

9. APPENDIX 9: IMPACT ASSESSMENT CALCULATIONS

BUNDU RIETVALEI IMPACT ASSESSMENT											
NEG/POS	Potential impacts	Spatial scale	Duration	Severity	Probability	Degree of certainty	Significance before mitigation	Proposed mitigation measures	Predicted Mitigation Efficiency	Deduction for mitigation	Significance after mitigation
TERRESTRIAL BIODIVERSITY, HABITAT & ECOLOGY											
Neg	Loss of habitat: vegetation clearing for pit expansion	2	5	3	5	1	6,4	Fence off sensitive areas to prevent unauthorized access	1	3,0	3,4
								Manage topsoil stockpiles for optimal revegetation for rehabilitation; implement Stormwater Management Plan	1		
								Compile and implement Ecological Management Plan, Alien Invasive Plant management plan and monitoring.	1		
Neg	Displacement of avifauna due to habitat loss & transformation	2	4	4	4	1	6	Limit the mining activity footprint to the approved area	2	4,0	2,0
								Implement best practice standards	1		
								Baseline and operational monitoring and specialist recommended actions if impact is noted.	1		
Neg	Displacement of avifauna due to disturbance	2	4	4	4	1	6	Limit the mining activity footprint to the approved area	1	3,0	3,0
								Implement best practice standards	1		
								Baseline and operational monitoring and specialist recommended actions if impact is noted.	1		
Neg	Displacement of fauna: Species of Conservation Concern - Clonia uvarovi	2	3	4	3	3	6,0	Possible habitat in trees in lower slopes, which are protected by exclusion of mining activities along the drainage line and buffer where trees occur.	2	3,0	3,0
								Prevent any erosion along drainage lines to protect habitat	1		
Neg	Displacement of fauna: Species of Conservation Concern - Knixys lobatsiana	2	3	4	3	3	6,0	Mining activities are not to take place in the rocky areas of mid slope and crest, which must be left open for connectivity	2	3,0	3,0
								An active search to be conducted prior to commencement and relocation of fauna by specialist	1		
Neg	Proliferation of alien vegetation	2	3	4	3	3	6,0	Alien and Invasive Plant removal plan	1	2,0	5,0
								Implement Ecological Management Plan	1		
Neg	Impact on Ecological Support Area corridor function & habitat availability for breeding and foraging in Class 1 Ridge	4	5	1	5	1	6,4	No mining activities may encroach on the ridge outside the approved footprint, which is limited to the foot slope of the ridge; compile and implement Ecological Management Plan	2	3,0	3,4
								Fence off sensitive areas to prevent unauthorized access; Monitor excavations daily and remove any trapped animals, release outside the activity zone	1		
Neg	Impact on Ecological Processes	2	5	1	5	1	5,6	Implement Ecological Management Plan and SWMP	1	3,0	2,6
Neg	Loss of habitat quality: sedimentation	3	3	4	4	3	6,8	Alien and Invasive Plant removal plan	2		
								Erosion control: SWMP	1		
								Maintain freeboard in sediment ponds and RWD	1		
Neg	Cumulative Ecological impact	1	5	1	5	1	5,2	Stormwater control: SWMP	2	4,0	1,2
								Limit activities to approved footprint on lower ridge slope and implement Ecological Management Plan	2		
								Implement stormwater runoff control measures	1		
								Alien and Invasive Plant management and monitoring plan	1		

TERRESTRIAL BIODIVERSITY, HABITAT & ECOLOGY IMPACT SCORE								5,5			3,1
AQUATIC ECOSYSTEMS & SURFACE WATER RESOURCES											
Neg	Geomorphology: Erosion & Sedimentation	1	3	1	2	1	3,2	Implement conceptual SWMP to dissipate runoff energy	1	2	1,2
								Visually monitor monthly and adapt	1		
Neg	Water Quality: pollution from hazardous waste & mine water & stormwater	1	3	1	2	1	3,2	Hazardous waste management: drip trays, spill kit, contaminated soil removal to registered hazardous waste disposal site, vehicle visual inspections	1	3	0,2
								Implement buffer zone around wetland & establish vegetation cover around stormwater outlets	1		
								Watercourse monitoring every three years	1		
								Implement conceptual SWMP to separate dirty and clean stormwater & access road	1		
Neg	Hydrology: surface flow & habitat impacts from mining	2	3	3	4	1	5,2	Implement buffer zone around wetland & revegetation of disturbed non-active cleared areas in 6 months	1	3	2,2
								Dissipate runoff to prevent erosion and sedimentation	1		
								Implement conceptual SWMP to separate dirty and clean stormwater, and dissipate runoff to prevent erosion and sedimentation.	1		
								Implement buffer zone around wetland	1		
