# ENVIRONMENTAL IMPACT STATEMENT

RED HILL
MINING LEASE

## Glossary, Abbreviations and Units

# Glossary

| Term | Definition |
|---|---|
| Access | the location where vehicles move between private property and the public road |
| Alluvial | sediments deposited by flowing water |
| Alluvial aquifer | an aquifer formed of unconsolidated material deposited by water, typically occurring adjacent to river channels and in buried or palaeochannels |
| Alluvium | sediments (clays, sands, gravels and other materials) deposited by flowing water. Deposits can be made by streams on river beds, floodplains, and alluvial fans |
| Annual average daily traffic | the volume of traffic over a day as averaged from a complete years' worth of traffic counts. |
| Aquatic | associated with and dependant on water (e.g. aquatic vegetation) |
| Aquatic ecosystems | abiotic (physical and chemical) and biotic components, habitats and ecological processes contained within rivers and their riparian zones and reservoirs, lakes, wetlands and their fringing vegetation |
| Aquiclude | a low-permeability unit that forms either the upper or lower boundary of a groundwater flow system. |
| Aquifer | saturated permeable geological unit that is permeable enough to yield economic quantities of water to boreholes |
| Aquifer system | heterogeneous body of intercalated permeable and less permeable material that acts as a water-yielding hydraulic unit of regional extent |
| Aquifer test | a hydrological test performed on a well, aimed to increase the understanding of the aquifer properties, including any interference between wells, and to more accurately estimate the sustainable use of the water resource available for development from the well. |
| Aquitard | saturated geological unit with a relatively low permeability that retards and restricts the movement of water, but does not prevent the movement of water; while it may not readily yield water to boreholes and springs, it may act as a storage unit |
| Arboreal | living in trees |
| Assemblage | a group of species co-occurring at a location |
| Australian Height Datum (AHD) | the Australian height datum, adopted by the National Mapping Council of Australia, for referencing a level or height back to a standard base level. |
| Austroads | The association of Australian and New Zealand road transport and traffic authorities that aims to promote improved road transport outcomes and produces nationally accepted guidelines. |
| Available drawdown | height of water above the depth at which the pump is set in a borehole at the time of water level measurement (metres) |
| Average daily traffic | the volume of traffic over a day as averaged from an incomplete year's worth of traffic counts |
| Averaging period | time period over which air quality measurements or predicted impacts are averaged |
| Background traffic | the expected volume of traffic at a particular point without the addition of the traffic associated with the project under consideration |
| Bank storage | water that percolates laterally from a river in flood into the adjacent geological material, some of which may flow back into the river during low-flow conditions |
| Baseflow | amount of groundwater flowing into a river |
| Basic model | with limited data availability and status of hydrogeological understanding, and possibly limited budgets, a Basic model could be suitable for preliminary quantitative assessment (rough calculations), or to guide a field program |
| Bore (borehole) | a well, excavation, or any other artificially constructed or improved groundwater cavity which can be used for the purpose of intercepting, collecting or storing water from an aquifer; observing or collecting data and information on water in an aquifer; or recharging an aquifer. Interchangeable with bores, wells, piezometers |

| Term | Definition |
|---|---|
| Brackish | water that contains between 1,000 and 10,000 mg/L of dissolved solids |
| Brine | water that contains more than 35,000 mg/L of dissolved solids |
| Buffer | area of vegetation providing protection from disturbance |
| Calibration | calibration of a model is the process where parameters in the model are fine tuned to get the best possible match between actual and modelled data over a defined period |
| Carbonaceous | defining attribute of a substance rich in carbon |
| Carrying capacity | The number of individuals that can be supported in a given area within natural resource limits without degradation of those resources. The carrying capacity for any given area is not fixed. |
| Catchment | area from which any rainfall will drain into the watercourse, contributing to the runoff at a particular point in a river system; synonymous with the term river basin |
| Chainage | the distance in kilometres along a road from a defined starting point |
| Community (ecology) | group of populations of plants and animals in a given place |
| CONCAWE | 'the propagation of noise from petroleum and petrochemical complexes to neighbouring communities' prediction method |
| Conceptual model (groundwater) | A simplified and idealised representation (usually graphical) of the physical hydrogeologic setting and our hydrogeological understanding of the essential flow processes of the system. This includes the identification and description of the geologic and hydrologic framework, media type, hydraulic properties, sources and sinks, and important aquifer flow and surface-groundwater interaction processes. |
| Cone of depression | the radial decline of potentiometric levels or underground water levels around a point of water extraction from an aquifer |
| Confined aquifer | An aquifer that is overlain and underlain by impervious layers. The water level in bores tapping confined aquifers rises within the bore to a level above the top of the aquifer, and may result in an artesian or sub artesian bore. Confined aquifers tend to occur in the central and deeper parts of the Basin. |
| Confining layer | layer of low permeability material overlying an aquifer, which restricts the vertical movement of water |
| Connectivity | the connectedness between patches of suitable habitat for an individual species or group of species |
| Contamination | introduction of any substance into the environment by human activities |
| Corridor | a continuous link of suitable habitat between two vegetation patches allowing movement by fauna |
| Crash data | recorded road crashes along a particular section of public road |
| Critical delay | the highest average traffic delay experienced by any traffic movement at an intersection |
| Critical movement | in the context of critical traffic delay intersections, it is the traffic movement which experiences the highest average delay of any of the movements at that intersection |
| Cryptic (ecology) | difficult to observe |
| Degree of saturation (DOS) | The ratio of the number of vehicles requiring entry to an intersection in a specified period to the number which could enter if an approach was fully saturated (i.e. at capacity) during that period. |
| Dewatering | Removing underground water for construction or other activity. It is often used as a safety measure in mining below the water table or as a preliminary step to development in an area. |
| DIALOG | a computer based literature search database |
| Dissolved solids | minerals and organic matter dissolved in water |
| Diurnal | active during the day |
| Dominant | one or more species, by means of their number, coverage, or size that exerts considerable influence upon or control of the conditions of existence of associated species |

