An Independent Scientific Assessment of the **Hillside Copper Mine** Proposal (Mining Lease Proposal & Management Plan) by Rex Minerals Ltd with a Focus on Marine Impacts

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This work is dedicated to marine biologists Dr. Lara A. Ferry-Graham and Dr. Michael H. Graham, who provided their expert knowledge to the production of the British children's television series *Octonauts* and the movie *Finding Nemo*.

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1. Overview

The upper reaches of Gulf St. Vincent accommodate an ecologically valuable marine and wetland habitat in a region of extremely slow oceanic flushing (see Kämpf, 2014). A marine park has been recently established in upper Gulf St. Vincent for protection of this significant region.

Rex Minerals Ltd (henceforth referred to as "proponent") propose to build South Australia's second largest open-pit mine for the production of 335 Kt/annum of copper/gold concentrate and 1.2 Mt/annum of magnetite concentrate for a period exceeding 15 years. This large mine is proposed to be located in the upper Gulf St. Vincent, near Pine Point at a distance of ~8 km from Ardrossan. The proposed lease site stretches over a distance of 3 km along the coastline and the open pit mine will be located close – within kilometres – from the sea (**Figure 1**).

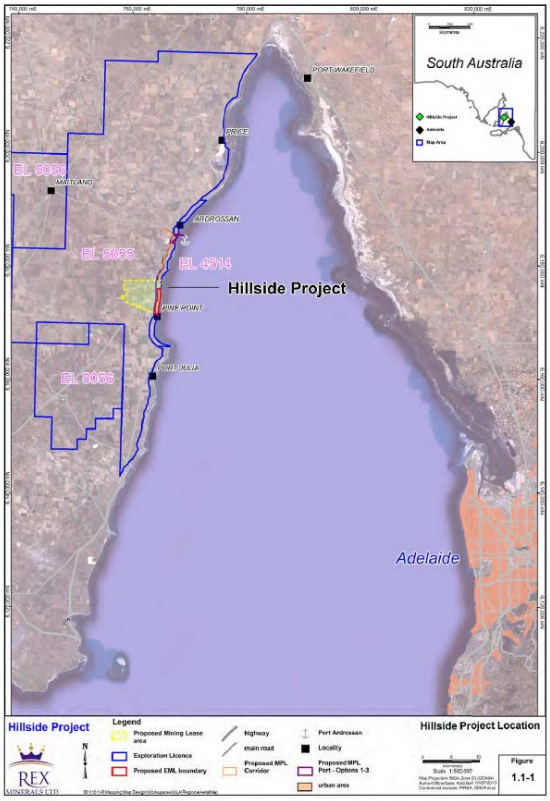

Figure 1: Proposed Hillside Project Location. The red-bounded area indicates the EML (Extractive Mineral Lease) boundary. Taken from the proponent's proposal.

2. Scientific Quality of Marine Impact Assessment

The proponent did not undertake any marine dispersal studies as part of their proposal. For a project of this enormous scale, the use of state-of-the-art hydrodynamic modelling tools should be a standard requirement for the assessment of the effects of the dispersal of dust and potential coastal surface discharges into the marine environment. A clockwise circulation pattern in the gulf, also briefly mentioned in Section 5.11.1 of the proposal, implies a possibly continuous influx of mining-related pollutants into the upper Gulf St. Vincent marine park. The existence of northward flow along the western coast of upper Gulf St. Vincent is confirmed in one of the few oceanographic studies that have been undertaken in the study region (**Figure 2**). The proponent has decided to ignore this flow pattern and its potential detrimental impacts on the marine ecology of the upper Gulf St. Vincent – although there are industry-standard scientific tools that could be and should have been used to address this important point.

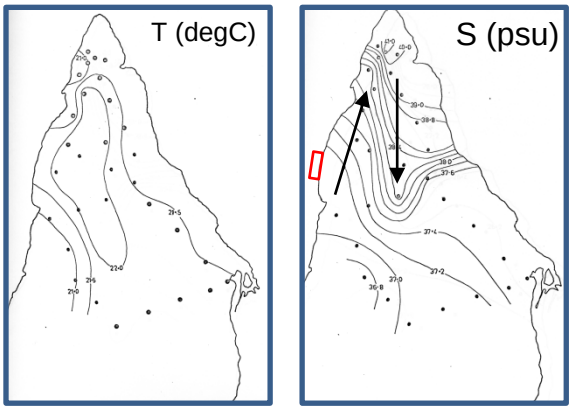

Figure 2: Horizontal surface temperature and salinity distributions for early March 1975. Station positions are shown as dots. Arrows indicate the flow direction. The red triangle indicates the EML (Extractive Mineral Lease) boundary of the. Data source: King (unpublished cruise report, 1976). Published in Kämpf (2005).

