

RISK MATRIX (Based on DWS 2015 publication: Section 21 c and I water use Risk Assessment Protocol)
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Risk to be scored for construction and operational phases of the project. MUST BE COMPLETED BY SACNASP PROFESSIONAL MEMBER REGISTERED IN AN APPROPRIATE FIELD OF EXPERTISE.

No.	Phases	Activity	Aspect	Impact	Severity					Severity	Spatial scale	Duration	Consequence		Frequency of activity	Frequency of impact	Legal Issues	Detection		Likelihood	Significance	Risk Rating	Confidence level	Control Measures	PES AND EIS OF WATERCOURSE
					Flow Regime		Physico & Chemical (Water Quality)		Habitat (Geomorph+Vegetation)																
	Preconstruction	Site Clearance for construction	Vegetation Removal	Increase in erosion from cleared areas	5		5		5		5		11		3	3	5	3		14	154	M	H	Construct in the dry season and install silt bunds: Erosion control measures will be implemented as soon as erosion has become evident. Water velocity will be reduced as far as feasible.	C
			Vegetation Removal	Increase in turbidity, suspended solids and sedimentation of nearby water resources	5		5		5		5		11		3	3	5	3		14	154	M	H	Limit disturbed footprint and install retardation structures	C
			Movement of vehicles and machinery	Accidental hazardous substances spillage during site establishment	5		5		5		5		11		3	3	5	3		14	154	M	H	Operate using best practises by storing hazardous substances in an adequately sized bunded area, with appropriate safety equipment. Place spill kits on site which are operated by trained staff members for the adhoc remediation of minor chemical and hydrocarbon spillages.	C
			Vegetation Removal and movement of vehicles in wetlands	Placement of infrastructure in sensitive wetland habitat areas resulting in the loss of ecological structure.	5		5		5		5		11		4	4	5	3		16	176	M	H	Access roads for support vehicles, and vehicles used in the construction of the crossings, should not encroach into the freshwater features.	C
			Planning of infrastructure	Potential poor planning, resulting in the placement of the linear development within wetland habitat, leading to altered habitat.	5		5		5		5		12		3	3	5	3		14	168	M	H	Wetland areas other than the immediate areas of crossing are to be demarcated as no-go areas for vehicles and construction personnel. Vegetation removal should be kept at a minimum to avoid loss of freshwater features' assimilation and attenuation abilities.	C
			Movement of vehicles and machinery in wetlands	Increased anthropogenic activity within the wetland feature leading to an increased impact on the biological structure of the wetland features and the associated effects that this will have on service provision.	5		5		5		5		12		3	3	5	3		14	168	M	H	Rehabilitation should be conducted in a manner that ensures that the wetland features' conditions are reinstated to as natural a state as possible	C
			Vegetation Removal	Bush clearing and erosion may cause localised impacts on water quality which may affect the aquatic habitats and ecology within the area	5		5		5		5		10		4	4	5	3		16	160	M	H	All construction must be done in such a manner so as to ensure species migration will take place by ensuring a suitable structure height to allow species to move under or over the pipelines and roads.	C
			Planning of infrastructure	Failure to initiate a rehabilitation plan and alien control plan during the pre-construction phase may lead to further impacts during the construction and operation phase	5		5		5		5		11		3	4	5	3		15	165	M	H	Any storage facilities and all other non-essential activities should be located away from the identified wetlands in order to avoid water and soil contamination.	C
		Construction and ground preparation for the planned Pit 1 extension and water pipeline	Construction and ground preparation for the planned water pipeline	Impact on surface water flow as a result of impeding flow while under construction of the pipeline over the non-perennial streams	5		5		5		5		10		3	3	5	3		14	140	M	H	Construction must take place within the dry season as far as possible: Gabions and mattresses will be used to protect the river banks: All litter and debris will be continuously removed during construction.	C
		Construction and maintenance of stormwater contrl measures	Vehicle Movement	Impact on surface water quality as a result of accidental spillages of hazardous substances from construction vehicles used during construction of the crossings, as well as from hazardous storage areas	5		5		5		5		11		2	3	5	3		13	143	M	H	Access to the construction site will be controlled: Refuelling areas will be bunded and nozzles protected from spillage during refuelling: Vehicular access to the stream will be restricted: All spillages will need to be cleaned up as soon as practically possible: Proper management of stormwater drainage infrastructure should be ensured: Hazardous substances stored on site will be stored within a designated bunded areas fitted with a sump and valve. Collection of water within the bunded areas will be deemed hazardous and disposed of as such: Bunded areas will be water tight and inspected for leaks on a frequent basis: Leaks to the bunded areas will be rectified as soon as possible: Drip trays will be utilised for the collection of leaks from vehicles and machinery parked for long period of time: Should a spill occur, this will be handled at the source of the leak and prevented from transpiring to nearby watercourse: Ensure that routine maintenance on all vehicles is undertaken as per maintenance schedule and records are kept; and Sewage spillages will be seen as hazardous waste and will be handled as such	C