| Term | Definition |
|---|---|
| Drawdown | drop in groundwater level below the general level occurring when a borehole is pumped |
| Duricrust | hardened soil crust |
| Ecosystem | organic community of plants, animals and bacteria and the physical and chemical environment they inhabit |
| Ecosystem function | processes including soil formation and stabilisation, nutrient cycling, water infiltration, pollination and seed production |
| Ecotone | transitional zone between two diverse communities/habitats |
| Effective storage (aquifers) | Volume of groundwater an aquifer takes in and releases is limited by the storage capacity. Aquifers may be regularly recharged but have insufficient storage to contain the recharge thus seasonal seeps are formed and the aquifer is incapable of storing groundwater volumes over extended dry periods. |
| Endemic | a species restricted to a particular place or region |
| Ephemeral | a stream or creek that carries water only during or immediately after rainfall |
| Ephemeral river | storm-event driven rivers where flow occurs less than 20 per cent of the time; these rivers have limited baseflow component with no groundwater discharge |
| Equivalent standard axles | the number of standard axle loads that are equivalent in damaging effect on a pavement to a given vehicle or axle loading |
| Exotic species | an introduced species |
| Extant | still in existence |
| External road network | The road network outside the direct control and ownership of a development project. The external road network is usually controlled by either the Department of Transport and Main Roads or a local council. |
| Extraction | in relation to any bore includes withdrawing, taking, using or permitting the withdrawing, taking or using of water from that bore |
| Evapotranspiration | the sum of evaporation and transpiration |
| Fault | zone of displacement in rock formations resulting from forces of tension or compression in the earth's crust |
| Fecundity | reproductive output; number of offspring produced |
| Flow regime | recorded or historical sequence of flows used to create a hydrological profile of a water resource |
| Fluvial | relating to or arising from the action of flowing water in a river |
| Flux | rate of groundwater flow per unit width of aquifer |
| Formation | general term used to describe a sequence of rock layers |
| Fracture | any break in a rock including cracks, joints, and faults |
| Fresh water | water that contains less than 1,000 mg/L salts |
| Gilgai | depression in an irregular land surface |
| Groundwater | water found in the subsurface in the saturated zone below the water table or piezometeric surface i.e. the water table marks the upper surface of groundwater systems |
| Groundwater dependent ecosystems | ecosystems which have their species composition and natural ecological processes wholly or partially determined by groundwater |
| Groundwater flow | movement of water through openings and pore spaces in rocks below the water table (i.e. in the saturated zone) |
| Groundwater flow model | an application of a mathematical model to represent a site-specific groundwater flow system |
| Groundwater resource | groundwater available for beneficial use, including humans, aquatic ecosystems and the greater environment |

| Term | Definition |
|---|---|
| Growth rate (traffic) | the annual per cent change in the number of vehicles passing a given point on a road |
| Heavy vehicles | a heavy vehicle is defined as any vehicle with three or more axles or with dual tyres on the rear axle |
| Heterogeneous | composed of parts of different kinds; having widely dissimilar elements or constituents |
| Heterogeneous (ecology) | composed of species and/or structure that are not the same or similar |
| Homogeneous | composed of parts or elements that are all of the same kind; not heterogeneous |
| Homogeneous (ecology) | composed of species and/or structure that are all the same or similar |
| Homogeneous (groundwater) | characteristic of the geological unit in which hydraulic conductivity is independent of position or direction; opposite of heterogeneous |
| Hydraulic conductivity | measure of the ease with which water will pass through earth material; defined as the rate of flow through a cross-section of one square metre under a unit hydraulic gradient at right angles to the direction of flow (metres per day) |
| Hydraulic equation | an expression of the law of mass conservation for purposes of water budgets. It may be stated as inflow equals outflow plus or minus changes in storage |
| Hydraulic gradient | change in the hydraulic head over a certain distance |
| Hydraulic head | elevation to which water will rise in a borehole connected to a point in an aquifer |
| Hydrology | study of the properties, circulation and distribution of water |
| Infiltration | downward movement of water from the atmosphere into the ground; not to confused with percolation |
| Intergranular flow | Flow that occurs between individual grains of rock |
| Intersection capacity | The maximum sustainable traffic flow rate at which vehicles can reasonably be expected to traverse a point or uniform segment of a lane or roadway under given roadway, geometric, traffic, environmental and control conditions; usually expressed as vehicles per hour. |
| Intersection movement | a traffic path through an intersection with a discrete origin and destination |
| Isotropic | condition of having properties that are uniform in all directions, opposite of anisotropic |
| k-factor | soil erodibility |
| Kilde 130 | Norwegian ministry of the environment and communications rail noise prediction method |
| Landform | a geomorphological unit |
| Level of service (LOS) | A qualitative measure describing traffic operational conditions within a traffic stream, and their perception by motorists and/or passengers. These conditions are generally described in terms of speed and travel time, freedom to manoeuvre, traffic interruptions, comfort, convenience and safety. |
| Light vehicles | a light vehicle is defined as any vehicle with two axles and without dual tyres on the rear axle |
| Lithic | relating to or composed of stone |
| Lithology | physical character of rocks |
| Macro-invertebrate | aquatic invertebrates visible to the naked eye |
| Macrophyte | emergent, submergent or floating plants that are not microscopic |
| Major aquifer | highly permeable formations, usually with a known or probable presence of significant fracturing, may be highly productive and able to support large abstractions for public supply and other purposes; water quality is generally very good |
| Micro-bat | bats belonging to the suborder Microchiroptera, typically small, insectivorous and able to echolocate |
| Microchiropteran | bats belonging to the suborder Microchiroptera |