Although the proponent acknowledges the ecologic significance of the upper Gulf St. Vincent, the proponent decided to ignore a number of recent oceanographic studies documenting the circulation (Bye and Kämpf, 2005) and the slow flushing of this region (e.g. Kämpf et al., 2009; Kämpf, 2014) . For coastal pollution sources, it greatly matters whether the receiving water body is a rapidly flushed coastal ocean or a sheltered estuarine system. The proponent ignored this important point.

Flushing time and water age are scientific concepts used to determine the ability of a water body to disperse effluents. Water age is a measure of the relative age of gulf water with reference to the ambient ocean. For instance, a unidirectional flow of 10-20 cm/s through a channel the same length as Gulf St. Vincent (~150 km) would create a water age ranging from zero at the channel's entrance to a maximum of 8-17 days at the channel's exit. Although net water flows in Gulf St. Vincent are of the same magnitude (e.g. Bye and Kämpf, 2006), the water in upper Gulf St. Vincent is substantially older, exceeding 200 days (**Figure 3**). The reason for this slow flushing is essentially that that the gulf is a semi-enclosed body of water and not an open channel, such that the upper reaches of the gulf are relatively

isolated from the gulf's circulation. Due to this slow flushing, upper Gulf St. Vincent is much more vulnerable to industrial pollution than coastal oceans.

Indeed, similar to Upper Spencer Gulf, the rich and distinctive marine biodiversity and birdlife of the upper reaches of Gulf St. Vincent could only evolve because of the existence of a hypersaline environment of slow flushing. While the Upper Spencer Gulf is targeted to become the State's "heavy industry hub", which does not come without environmental degradation, this proposal is a threat to the ecology of the upper Gulf St. Vincent. Given the dramatic decrease in seagrasses in Adelaide Metropolitan waters, as documented in the Adelaide Coastal Waters Study (Fox et al., 2007), the proposed mining activities pose a severe threat to the health of the remainder healthy seagrass beds of the gulf.

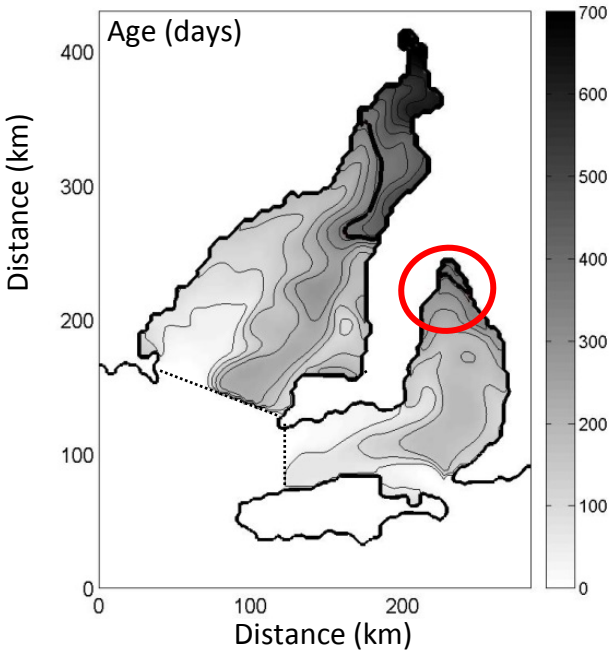

Figure 3: Simulated distribution of water age (days) of South Australian gulfs. Thick lines highlight values of one year. Dotted lines are the assumed boundaries between gulf and shelf water used in the calculations. The circle indicates the slowly flushed upper reaches of Gulf St. Vincent. From Kämpf et al. (2009).

The proponent has neither reviewed nor scientifically explored the physical oceanography of Gulf St. Vincent and its upper reaches. The proponent has decided not to simulate the pathway and dispersal of coastal surface runoff events and the sediment contained in it. The proponent has also decided not to scientifically study the pathway and dispersal of mining-related dust deposition in the marine environment. Consequently, the proponent's claims in the impact assessment that both factors (ML-A7, ML-SW1,2,3,4) are of minor consequences cannot be scientifically tested and are pure speculations being void of any credible scientific evidence. Hence, the assessment of marine-related consequences presented as part of the proposal does not meet the required scientific standards and should be rejected. Indeed, due to the close vicinity of mining activities, the marine environment must be declared one of the "nearest sensitive receptors". Figure 8.3-2 of the proposal (reproduced here as **Figure 4**) demonstrates the proponents ignorance of the marine environment.

