

Howe, Mark (DMITRE)

From: S.I. & A.K. Lodge [REDACTED]
Sent: Friday, 8 November 2013 1:44 PM
To: DMITRE:MiningRegRehab
Subject: REX Minerals MLP Submission
Attachments: REX Minerals MLP Response Stewart I Lodge.docx; 11337 ADV081113 ER1D.pdf; Kaempf Submission.pdf

Att. Mr Mark Howe
Re Rex Minerals MLP Submission

Please find attached

1. My REX Minerals MLP submission

which includes

2. an independent hydrology assessment of the REX Minerals Hydrology Investigation Report &
3. the Kaempf report on Potential impacts on the Gulf St Vincent.

Regards

Stewart Lodge
[REDACTED]

File No: T2951-v08
Doc No: A1806600

Mr. Mark Howe

Mining Regulation & Rehabilitation Branch

DIMITRE

REX Minerals MLP Response

This mining proposal is absurd to say the least. To place a 2.4k x 1.1k open cut mine with a 380ha tailings dam & waste rock dumps up to 115m in height in a location amongst prime agricultural land & residential settlements adjacent to the coastline beggars belief. Public health & the environment are at risk with REX's experiment. The MLP is misleading in places & wrong & out of date in others. A junior exploration company should not be given a mining lease to mine this land for the following reasons:

1) DUST

I have worked in the mining industry since 1977 and am yet to see mine dust brought under control in hot, dry & windy conditions. It just does not happen! Given the number of these type of days we receive each year it will be impossible to live near this mine. I on occasions drive a CAT 555 100 ton haul truck converted to a 70,000 litre water truck to keep the dust down at a mine on YP. In weather conditions described above it is impossible to keep the dust down. That is with only two 555 CAT haul trucks running. REX say they will have two water trucks running for sixty two 793 CAT haul trucks. They will struggle to keep their own dust down on the bad hot northerly wind days! What happens if one water truck breaks down? REX state that dust monitors will be in real time surveillance by the EPA but in reality will this happen? They say they will close trucks down during these dust events but stopping operations will not stop dust & monitors will not stop dust. If the EPA come over after one of these bad days it has invariably rained because of the nature of the weather change. All may be ok for a few days.

Table 7.2 shows a summary of TSP & PM₁₀ emissions. It shows that 1,381,227 kgs of dust is generated by the mine & port per annum with 599,494 being in the PM₁₀ range. Given that this dust will contain elevated levels of uranium, copper, iron ore & potential fibrous material it is unacceptable to allow these emissions into the surrounding air, onto surrounding vegetation (including crops) & into the ocean. These emissions are only estimated so in reality they may be much much higher. REX have denied that there will be toxic dust anywhere at the port in the YP Country Times on 9/10/13 and yet we see that an estimated 6.111 tonnes of TSP emissions will occur per year in this area. From the Prominent Hill copper concentrate MSDS it says it is extremely toxic to marine life. It is only 460 meters from the proposed port processing shed to the closest house in Ardrossan. There are approximately 30 employees & contractors (including myself) at Arrium & also a large number of employees at Viterra both to the north & south of the proposed shed. All these employees will be subject to constant dust emissions.

This dust will of course be deposited on all roofs & into rain water tanks between Ardrossan & south of the tourist mecca of Black Point. On a hot 50 km/hr northerly wind day it will be unliveable at Pine Point! It would be most advisable for DIMITRE representatives to inspect Hillside on a "nasty" day and stand outside and feel the sand blasting they will get even without a mine and dry waste rock dumps.

The Kaempf submission on the gulf speaks for itself. Mr. Parry from REX has denied that there will be an effect on the gulf from dust.

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.

From Table 8.1 dust & odour impact assessment the figures for February & March are missing. There is also data missing in January, April, June, July, September & November. Did they completely forget December? If this is a precursor of future monitoring of mine dust how can our local community health be protected.

Please see attachment by Professor Jochem Kaempf.

In section 4.5 (Dust & Odour) it states:

Due to its limited availability, the site baseline PM₁₀ data set was not considered sufficient for use as background data. The PM₁₀ baseline monitoring data collected at site is further discussed in Section 8. Instead, Whyalla Schultz Reserve PM₁₀ data was used.

If this baseline PM₁₀ data was not collected properly it must be redone. It is not acceptable for a reserve in the urban area of Whyalla to be used as a baseline model for an area that is 175 km away in cropping country.