| Term | Definition |
|---|---|
| Micro-habitat | a small localised habitat within a larger ecosystem |
| Minor aquifer | fractured or potentially fractured rocks which do not have a high primary permeability, or other formations of variable permeability; aquifer extent may be limited and water quality variable |
| Model calibration | The process by which the independent variables (parameters) of a numerical model are adjusted, within realistic limits, to produce the best match between simulated and observed data (usually water-level values). This process involves refining the model representation of the hydrogeologic framework, hydraulic properties, and boundary conditions to achieve the desired degree of correspondence between the model simulations and observations of the groundwater flow system. |
| Network peak | The (usually) hour long period during which traffic volumes on the road network are at the highest level. |
| Nomenclature | system of names, terminology |
| Non-aquifer | formations with negligible permeability that are generally regarded as not containing groundwater in exploitable quantities; groundwater bodies, which are essentially impermeable, do not readily transmit water and/or have a water quality which renders it unfit for use |
| Nutrients | substances that help living things grow (e.g. nitrogen, phosphate, potassium) |
| Observation well | A non-pumping well used to observe the elevation of the water table or the potentiometric surface. An observation well is generally of larger diameter than a piezometer and typically is screened or slotted throughout the thickness of the aquifer. |
| Oxidation | addition of oxygen to a compound; entails the loss of an electron |
| Palaeochannel | buried stream channel |
| Passage | en route migration |
| Pavement impact | Pavements are designed to carry a pre-determined level of traffic load, measured in ESAs, after which the pavement is likely to require structural improvements. New developments can generate increased heavy vehicle traffic which may adversely impact the structure or condition of a pavement. |
| Pavement markings | Any painted lines, raised pavement markers, traffic domes and the like placed on the road to direct and control the movement or parking of traffic. |
| Peak period | typically the one hour period that has the highest traffic demands |
| Perched aquifer | Perched aquifers occur in the upper catchments. They sit over a thick layer of clayey weathered sediments and have no connection to the fractured rock aquifers beneath the clay. This lack of connection means that their ecosystems are highly dependent on rainfall runoff, lateral subflow, from unconsolidated sediments overlying the clay or upstream flow contributions. These systems are more sensitive to surface water changes. Development of surface water resources or disruptions to subsurface flow will have the greatest impact on flora and fauna in this setting. |
| Percolation | process of the downward movement of water in the unsaturated zone under the influence of gravity and hydraulic forces; term used to differentiate from infiltration, which specially refers to the movement of water from the atmosphere into the ground |
| Permeability | ease with which a fluid can pass through a porous medium and is defined as the volume of fluid discharged from a unit area of an aquifer under unit hydraulic gradient in unit time (metres per day) |
| Permeable (materials) | materials that allow liquids to flow through them |
| pH | absolute value of the decimal logarithm of the hydrogen-ion concentration (activity); used as an indicator of acidity (pH < 7) or alkalinity (pH > 7) |
| Piezometric level | elevation to which groundwater levels rise in boreholes that penetrate confined or semi-confined aquifers |
| Piezometric surface | imaginary surface representing the piezometeric pressure or hydraulic head throughout all or part of a confined or semi-confined aquifer |