		Construction and ground preparation for the planned Pit 1 extension and water pipeline	Debris from poor handling of materials and/or waste blocking watercourses, resulting in	Water Course flow impediment and pollution.	5		5		5		5		5	1	1	7		1	1	5	1		8	56	L	H	Operate using best practises in separating waste streams and disposing of the waste correctly.	C
		Construction and ground preparation for the planned Pit 1 extension and water pipeline	Dirty water runoff	Contaminated dirty water runoff to surrounding areas resulting in the impact on local surface water quality	5		5		5		5		5	4	3	12		4	3	5	4		16	192	H	H	Construct diversion drains around the site timeously prior to operation and Ensure adherence to GNR 704 of the NWA.	C
		Construction and ground preparation for the planned Pit 1 extension and water pipeline and movment of construction vehicles	Dirty water runoff	Increase in turbidity of the local water streams as a result of runoff of cleared areas	5		5		5		5		5	3	2	10		4	2	5	2		13	130	M	H	Where necessary, and as defined when the final detailed project design is confirmed, construct sediment collection paddocks downstream of the working activities to minimise uncontrolled runoff from the site; Minimise the areas that are to be stripped of vegetation; Adequate storm water management should be considered in the detailed design of the proposed infrastructure in order to minimize undue erosion; Erosion can also be limited by ensuring that mine vehicles and human movement is limited to project specific dedicated access ways; Stormwater culverts and clean water diversions will be designed and constructed to accommodate the 1:50 year storm event around the mining areas; Stormwater runoff will be directed towards natural watercourses; Construction will be undertaken during the dry season, where possible, to minimise the potential for stormwater runoff; Routine surface water quality monitoring up and down stream of construction activities and position of infrastructure and activities associated with the Project will be undertaken on a monthly basis.	C
		Site clearance	Surface water runoff	Increase of surface runoff and potentially contaminated water that needs to be maintained in the areas where site clearing occurred.	5		5		5		5		5	2	3	10		3	3	5	3		14	140	M	H	Adequate protection measures at river crossings will be included in the pipeline designs.	C
		Construction of river diversion	Diversion of water flow	Construction of possible river diversion may temporarily disturb the water course affecting the hydrology of the water courses	5		5		5		5		5	2	2	9		3	4	1	1		9	81	M	H	The point where the diversion re-enters the natural system must enter the system at the same elevation as the receiving aquatic environment as well as consist of an energy dissipation structures thereby preventing erosion and incision of the natural watercourse; and The point where the diversion re-enters the natural watercourse must enter the system where possible at an acute angle to prevent the creation of turbulent flow, erosion and incision.	C

		Site clearance	Vehicle and personnel Movement in wetland areas	Impact on the hydrological functioning and sediment balance of the wetland systems	5	5	5	5	5	3	2	10	2	2	5	2	11	110	M	H	Avoid encroachment of activities into the watercourse where feasible; Rehabilitation should be conducted in a manner that ensures that the wetland features' conditions are reinstated to as natural a state as possible; As much vegetation growth as possible should be promoted within the wetland features in order to protect soils. In this regard, special mention is made of the need to prevent the loss of large areas of the freshwater features' vegetation and the use of indigenous vegetation species' where hydro seeding and rehabilitation planting (where applicable) are to be implemented; Any construction-related waste must not be placed in the vicinity of the wetland features; Stockpiled soil must be removed and the area must be levelled to avoid sedimentation of the wetland features from runoff.	C
		Site clearance	Vehicle and personnel Movement in wetland areas	Alternative 2	5	5	5	5	5	3	3	11	3	3	5	2	13	143	M	H		C
		Site clearance	Vehicle and personnel Movement in wetland areas	Alternative 3	5	5	5	5	5	3	3	11	3	3	5	2	13	143	M	H		C