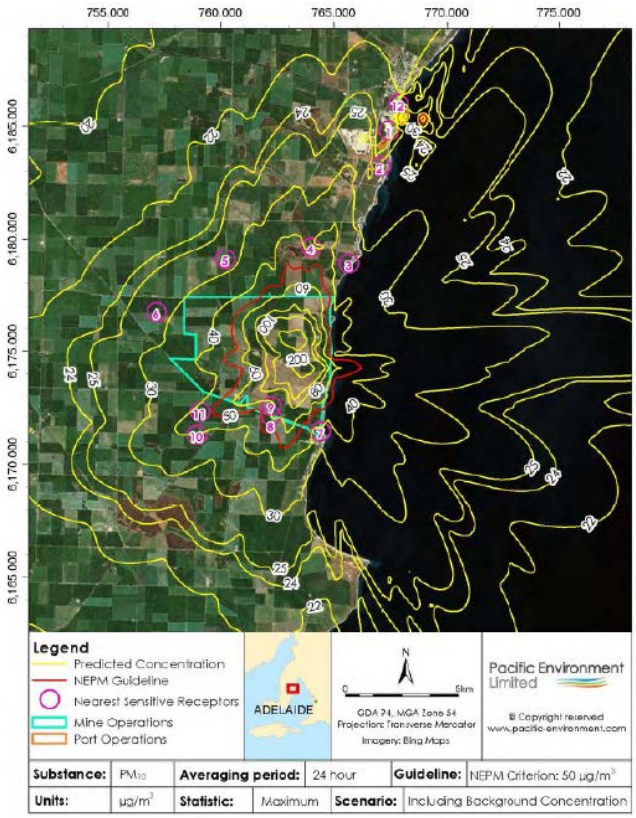

Figure 4: Predicted maximum 24-hour PM_{10} concentration – including background concentrations with dust emission controls in place. Figure 8.3-2 of the proponent's proposal.

3. Water Quality Policy

The *Environment Protection (Water Quality) Policy 2003* (Water Quality Policy) has been introduced by the Environment Protection Authority (EPA) to provide a consistent approach to the protection of water quality across all South Australian waters. It encompasses marine, estuarine and inland waters (including underground and surface water), and replaces the *Environment Protection (Marine) Policy 1994* and certain other environment protection policies. The Water Quality Policy covers: water quality objectives (environmental values plus water quality criteria), management and control of point and diffuse sources of pollution obligations relating to particular activities, and water quality criteria, discharge limits and listed pollutants.

For the proposed project, both the locally enhanced air-sea flux of dust and the occasional surface run-off of mining-related pollutants should be legally classified as point-source discharges that must comply with the Water Quality Policy. It should be pointed out that the proponent fails to scientifically demonstrate that such events will comply with regulations set out in the Water Quality Policy, in particular, that 1) adverse marine impacts of pollution events are limited to mixing zones with a radius of less than 100 m, and 2) that there are no risks to the adjacent marine park. Hence, the proponent should be asked to provide this scientific evidence.

4. Increase in Ship Traffic

The proponent proposes to use the Port Ardrossan facility for export purposes of their mining products. According to the proponent, this facility is currently used by Arrium to ship dolomite (approximately 18 ships per year) and Cheetham Salt to ship commercial grade salt (approximately two ships per year). With the propose upgrade of the port, ship traffic would increase from currently 20 ships per year to 76 ships per year. Port Ardrossan is situated within the Upper Gulf St. Vincent marine park and this substantial increase in ship traffic and associated pollution risk, including the potential import of marine pests, poses a severe additional hazard to the marine environment of the adjacent marine park – if not for the entire gulf system.

5. Summary and Recommendations

Copper production is not an environmentally benign activity. From mining and milling through processing to refining, copper production can have significant adverse impacts on air quality, surface and groundwater quality, the land, and, in this case, also the sea. The proponent substantially plays down adverse marine impacts in their environmental impact assessment. In particular, the proponent ignores scientific findings documenting the extremely slow flushing of the upper Gulf St. Vincent. When taking this factor into account, then continuous dust deposition and occasional flood-driven surface runoff of pollutants and sediments into the marine environment indeed poses an extremely high risk of severe environment damage, given the close vicinity of the mine operations to the sea.

If this project goes ahead, substantial negative inferences between mining operations with the marine ecology at a large scale are unavoidable. Hence, from the conservation point of view and given the high likelihood of environmental damage to the upper Gulf St. Vincent ecosystem, the author recommends that this mining proposal be rejected.

The author also strongly recommends that mining-related marine pollution events (e.g. locally enhanced dust deposition and flooding related concentrated surface runoff) be classified as point-source discharges that must comply with *Environment Protection (Water Quality) Policy 2003.* The implementation of this recommendation implies that, as part of the proposal, the proponent should be obliged to scientifically demonstrate that mining-related pollution events satisfy the requirements of the Water Quality Policy at all times.

References

Reprints of most publications are available from the author on request.

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