| Term | Definition |
|---|---|
| Pollution | introduction into the environment of any substance by the action of humans, which is or results in significant harmful effects to humans or the environment |
| Porosity | porosity of a water-bearing formation is determined by that part of its volume consisting of openings or pores |
| Potable water | water that is safe and palatable for human use |
| Preferential flow | preferential movement of groundwater through more permeable zones in the subsurface |
| Primary aquifer | aquifer in which water moves through the original interstices of the geological formation |
| Recharge | recharge is defined as the process by which water is added from outside to the z zone of saturation of an aquifer, either directly into a formation, or indirectly by way of another formation |
| Rehabilitation | restore to former condition or status |
| Remediation | restore to health, requires that impact is reduced to some acceptable level |
| Residual | something left after other parts/components have been removed or addressed. |
| Resource (water) | quality of all aspects of a water resource including (a) the quality, pattern, timing, water level and assurance of instream flow, (b) the water quality, including the physical, chemical and biological characteristics of water, (c) the characteristic and condition of the instream and riparian habitat; and (d) the characteristics, condition and distribution of aquatic biota |
| Rest water level | groundwater level in a borehole not influenced by abstraction; synonymous with static water level, but no groundwater levels are ever truly static as they continually respond to recharge, discharge and abstraction |
| Right turn bay | a lane allocated for use exclusively by right turning vehicles |
| River | physical channel in which runoff will flow; generally larger than a stream, but often used interchangeably |
| Road and Traffic Authority | the State Road Authority in New South Wales which is the State Government Agency responsible for the state road network |
| Roundabout | A channelised intersection at which all traffic moves clockwise around a central traffic island. |
| Runoff | surface and subsurface flow from a catchment, but in practice refers to the flow in a river i.e. excludes groundwater not discharged into a river |
| Run-of-mine | material from a mine that has not been crushed or screened |
| Safe yield | amount of water that can be withdrawn from an aquifer without producing an undesired effect like water level reaching the position of the main water yielding fracture |
| Saline water | water that is generally considered unsuitable for human consumption or for irrigation because of its high content of dissolved solids |
| Saturated zone | subsurface zone below the water table where interstices are filled with water under pressure greater than that of the atmosphere |
| Seagull intersection | An intersection where a triangular island is used to separate turning traffic from through traffic in the same carriageway |
| Seal width | The width of the carriageway sealed to protect and waterproof the underlying pavement inclusive of sealed shoulders. |
| Seasonal river | rivers driven by seasonal rainfall patterns where flow occurs between 20% and 80% of the time; these rivers have a limited baseflow component with little or no groundwater discharge |
| Secondary aquifer | aquifer in which water moves through secondary openings and interstices, which developed after the rocks were formed i.e. weathering, fracturing, faulting |
| Secondary interstices | openings in the rock that were developed by processes that affected the rocks after they were formed |
| Sediment | particles derived from rocks or biological material that have been transported by air or water |

| Term | Definition |
|---|---|
| Sedimentary aquifer | These occur in consolidated sediments such as porous sandstones and conglomerates, in which water is stored in the intergranular pores, and limestone, in which water is stored in solution cavities and joints. These aquifers are generally located in sedimentary basins that are continuous over large areas and may be tens or hundreds of metres thick. In terms of quantity, they contain the largest groundwater resources |
| Seep | diffuse wetland area where interflow and groundwater emerges, usually at a slow rate or small volume, to become surface flow |
| Semi confined aquifer | An aquifer confined by a low-permeability layer that permits water to slowly flow through it. During pumping of the aquifer, recharge to the aquifer can occur across the confining layer. Also known as a leaky artesian or leaky confined aquifer |
| Sensitivity analysis | The measurement of the uncertainty in a calibrated model as a function of uncertainty in estimates of aquifer parameters and boundary conditions |
| SIDRA | Traffic analysis software developed by SIDRA SOLUTIONS which provides estimates of capacity and performance statistics for isolated intersections |
| SIGNAL analysis | Stream Invertebrate Grade Number – Average Level; a biotic index for measuring habitat quality based on invertebrate families |
| Signalised intersection | an intersection at which the movement of vehicles and pedestrians is generally controlled by traffic signals |
| Simulation | one complete execution of a groundwater modelling program, including input and output |
| Source population | breeding group that produces enough offspring to be self-sustaining and that often produces excess young that must disperse to other areas |
| Specific capacity | The ratio of the rate of discharge of water from the well to the drawdown of the water level in the well. Specific capacity should be described on the basis of the number of hours of pumping prior to the time the drawdown measurement is made. It will generally decrease with time as the drawdown increases |
| Specific storage | The amount of water per unit volume of a saturated formation that is expelled from storage due to compression of the mineral skeleton and the pore water |
| Specific yield | ratio of the volume of water that a given mass of saturated rock or soil will yield by gravity from that mass |
| Spring | point where groundwater emerges, usually as a result of topographical, lithological or structural controls |
| State-controlled roads | a road declared to be controlled by the Department of Transport and Main Roads, including all AusLink National Roads in Queensland |
| Static water level | rest water level |
| Stepping stones | disconnected patches of habitat that more mobile species, or species with some tolerance of modified habitat, move through from one vegetation patch to another |
| Stochastic | A description of a parameter or a process with random qualities. A stochastic parameter has a range of possible values, each with a defined probability. The outcome of a stochastic process is not known with certainty |
| Storage coefficient | volume of water an aquifer releases from or takes into storage per unit surface area of the aquifer per unit change in head |
| Storativity | Storage can be defined as the volume of water that a saturated confined aquifer releases from storage per unit surface area of the aquifer per unit decline in the water table. Quantifies the aquifers ability to release water |
| Sub-artesian | Groundwater that does not rise above the surface of the ground when accessed by a bore and must be pumped to the surface |
| Successional (succession) | replacement of one kind of community by another kind |
| Surface runoff | part of the total runoff that travels over the ground surface to reach a stream or river channel |
| Sustainable yield | safe amount of water that can be abstracted from a borehole over a long period of time (usually 1 or 2 years) without the water level reaching the position of the pump or main water strike |