Neg	Hydrology: surface flow & habitat impacts from processing and stockpiling	2	3	3	5	1	5,6	Contain water from processing and stockpiling and reuse in the process	1	3	2,6
								Implement conceptual SWMP to separate dirty and clean stormwater	1		
Neg	Hydrology: stormwater containment	1	3	2	2	1	3,6	Implement erosion control for discharge of clean stormwater.	1	2	1,6
AQUATIC ECOSYSTEM IMPACT SCORE								4,2			1,6
GROUNDWATER RESOURCES											
Neg	Disturbing vadoze zone during excavation	1	3	3	3	1	4,4	Water balance annual updating	1	3,0	1,4
								Keep excavation within approved footprint	1		
								Flow meters, record keeping & auditing	1		
Neg	Water Quality: pollution from hazardous waste & mine water	1	3	3	3	1	4,4	Hazardous waste management: drip trays, spill kit, contaminated soil removal to registered hazardous waste disposal site, vehicle visual inspections	1	2,0	2,4
								Implementing waste classification requirements including permeability testing of sediment in ponds and if not suitable a clay liner must be implemented	1		
Neg	Overabstraction from borehole	2	3	2	3	1	4,4	Abstraction to be metered and recorded and recommended volume may not be exceeded ()	1	3,0	1,4
								Records to be sent to DWS bi-annually or as per WUL conditions; annual external audits	1		
								Calibration of flow meters every two years	1		
Neg	Dewatering impact on baseflow to nearby Swartspruit	2	3	2	3	1	4,4	Groundwater intercepted in the quarry must be analysed and compared to the discharge limits for discharge into the wetland adjacent to the Swartspruit	1	2,0	2,4
								Recycle water in the processing plant as much as possible and reduce losses	1		
WATER RESOURCES IMPACT SCORE								4,4			1,9
HERITAGE RESOURCES											
Neg	Impacts on graves on site	2	2	2	1	1	3,2	Graveyard to be fenced and 20m buffer to be excluded from mining area	1	2	1,2
								Chance finds protocol: contact heritage specialist	1		
HERITAGE RESOURCES IMPACT SCORE								3,2			1,2
SOCIAL ASPECTS											
Neg	Impacts on African Grey Parrots	3	3	4	4	3	6,8	Maintain noise level below 120dB for broilers (and vibrations below 10mm/s for layers)	1	3,0	3,8
								Implement lowest impact blasting methodology	1		
								Continuous monitoring during operation of noise, ground vibration and air quality as specified in these studies	1		
Neg	Impacts on Poultry	3	3	3	4	3	6,4	Maintain noise level below 120dB for broilers (and vibrations below 10mm/s for layers)	1	3,0	3,4

								Implement lowest impact blasting methodology	1		
								Continuous monitoring during operation of noise, ground vibration and air quality as specified in these studies	1		
Neg	Impacts on agricultural activities	3	3	3	2	3	5,6	Implement dust suppression measures	1		
								Monitoring of air quality (dust) and adapting frequency	1	2,0	3,6
Pos	Impact on Social development (SLP)	3	5	4	5	5	8,8	SLP: School sportsfield	2		
								ABET training for workers	2		
Pos	Multiplier impacts on Local Economy	3	4	3	3	1	5,6	Discount on materials for individual housing for workers	2	6,0	2,8
Pos	Skills development and training	3	4	3	3	1	5,6	Register of local SMME's	1	1,0	4,6
Pos	Employment opportunities	3	4	3	4	1	6,0	ABET training for workers; mentorship for in-situ learning	2	2,0	3,6
								Training and skills development as per SLP	1	1,0	5,0
SOCIAL ASPECTS IMPACT SCORE							6,4				2,8
WASTE MANAGEMENT											
Neg	Waste classification: impacts on water resources	2	3	3	3	3	5,6	Testing of permeability of existing settling ponds and RWD sediment and lining structures if required	2	2,0	3,6
Neg	Soil/water/air pollution due to improper waste handling, storage and disposal	2	3	3	3	3	5,6	Store & handle all chemicals & hydrocarbons in designated workshop areas	1		
								Keep a spill kit and remove contaminated soil to registered hazardous landfill site	1	3,0	2,6
WASTE MANAGEMENT IMPACT SCORE							5,6				2,6
NOISE											
Neg	Nuisance and health risks caused by an increase in the ambient noise level as a result of noise impacts associated with the construction of the project.	3	1	3	3	1	5,6	'Low noise' equipment, or methods of work is to be selected; Avoid clustering of mobile plant near receptors and enforce rest periods for unavoidable maximum noise events;	1		
								Investigate use of alternatives to audible reversing alarms (such as broadband noise emitting models) or configure to maximise forward movements of mobile plant; Regular inspection and maintenance of all equipment is to be established; o Avoid unnecessary equipment idling;	1		