		Site clearance	Topsoil revoval and vehicle movement within wetland areas	Increased runoff due to topsoil removal and vegetation clearance leading to possible erosion and sedimentation of wetland and riparian resources	5	5	5	5	5	3	2	10	3	2	5	2	12	120	M	H	Restrict construction to the drier winter months if possible, to avoid increased water inputs and sedimentation within the wetland; Adequate storm water management must be incorporated into the design of the proposed development throughout all phases in order to prevent erosion of topsoil and the loss of floral and faunal habitat. In this regard, special mention is made of: Sheet runoff from cleared areas, paved surfaces and access roads needs to be curtailed; Runoff from paved surfaces should be slowed down by the strategic placement of berms; and All topsoil and waste stockpiles must have berms and catchment paddocks at their toe to contain runoff of the facilities.	C
		Site clearance	Vehicle movement within wetland areas	Soil compaction and levelling as a result of construction activities and vehicle movement leading to loss of wetland and riparian habitat	5	5	5	5	5	3	3	11	4	3	5	2	14	154	M	H	No construction of infrastructure may take place within riparian and wetland areas and associated buffer zones unless authorisation is granted by the DWS; As far as possible all mining activity and infrastructure should be excluded from the wetland and riparian areas and associated 100 m buffer zone; If this is not possible, pipelines should be designed to cross drainage lines at right angles and be placed outside of the active channels; All areas of increased ecological sensitivity should be designated as No-Go areas and be off limits to all unauthorised construction vehicles and personnel; All development footprint areas and areas affected by the proposed mining development should remain as small as possible and any disturbance of sensitive habitat must be actively avoided; Construction vehicles must remain on demarcated roads and should not encroach into the wetland areas or their associated buffer zones; It must be ensured that contractor laydown areas are located outside of wetland and riparian areas and associated 100 m buffer zones and excluded from clearing activities in order to minimise vegetation loss and resultant erosion and sedimentation.	C
		Maintenance of existing and new infrastructure	Pipeline breakage and spillage of contaminated water into the water courses	Impact on water quality and erosion as a result of the pipeline breaking and spillage to non-perennial streams.	5	5	5	5	5	1	1	7	2	1	5	1	9	63	M	±	Operation of the pipeline should be conducted using best practises; Frequent monitoring of the pipeline should be done to ensure leakages are identified and repaired timeously.	C
		Maintenance of existing and new infrastructure	Pump failure in the mine pit	Pump failure will result in dirty water accumulation in the pit, leading to uncontrolled dirty water management and associated pollution.	3	3	3	3	3	1	1	5	2	2	5	2	11	55	L	±	Undertake regular structural inspections of pumps and pipes of exiting pit; Ensure groundwater investigation is done to understand groundwater levels; and Stormwater culverts and clean water diversions will be designed and constructed to accommodate the 1:50 year storm event.	C
		Pumping of water from Dorstfontein East to Dorstfontein West	Poor stormwater management	Impact on water quality and availability as a result in ineffective dirty water separation, and dirty water entering into the wetland.	3	3	3	3	3	1	1	5	2	2	5	2	11	55	L	±	Monitor the effective usage and functioning of the upstream bunds constructed upstream of the affected site; Monitor and maintain good vegetation cover, to reduce runoff;	C
		Operation of the mine	Groundwater ingress into water resources	High rate of ground water ingress causing flooding of the pit	3	3	3	3	3	2	2	7	4	4	5	2	15	105	M	±	Develop and implement controls to clean up oil/diesel leaks and spillages of any designated hazardous waste.	C
		Operation of the mine	Poor stormwater management	The rainfall water within the designated dirty water area of the pit 1 extension area that forms part of the MAR to the local water courses will be removed from the catchment. This will result in a lower intensity potential on the local surface water resource	3	3	3	3	3	3	2	8	4	2	5	2	13	104	M	±	The clean stormwater will be diverted which further mitigates the impact.	C
		Operation of the mine	Poor stormwater management	Increase in volume of contaminated water that needs to be managed within the footprint	3	3	3	3	3	2	3	8	3	3	5	2	13	104	M	±	Monitor the effective usage and functioning of the upstream bunds constructed upstream of the affected site; Monitor and maintain good vegetation cover, to reduce runoff; Develop and implement controls to pick up oil/diesel leaks and spillages of any designated hazardous waste.	C

River crossings	Soil Erosion leading to siltation of water courses	Erosion of stream banks as a result of crossings and diversions leading to siltation of the streams	5		5		5		5	2	2	9		3	4	5	1		13	117	M	±	River crossings and diversions will be inspected monthly; Erosion control measures will be implemented should it be evident that erosion has occurred; Establish vegetation around disturbed areas to prevent any erosion; Stormwater runoff will be handled on surface and directed towards natural watercourses.	C