| Term | Definition |
|---|---|
| Synergism | interaction of different components that produces a total effect greater than that of the sum of the individual effects |
| Total dissolved solids | concentration of dissolved solids |
| Through flow | Movement of water horizontally beneath the land surface; it occurs once water has infiltrated the soil; the water moves downwards under gravity and because the soil becomes more compact and less permeable with increasing depth, water will begin to move sideways at speeds of between 0.005 to 0.3 metres per hour. It usually happens when the soil is completely saturated with water |
| Topographic divide | The boundary between adjacent surface water boundaries. It is represented by a topographically high area. |
| Transmissivity | Rate at which water is transferred through a unit width of an aquifer under a unit hydraulic gradient; it is expressed as the product of the hydraulic conductivity and the thickness of the saturated portion of an aquifer.<br>Transmissivity is the rate at which water moves through the aquifer |
| Transpiration | evaporation of water from plants |
| Uncertainty analysis | the quantification of uncertainty in model results due to incomplete knowledge of model aquifer parameters, boundary conditions or stresses |
| Unconfined aquifer | aquifer with no confining layer between the water table and the ground surface where the water table is free to fluctuate |
| Unsaturated zone | part of the geological stratum above the water table where interstices and voids contain a combination of air and water; synonymous with zone of aeration or vadose zone |
| Volant | capable of flying |
| Vulnerability (groundwater contamination) | the tendency or likelihood for contamination to reach a specified position in the groundwater system after introduction at some location above the uppermost aquifer |
| Water budget | an evaluation of all the sources of supply and the corresponding discharges with respect to an aquifer or a drainage basin |
| Water table | surface within the zone of saturation of an unconfined aquifer over which the pressure is atmospheric |
| Well field | group of boreholes in a particular area usually used for groundwater abstraction purposes |
| Well point | shallow, small diameter hole used to abstract groundwater from primary aquifers |
| Wind-throw | trees uprooted by wind |
| Yield | quantity of water removed from a water resource (e.g. yield of a borehole) |

# Abbreviations

| Abbreviation | Definition |
|---|---|
| 1D | one-dimensional |
| 2D | two-dimensional |
| ABS | Australian Bureau of Statistics |
| AADT | annual average daily traffic |
| AAMC | Anglo American Metallurgical Coal |
| AC | acid consuming |
| ACARP | Australian Coal Association Research Program |
| ACH | Aboriginal cultural heritage |
| ACH Act | *Aboriginal Cultural Heritage Act 2003* |
| AED | Advanced Environmental Dynamics Pty Ltd |
| AEP | annual exceedence probability (or probability of occurrence in a one year period) |
| AFC | armoured face conveyor |
| AHD | Australian Height Datum |
| Al | aluminium |
| ALC | agricultural land classification |
| Alluvium | Alluvium Consulting |
| AMD | acid and metalliferous drainage |
| ANC | acid neutralising capacity |
| ANZECC | Australia and New Zealand Environmental Conservation Council |
| ARI | average recurrence interval |
| As | arsenic |
| AS | Australian Standard |
| ASC | Australian soil classification |
| ASS | acid sulphate soils |
| AUD$ | Australian dollar |
| ave | average |
| AWBM | Australian Water Balance Model |
| BA | Birds Australia |
| BAC | BMA Local Buy Program advisory committee |
| BBCGP | Bowen Basin Coal Growth Project |
| BCN | BMA Community Networks |
| BoM | Bureau of Meteorology |
| BOP | Biodiversity Offset Policy |
| BMA | BHP Billiton Mitsubishi Alliance |
| BMC | BHP Mitsui Coal |
| BPA | biodiversity planning assessment |
| BRM | Broadmeadow Underground Mine |
| BSO | Broadmeadow Sustaining Operations |
| c. | circa |

| Abbreviation | Definition |
|---|---|
| CALMET | CALifornia METeorological Model |
| CALPUFF | California Plume Dispersion Model |
| CAMBA | China-Australia Migratory Bird Agreement |
| Cd | cadmium |
| CEC | cation exchange capacity |
| CFC | chlorofluorocarbons |
| $CH_4$ | methane |
| CHMP | cultural heritage management plan |
| CHPP | coal handling and preparation plant |
| CLR | Contaminated Land Register |
| CMSH Act | Coal Mining Safety and Health Act 1999 |
| CMSH Regulation | Coal Mine Safety and Health Regulation 2001 |
| Co | cobalt |
| $CO_2$ | carbon dioxide |
| $CO_2$-e | carbon dioxide equivalent |
| Converge | Converge Heritage + Community |
| CoRTN | calculation of road traffic noise |
| CPP | Community Partnerships Program |
| CPRS | Carbon Pollution Reduction Scheme |
| CQ | Central Queensland |
| CQCA | Central Queensland Coal Association |
| CQSS | Central Queensland Strategy for Sustainability |
| Cr | chromium |
| CRA | Conzinc Riotinto of Australia |
| CRS | chromium reducible sulfide |
| CSG | coal seam gas |
| CSIRO | Commonwealth Scientific and Industrial Research Organisation |
| CSN | crucible swell number |
| CSR | crown separation ratio |
| C-Res | Community Resourcing |
| Cu | copper |
| Cwlth | Commonwealth |
| DBH | diameter at breast height |
| DCCEE | Department of Climate Change and Energy Efficiency |
| DCS | Department of Community and Safety |
| DEEDI | Department of Employment, Economic Development and Innovation (Queensland – former) |
| DEEWR | Department of Education, Employment and Workplace Relations (Commonwealth) |
| DERM | Department of Environment and Resource Management (Queensland – former) |
| DET | Department of Education and Training (Queensland – former) |
| DHSA | Drill Hole Spacing Analysis |

