and Safety in Opencast Mines, Alluvial Mines, and Quarries; <https://www.worksafe.govt.nz/topic-and-industry/extractives/guidance-position-statements/health-and-safety-at-opencast-mines-alluvial-mines-and-quarries/>.
- Good Practice Guidelines: Safe Use of Machinery (WorkSafe NZ); <https://www.worksafe.govt.nz/topic-and-industry/manufacturing/safe-use-of-machinery/>.
- Good Practice Guidelines: Worker Health – Exposure to Dust and Noise in Mining.

Australian Guidelines and Reference Documents

- MDG15 – Mobile and Transportable Equipment for Use in Mines (NSW DPI).
- AS/NZS 4024 Series – Safety of Machinery (Joint Australian/New Zealand Standard).
- NSW Work Health and Safety (Mines and Petroleum Sites) Regulation 2022.

Supporting Industry Resources

- Manufacturer and OEM Equipment Manuals – Technical specifications and maintenance procedures.
- Supplier Performance Data Sheets and Case Studies – Information on fuel efficiency, cycle times, and return on investment.
- Site-Specific Risk Assessments and Equipment Evaluations.

Where any Acts, regulations, standards, codes of practice, guidelines, or authority requirements and conditions cited in this skill standard are amended, replaced, or superseded during the lifetime of the standard, the current versions shall apply for assessment purposes until this skill standard is formally reviewed.

Pārongo Whakaū Kouna | Quality assurance information

Ngā rōpū whakatau-paerewa Standard Setting Body	Hanga-Aro-Rau Manufacturing, Engineering and Logistics Workforce Development Council
Whakaritenga Rārangi Paetae Aromatawai DASS classification	Engineering and Technology > Extractive Industries > Extractive Industries Management
Ko te tohutoro ki ngā Whakaritenga i te Whakamanatanga me te Whakaōritenga CMR	0014

Hātepe Process	Putanga Version	Rā whakaputa Review Date	Rā whakamutunga mō te aromatawai Last date for assessment
Rēhitatanga Registration	1	25 September 2025	N/A
Kōrero whakakapinga Replacement information	This skill standard replaced unit standard 30902.		
Rā arotake Planned review date	31 December 2030		

Please contact Hanga-Aro-Rau Manufacturing, Engineering and Logistics Workforce Development Council at qualifications@hangaarorau.nz if you wish to suggest changes to the content of this skill standard.