Waste Management	Incorrect waste management practises that may lead to pollution of water resources	Impacts on surface water resources quality as a result of incorrect waste management practises and pollution.	5		5		5		5	3	3	11		2	2	5	3		12	132	M	±	A waste management plan will be compiled and approved for implementation of site. This management plan should focus on the waste hierarchy of the NEM:WA; No waste may be disposed of to land without the necessary legal permits; Waste will be removed from site by an accredited waste removal company and legally disposed of. Disposal certificates will be kept on site for audit purposes; Sufficient waste receptacles will be placed around the site allowing the separation of waste as source.	C
Operation of the mine and maintenance of infrastructure	Vehicle and personnel movement within wetland areas	Loss of habitat and wetland ecological structure as a result of continual wetland disturbance and uncontrolled wetland degradation.	5		5		5		5	3	3	11		3	3	5	2		13	143	M	±	Operational vehicles should be restricted to travelling only on designated roadways to limit the ecological footprint of the proposed development activities; It must be ensured that contractor laydown areas are located outside of wetland and riparian areas and associated 100 m buffer zones and excluded from clearing activities in order to minimise vegetation loss and resultant erosion and sedimentation where not approved by DWS; Compacted areas are to be ripped, re-profiled and revegetation as soon as areas becomes available; Any areas where active erosion within the wetland features are observed must be immediately rehabilitated in such a way as to ensure that the hydrology of the area is re-instated to conditions which are as natural as possible; Cutting/ clearing of the herbaceous layer within the wetland areas along the linear development should be avoided so as to retain soil stability provided by the grass root structures.	C
Operation of the mine and maintenance of infrastructure	Vehicle and personnel movement within wetland areas	Alternative 2	5		5		5		5	3	3	11		3	3	5	2		13	143	M	±	As much vegetation growth as possible should be promoted within the wetland features in order to protect soils. In this regard, special mention is made of the need to prevent the loss of large areas of the freshwater features' vegetation and the use of indigenous vegetation species' where hydro seeding and rehabilitation planting (where applicable) are to be implemented; No dumping of waste should take place within wetland and riparian areas or their buffer zones. If any spills occur, they should be immediately cleaned up; It must be ensured that mining related waste or spillage and effluent do not affect the sensitive habitat boundaries, wetland resources and associated buffer zones. All waste and rubble must be removed from site and disposed of according to relevant SABS standards; Implement an alien vegetation control program within the wetland features and ensure establishment of indigenous species within areas previously dominated by alien vegetation; Maintain the REC for each of the wetland features, as stated within the wetland report during the life of the development.	C
Operation of the mine and maintenance of infrastructure	Vehicle and personnel movement within wetland areas	Alternative 3	5		5		5		5	3	3	11		3	3	5	2		13	143	M	±	Rehabilitation should be conducted in a manner that ensures that the wetland features' conditions are reinstated to as natural a state as possible.	C
Operation of the mine and maintenance of infrastructure	Vehicle and personnel movement within wetland areas	Potential poor planning, resulting in the placement of the linear development within wetland habitat, leading to altered habitat	5		5		5		5	3	2	10		2	2	5	2		11	110	M	±	Flow continuity and connectivity of the freshwater features must be reinstated post- construction activities; Regular monitoring of water quality must be implemented in order to ensure the impacts of runoff and decant of water into wetland resources is prevented or minimised; Adequate storm water management must be incorporated into the design of the proposed development throughout all phases in order to prevent erosion of topsoil and the loss of floral and faunal habitat. In this regard, special mention is made of: Sheet runoff from cleared areas, paved surfaces and access roads needs to be curtailed; Runoff from paved surfaces should be slowed down by the strategic placement of berms; All topsoil and waste stockpiles must have berms and catchment paddocks at their toe to contain runoff of the facilities.	C
Operation of the mine and maintenance of infrastructure	Vehicle and personnel movement within wetland areas	Impact on the hydrological functioning of the wetland systems as a result of reduce wetland footprints and uncontrolled disturbance during maintenance activities	5		5		5		5	3	3	11		3	2	5	2		12	132	M	±	Dirty water must be recycled back into the mining system; All wetland areas adjacent to the operational footprint will demarcated as no-go areas.	C
Operation of the mine and maintenance of infrastructure	Vehicle and personnel movement within wetland areas	Impacts on the hydrological functioning of the wetland as a result of the pit 1 extension	5		5		5		5	3	3	11		4	3	5	2		14	154	M	±		C