| Abbreviation | Definition |
|---|---|
| DIDO | drive-in, drive-out |
| DITR | Department of Industry, Tourism and Resources |
| DIP | Department of Infrastructure and Planning (Queensland – former) |
| DLA | designated landscape area |
| DLGP | Department of Local Government and Planning (Queensland) (Queensland – former) |
| DLGPSR | Department of Local Government, Planning, Sport and Recreation (Queensland – former) |
| DMC | dense medium cyclones |
| DoPC | Department of Premier and Cabinet (Queensland) |
| DOS | degree of saturation |
| DPI | Department of Primary Industries |
| DSDIP | Department of Science, Information Technology, Innovation and the Arts |
| DSEWPaC | Department of Sustainability, Environment, Water, Population and Communities (Commonwealth - former) (now Department of Environment) |
| EA | environmental authority |
| EAP | employee assistance program |
| EAT | Emerson Aggregate Test |
| EC | electrical conductivity |
| EC (1:5) | EC measured on a solid to water ratio of 1:5 (water extract) |
| ECe | electrical conductivity of a saturated soil paste extract |
| eCEC | effective cation exchange capacity |
| EEO | Energy Efficiency Opportunities |
| EEO Act | *Energy Efficiency Opportunities Act 2006* |
| EETM | Emission Estimation Technique Manual |
| EFM | Eaglefield Mine |
| EFO | environmental flow objectives |
| EHP | Department of Environment and Heritage Protection |
| EIS | environmental impact statement |
| EM plan | environmental management plan |
| EMP(s) | environmental management program(s) |
| EMR | Environmental Management Register |
| enHealth | environmental health committee |
| EP Act | *Environmental Protection Act 1994* |
| EPA | Environmental Protection Agency |
| EPBC Act | *Environment Protection and Biodiversity Conservation Act 1999* |
| EPC | exploration permit (coal) |
| EPCA | application for exploration permit coal |
| EPCM | engineering, procurement and construction management |
| EPHC | Environment Protection Heritage Council, (established by Council of Australian Governments) |
| EPM | exploration permit (minerals) |
| EPP(s) | environmental protection policy(ies) |

| Abbreviation | Definition |
|---|---|
| EPP | exploration permits (petroleum) |
| EPP (Air) | *Environmental Protection (Air) Policy 2008* |
| EPP (Noise) | *Environmental Protection (Noise) Policy 2008* |
| EPP (Water) | *Environmental Protection (Water) Policy 2009* |
| EP Regulation | Environmental Protection Regulation 2008 |
| EP (Waste Management) Regulation | Environmental Protection (Waste Management) Regulation 2000 |
| ERA | environmentally relevant activity |
| ESA | environmentally sensitive area |
| ESCP | erosion and sediment control plan |
| ESD | ecologically sustainable development |
| ESP | exchangeable sodium percentage |
| Ext | extreme |
| FCM | Fort Cooper Measures |
| FHA | fish habitat area |
| FIFO | fly-in, fly-out |
| FPC | foliage protection cover |
| FTE | full-time equivalent |
| FY | financial year |
| GBR | Great Barrier Reef |
| GBRMP | Great Barrier Reef Marine Park |
| GBRMPA | Great Barrier Reef Marine Park Authority |
| GBRWHA | Great Barrier Reef World Heritage Area |
| GCE | Goonyella Complex Expansion |
| GDE | groundwater dependant ecosystem |
| GED | general environmental duty |
| GHG | greenhouse gas |
| GI | ground integrity |
| GIS | geographic information systems |
| GLD | BHP Billiton Group Level Document |
| GLS | Goonyella Lower Seam |
| GMA | groundwater management area |
| GMS | Goonyella Middle Seam |
| GP | general practitioner |
| GPR | ground penetrating radar |
| GPS | Global Positioning System |
| GQAL | good quality agricultural land |
| GRB | Goonyella Riverside and Broadmeadow |
| GRM | Goonyella Riverside Mine |
| Gros | Grosvenor |

| Abbreviation | Definition |
|---|---|
| Growth Projects BCN | Bowen Basin Coal Growth Projects Community Network |
| GS1 | Goonyella tailings dam |
| GSQ | Geological Survey of Queensland |
| GSSE | GSS Environmental |
| GSV | ground surface visibility |
| GUS | Goonyella Upper Seam |
| HAS | historical archaeological site |
| HAZOP | hazard and operability |
| HDD | horizontal directional drilling |
| HEC-RAS | Hydrologic Engineering Centre River Analysis System (flood modelling software) |
| HERBRECS | Queensland DERM Herbarium Database |
| HES | high ecological significance |
| HGI | Hardgrove Grindability Index |
| HI | historical interest |
| HIL(s) | health-based Investigation level(s) |
| HPCT | Hay Point Coal Terminal |
| HVR | high value regrowth |
| IAS | initial advice statement |
| ICOMOS | International Council on Monuments and Sites |
| IDAS | integrated development assessment system |
| ILUA(s) | Indigenous land use agreement(s) |
| IMC | IMC Mining Group Pty Ltd |
| IMG | incidental mine gas |
| IPCC | Intergovernmental Panel on Climate Change |
| IQQM | integrated quantity quality model (water resources systems modelling software) |
| IRC | Isaac Regional Council |
| IRCIA | Isaac River Cumulative Impact Assessment (of Mine Developments) |
| JAMBA | Japan-Australia Migratory Bird Agreement |
| JORC | Joint Ore Reserves Committee |
| KPI | key performance indicator |
| KRA(s) | key resource area(s) |
| LCZ | landscape character zones |
| LFA | landscape function analysis |
| LGA | local government area |
| LOS | level of service |
| LOX | limit of oxidation |
| LP Act | *Land Protection (Pest and Stock Route Management) Act 2002* |
| LP Regulation | Land Protection (Pest and Stock Route Management) Regulation 2003 |
| LPG | liquefied petroleum gas |
| LS | land suitability |