								Limit activities to day-time working hours (6am – 6pm); Establish community engagement and ensure all affected persons have been consulted with prior to the commencement of and during activities.	1	3,0	2,6
Neg	Nuisance and health risks caused by an increase in the ambient noise level as a result of noise impacts associated with the operation of the project.	3	2	3	3	1	6,0	Train operational staff on noise control plan during health & safety briefings; o Regular inspection and maintenance of all equipment. Noise berms.	1		
								Avoid clustering of noisy equipment near sensitive receptors. Restrict activities on project site to day-time hours only.	1		
								A noise complaints register must be kept. If complaints are received, noise sampling should be undertaken at the NSRs and source of noise should be investigated.	1	3,0	3,0
Neg	Nuisance and health risks caused by an increase in the ambient noise level as a result of noise impacts associated with the closure of the project.	3	1	3	3	1	5,6	Regular inspection and maintenance of all equipment. Avoid clustering of noisy equipment near sensitive receptors.	1		
								Restrict activities on project site to day-time hours only.	1		
								A noise complaints register must be kept. If complaints are received, noise sampling should be undertaken at the NSRs and source of noise should be investigated.	1	3,0	2,6
Neg	Crushing and hauling noise impact	3	3	3	3	3	6,0	Activities within working hours: 6:00 - 18:00 and implement mitigation to remain within Environmental Noise Standards for agricultural districts		3,0	3,0
NOISE IMPACT SCORE							5,8				2,8
VISUAL											
Neg	Visual impact on surrounding residents	3	4	4	5	5	8,4	Pit area limited to the foot slope of the ridge	3		
								Once an area has been mined out and will not be disturbed through further mining activities, implement rehabilitation activities.	2		
								Once an area has been mined out and will not be disturbed through further mining activities, implement rehabilitation activities.	1	6,0	2,4
VISUAL IMPACT SCORE							8,4				2,4
AIR QUALITY											

								Wet suppression where feasible on roads, stockpiles and materials handling activities	1		
								Minimise extent of disturbed areas. Reduction of frequency of disturbance. Early revegetation Stabilisation (chemical, rock cladding or vegetative) of disturbed soil.	1		
Neg	Potential nuisance impacts due to Total Suspended Particulate	2	3	1	4	1	4,4		1	3	1,4
Neg	Potential human health impacts due to PM10 and silicates	1	3	1	2	1	3,2	Wet suppression where feasible on roads, stockpiles and materials handling activities Minimise extent of disturbed areas. Reduction of frequency of disturbance. Early revegetation Stabilisation (chemical, rock cladding or vegetative) of disturbed soil	1,8	1,8	1,4
Neg	Potential human health impacts due to PM2,5	1	2	1	2	2	3,2	Wet suppression where feasible on roads, stockpiles and materials handling activities Minimise extent of disturbed areas. Reduction of frequency of disturbance. Early revegetation Stabilisation (chemical, rock cladding or vegetative) of disturbed soil. Minimise equipment idling time and service mobile and stationary equipment regularly.	1,6	1,6	1,6
AIR QUALITY IMPACT SCORE							3,6				1,5
TRAFFIC											
								Dust control measures on haul roads to maintain visibility	1		
Neg	Increased traffic in the project area	3	3	2	3	1	4,8	Minimise speed along the access road and R514	1	2,0	2,8
								Speed limit on haul road, avoid driving at night	1		
Neg	Presence of unmonitored animals along the road	3	3	2	2	1	4,4	Regular inspection and maintenance; emergency response contact numbers visible in office	1	2,0	2,4
								Regular inspection and maintenance; emergency response contact numbers visible in office	1		
Neg	Vehicle failure	3	3	2	2	1	4,4	Speed limit on haul road, avoid driving at night	1	2,0	2,4
								Minimise speed along the access road and R514	1		
Neg	Risks to the safety of pedestrians and road users	3	3	2	3	1	4,8	Dust control measures on haul roads to maintain visibility	1	2,0	2,8
TRAFFIC IMPACT SCORE							4,6				2,6
CUMULATIVE IMPACTS											
								Wet suppression where feasible on roads, stockpiles and materials handling activities Minimise extent of disturbed areas. Reduction of frequency of disturbance. Early revegetation Stabilisation (chemical, rock cladding or vegetative) of disturbed soil. Minimise equipment idling time and service mobile and stationary equipment regularly.			