| Abbreviation | Definition |
|---|---|
| LTCC | longwall top coal caving |
| LW | longwall |
| MDL | mineral development license |
| MIA | mine industrial area |
| MIBC | methyl isobutyl carbinol |
| MIWRP | Mackay Isaac Whitsunday Regional Plan |
| MIW | Mackay Isaac Whitsunday |
| ML | mining lease |
| MLA | mining lease application |
| MNES | matters of national environmental significance |
| MNM | Moranbah North Mine |
| Mo | molybdenum |
| Mod | moderate |
| MoU | Memorandum of Understanding |
| MPA | maximum potential acidity |
| MPS | multi-purpose services |
| MR Act | Mineral Resources Act 1989 |
| MRF | materials recycling facility |
| MRPHP | Major Resource Projects Housing Policy |
| MSDS | material safety data sheets |
| $N_2O$ | nitrous oxide |
| Na | sodium |
| NAF | non-acid forming |
| NAG | net acid generation |
| NAPP | net acid producing potential |
| NASA | National Aeronautics and Space Administration |
| NATA | National Association of Testing Authorities |
| NC Act | *Nature Conservation Act 1992* |
| NEPC | National Environment Protection Council |
| NEPM | National Environment Protection Measure |
| NET | northern economic triangle |
| NGA | National Greenhouse Accounts |
| NGER | National Greenhouse and Energy Reporting |
| NGER Act | *National Greenhouse and Energy Reporting Act 2007* |
| Ni | nickel |
| NICH | non-Indigenous cultural heritage |
| NPI | National Pollutant Inventory |
| NQBPC | North Queensland Bulk Ports Corporation |
| NQRR | North Queensland Resource Recovery |
| NRM | Department of Natural Resources and Mines |
| NRSET | National Resources Sector Employment Taskforce |

| Abbreviation | Definition |
|---|---|
| NSESD | National Strategy for Ecologically Sustainable Development |
| NSW | New South Wales |
| NSW DEC | New South Wales Department of Environment and Conservation |
| NZS | New Zealand Standard |
| $O_3$ | ozone |
| OESR | Office of Economic and Statistical Research |
| Pa | Pascals |
| PAF | potentially acid forming |
| PAF-LC | potentially acid forming – low capacity |
| PAWC | plant available water capacity |
| Pb | lead; or<br>Permian (Undivided) Back Creek Group |
| PCB | polychlorinated biphenyl |
| PDS | Property Data Solutions |
| PET | Plecoptera Ephemeroptera Trichoptera |
| pH | per hydroden - absolute value of the decimal logarithm of the hydrogen-ion concentration (activity); used as an indicator of acidity (pH < 7) or alkalinity (pH > 7) |
| pH (1:5) | pH measured on a solid to water ratio of 1:5 (water extract) |
| PHA | preliminary hazard analysis |
| PL | petroleum lease |
| $PM_{10}$ | particulate matter with an equivalent aerodynamic diameter less than 10 micrometres and a density of one gram per cubic centimetre |
| $PM_{2.5}$ | particulate matter with an equivalent aerodynamic diameter less than 2.5 micrometres and a density of one gram per cubic centimetre |
| PNC | potential neutralising capacity |
| PNL | planning noise level |
| PPE | personal protective equipment |
| PPL | petroleum pipeline licence |
| project | Red Hill Mining Lease |
| PSA | particle size analysis |
| PSI | preliminary site investigation |
| Pwt | Late Permian Fort Cooper Coal Measures |
| Qa | Quaternary Alluvium |
| QAS | Queensland Ambulance Services |
| QFRS | Queensland Fire and Rescue Service |
| QH Act | *Queensland Heritage Act 1992* |
| Qld | Queensland |
| QPP | Queensland Planning Provisions |
| QPS | Queensland Police Service |
| QR | Queensland Rail |
| QRC | Queensland Resources Council |

| Abbreviation | Definition |
|---|---|
| QWQ | Queensland Water Quality |
| RBL | rating background level |
| RE | regional ecosystem |
| REDC | Regional Economic Development Corporation |
| REDD | regional ecosystems description database |
| REM | rapid eye movement |
| RFS | rural fire service |
| RHHAS | Red Hill Heritage or Archaeological Site |
| RHHI | Red Hill Historical Interest |
| RHM | Red Hill Mine |
| RIA | river improvement areas |
| ROKAMBA | Republic of Korea – Australia Migratory Bird Agreement |
| ROM | run-of-mine |
| ROP | resource operation plan (water) |
| ROPS | rollover protective structures |
| RS1 | Riverside tailings dam |
| RTA | Residential Tenancies Authority |
| RUSLE | revised universal soil loss equation |
| S | sulphur |
| SAR | sodium absorption ratio |
| Sb | antimony |
| SCL | strategic cropping land |
| SCT | Strata Control Technology Operations |
| SD | statistical division |
| SDPWO Act | *State Development and Public Works Organisation Act 1971* |
| Se | selenium |
| SES | State Emergency Services |
| SHMS | Safety and Health Management System |
| SIA | social impact assessment |
| SIGNAL | Stream Invertebrate Grade Number – Average Level |
| SIMP | Social Impact Management Plan |
| SIS | surface to in-seam |
| SKM | Sinclair Knight Merz Pty Ltd |
| SL | special lease |
| SNL | specific noise level |
| Sp. | species (singular) |
| Spp. | species (plural) |
| SP Act | *Sustainable Planning Act 2009* |
| SPP(s) | State Planning Policy(ies) |
| SPRP | State Planning Regulatory Provision |