Neg	Impacts from dust and exhaust fumes	3	3	4	4	3	6,8		4	4,0	2,8
								Limit activities to day-time working hours (6am – 6pm); Establish community engagement and ensure all affected persons have been consulted with prior to the commencement of and during activities; Train operational staff on noise control plan during health & safety briefings; o Regular inspection and maintenance of all equipment. Noise berm; Avoid clustering of noisy equipment near sensitive receptors. Restrict activities on project site to day-time hours only; A noise complaints register must be kept. If complaints are received, noise sampling should be undertaken at the NSRs and source of noise should be investigated; Regular inspection and maintenance of all equipment. Avoid clustering of noisy equipment near sensitive receptors.	4	4,0	2,4
Neg	Impact from noise & vibration from blasting; crushing and hauling noise	3	3	4	3	3	6,4				
								Abstraction to be metered and recorded and recommended volume may not be exceeded; Records to be sent to DWS bi-annually or as per WUL conditions; annual external audits; Calibration of flow meters every two years; Groundwater intercepted in the quarry must be analysed and compared to the discharge limits for discharge into the wetland adjacent to the Swartspuit; Recycle water in the processing plant as much as possible and reduce losses	4	4,0	2,4
Neg	Impacts on groundwater abstraction	3	3	3	4	3	6,4				
								Hazardous waste management: drip trays, spill kit, contaminated soil removal to registered hazardous waste disposal site, vehicle visual inspections; Implementing waste classification requirements including permeability testing of sediment in ponds and if not suitable a clay liner must be implemented	4	4,0	2,4
Neg	Impacts on groundwater quality	3	4	3	3	3	6,4				
								Hazardous waste management: drip trays, spill kit, contaminated soil removal to registered hazardous waste disposal site, vehicle visual inspections; Implement buffer zone around wetland & establish vegetation cover around stormwater outlets; Watercourse monitoring every three years; Implement conceptual SWMP to separate dirty and clean stormwater & access road	4	4,0	2,4
Neg	Impacts on wetland characteristics (quality and flow)	3	4	3	3	3	6,4				

								Fence off sensitive areas to prevent unauthorized access; Manage topsoil stockpiles for optimal revegetation for rehabilitation; Minimise activities to authorized footprint; Limit activities to approved footprint on lower ridge slope; Implement stormwater runoff control measures; Alien and Invasive Plant management and monitoring plan; Limit the mining activity footprint to the approved area; Implement best practice standards; Baseline and operational monitoring and specialist recommended actions if impact is noted; Limit the mining activity footprint to the approved area; Implement best practice standards; Possible habitat in trees in lower slopes, which are protected by exclusion of mining activities along the drainage line and buffer where trees occur; Prevent any erosion along drainage lines to protect habitat; Mining activities are not to take place in the rocky areas of mid slope and crest, which must be left open for connectivity; An active search to be conducted prior to commencement and relocation of fauna by specialist; Alien and Invasive Plant removal plan; Implement Ecological Management Plan; No mining activities may encroach on the ridge outside the approved footprint, which is limited to the foot slope of the ridge; Monitor excavations daily and remove any trapped animals, release outside the activity zone; Fence off sensitive areas to prevent fauna from falling into excavations; Erosion control: SWMP; Maintain freeboard in sediment ponds and RWD; Stormwater control: SWMP; Hazardous waste management.			
Neg	Impact on Ecosystem Conservation Goals (Gold Reef Mountain Bushveld)	3	5	4	5	1	7,2		5	5,0	2,4
Neg	Sedimentation and alien vegetation proliferation in the catchment	4	4	3	3	3	6,8	Implement buffer zone around wetland; Contain water from processing and stockpiling and reuse in the process; Implement conceptual SWMP to separate dirty and clean stormwater; Implement erosion control for discharge of clean stormwater; erosion control measures as required.	4	5,0	1,8
CUMULATIVE IMPACTS SCORE							6,6				2,4