| Abbreviation | Definition |
|---|---|
| SRC | Sustainable Resource Communities |
| SRTM | Shuttle Radar Topography Mission |
| STP | sewage treatment plant |
| SWL | sound power level |
| TAPM | the air pollution model |
| Tb | Tertiary Basalt Flows and Plugs |
| TDS | total dissolved solids |
| TDM | Thiess Dampier Mitsui Coal Pty Ltd |
| TEC | threatened ecological community |
| TEOM | Tapered Element Oscillating Microbalance |
| TEP | transitional environmental program |
| TIA | traffic impact assessment |
| TLO | train load-out |
| TMR | Department of Transport and Main Roads |
| TOR | Terms of Reference |
| TQa | Tertiary-Quaternary Older Alluvial Deposits |
| TQr | Tertiary-Quaternary Residual Soils and Colluvium |
| Ts | Tertiary Suttor Formation |
| TSF | tailings storage facility |
| TSM | thick seam mining |
| TSP | total suspended particulates |
| TSS | total suspended soilds |
| TUFLOW | two dimensional flood modelling software |
| U | uranium |
| UC | uncertain |
| UDA | urban development area |
| UDC | Utah Development Company |
| UIS | underground in-seam |
| ULDA | Urban Land Development Authority |
| ULP | unleaded petroleum |
| URS | URS Australia Pty Ltd |
| UTM | Universal Transverse Mercator |
| V | vanadium |
| VAM | ventilation air methane |
| VM | volatile matter |
| VM Act | *Vegetation Management Act 1999* |
| VWP | vibrating wire piezometer |
| Water Act | *Water Act 2000* |
| WCED | World Commission on Environment and Development |
| WEEE | waste electrical and electronic equipment |
| WGS | World Geodetic System |

| Abbreviation | Definition |
|---|---|
| WHAM | Whitsunday Hinterland and Mackay |
| WHO | World Health Organisation |
| WPA | wetland protection area |
| WMA | wetland management areas |
| WRP | water resource plan |
| WTP | water treatment plant |
| WRR Act | *Waste Reduction and Recycling Act 2011* |
| Zn | zinc |

# Units

| Unit | Definition |
|---|---|
| ~ | approximately |
| < | greater than |
| > | less than |
| ≤ | greater than or equal to |
| ≥ | less than or equal to |
| % | per cent |
| °C | degrees Celsius |
| °E | degrees east |
| °S | degrees south |
| BCM | bank cubic metres |
| cm | centimetre |
| dB | decibels |
| dBA | decibels A weighted |
| dBL | decibels (unweighted or linear) |
| dS/m | deciSiemens per metre |
| dwt | dead weight tonnes |
| GL | gigalitre |
| GJ | gigajoules |
| GWh | gigawatt hour(s) |
| ha | hectares |
| Hz | hertz |
| kg | kilogram |
| kg $H_2SO_4$/t | kilograms of sulfuric acid per tonne |
| kg/a | kilograms per annum |
| kg/ha | kilograms per hectare |
| kL | kilolitres |
| km | kilometre |
| $km^2$ | square kilometre |
| km/cm | kilometres per centimetre |
| km/hr | kilometres per hour |
| kt | kilotonnes |
| kV | kilovolt(s) |
| kVA | kilovolt-ampere |
| kWh | kilowatt hours |
| L | litres |
| L/a | litres per annum |
| L/min | litres per minute |
| L/s | litres per second |

| Unit | Definition |
|---|---|
| L/t | litres per tonne |
| $L_{A90}$ | noise level (in decibels – A weighted) exceeded for 90 per cent of the measurement period |
| $L_{Aeq}$ | equivalent continuous (or 'average') noise level (in decibels – A weighted) |
| $L_{Amax}$ | maximum noise level |
| m | metres |
| m/day | metres per day |
| m/s | metres per second |
| $m^2$ | square metres |
| $m^3$ | cubic metres |
| $m^3$/ROM tonne | cubic metres per ROM tonne |
| $m^3$/s | cubic metres per second |
| mbcm | million bulk cubic metres |
| mbgl | metres below ground level |
| µg | micrograms |
| mg/kg | milligrams per kilogram |
| mg/L | milligrams per litre |
| µg/L | micrograms per litre |
| µg/$m^3$ | micrograms per cubic metre |
| mg/$m^2$/day | milligrams per square metre per day |
| ML | megalitres |
| ML/a | megalitres per annum |
| ML/year | megalitres per year |
| mm | millimetres |
| mm/day | millimetres per day |
| mm/s | millimetres per second |
| mm/yr | millimetres per year |
| µS/cm | microSiemens per centimetre |
| mt | million tonnes |
| mtpa | million tonnes per annum |
| MW | megawatt |
| MWh | megawatt hour |
| PJ | petajoules = 1 x$10^{15}$ joules |
| ppb | parts per billion |
| ppm | parts per million |
| t | tonne |
| t/a | tonnes per annum |
| t/ha/year | tonnes per hectare per year |
| t/$m^3$ | tonnes per cubic metre |
| tph | tonne per hour |
| W/$m^2$ | watts per square metre |