The impact of dust on surrounding crops and native vegetation (including the endangered spider orchid) will be a major concern. Who will compensate farmers for loss of production & potential contaminated produce.

2) Aquisitions

There are many landholders who will be displaced from their land & their family homes if the MLP is approved. Most don't want to sell and are not in negotiation except to say no to REX. Some families are 5th & 6th generation farmers in the area which means they have lived & worked in the communities for 130yrs+. If REX's plans to bring ore from other sites to Hillside even more people will be displaced. REX representatives have abused landholders on the phone. This is not acceptable!

3) Hydrology

REX's hydrology report appears to be very inaccurate and incomplete.

It was anticipated that the results of the workover and deepening of existing wells and drillholes would provide information that could be used in refining the layer 4 hydraulic conductivity values in the model. However, due to drilling related difficulties described above, it was concluded that the hole deepening program had not provided information that could be used with confidence.

2.1 Drilling to Depth

All groundwater assessments carried out included drilling to depths not exceeding approximately 200 m, whereas the pit is expected to extend to depths greater than 400 m and the underground

operations could occur at depths to nearly 700 m. The relatively shallow depth of assessment is considered a significant constraint to (dewatering) model reliability and confidence.

App 5.10A, pg 11

Drilling depths were planned to be 200 metres. Some wells were completed shallower due to not having the capacity to dispose of the water produced, and two were drilled to 204 metres. All wells were drilled to target zones of structural complexity or areas in which significant intersections of water had been encountered during reverse circulation (RC) drilling.

App 5.10A, pg 61

"It should be noted that the model was developed at an early stage in the evaluation process and is a simple representation of the aquifer system using the information available at the time. Subsequent assessments may provide information that may lead to the model needing to be revised. Pit design and scheduling also effects the model so if there are any significant changes to either of those the model will need to be re run"

App 5.10A Pg 71

The main contribution to the water balance is pit inflows. Any future work to better define the pit inflows will have the most significant effect on the water balance.

It is recommended that wells are constructed at an angle of 60° in locations where significant structures are known to exist but where groundwater assessment to date has not encountered high yielding rock units. This could include areas where weathering has been found in resource drilling to be shallow, where the rocks are siliceous (i.e. unlikely to be significantly weathered) or at locations where structures have been identified that post date major weathering events.

Water investigation wells have been installed to depths of approximately 200 metres. This is significantly shallower than the anticipated pit floor level of approximately 400 metres.

Hydrogeological parameters have been assumed at depths greater than 200 metres. It is recommended that wells be constructed to pit floor depths to enable hydraulic properties to be evaluated from 200 metres to the base of pit. These wells should be inclined at an angle, e.g. 60°. All wells should be test pumped in the manner described above. Additional long term tests may be carried out in wells that have intersected significant high yielding fracture sets.

~~Water samples should be collected from all wells installed and analysed as described.~~

Results of the coastal granites groundwater assessment should be incorporated in the model as appropriate.

The significance of the electromagnetic (EM) anomaly should be investigated further to determine if there is any correlation between the electromagnetic response and groundwater yields.

Nearby wells and available diamond drill holes/geotechnical investigation drill holes were also monitored during testing and changes in water level during testing recorded as observation well responses.

Why didn't REX have monitoring bores many kilometres away rather than in just the close proximity to the pit. How can REX possibly know the complete hydrological effects without performing full studies of the entire central Yorke Peninsula. We have a report (which has been reported to REX without follow up) that a fresh water bore which supplied a house & stock water at Sheoke Flat reduced it's water level by about 2 meters & burnt out a \$9000.00 bore pump at the same time as the observation wells were being pumped. The level returned after REX had finished. REX will after several years be needing to pump out up to about 38,000,000 Litres/day from the pit. Given that they use 13,000,000 L/day what happens to the excess 25,000,000L/day. If REX intend to reinject this pit water into the bore fields or pump out to sea, then this water must first go through a treatment plant.

What will be the full effect on the YP of removing 38,000,000 litres of water from the pit or interceptor bores everyday for twelve to fifteen years? The cone of depression caused by the removal of ground water from interceptor bores & and pit could lower the water table on YP. It doesn't matter whether the water is salty or fresh, the water table (which restricts rainwater from draining through topsoils) will be lowered. This could have the effect of drastically reducing yields over large areas of the YP because of the reduced rainfall retention. This matter should be extensively investigated as the cost to the state could be many of millions of dollars. The water bore levels on northern stations over the Great Artesian Basin have dropped due to mining. This is

overcome by drilling deeper bores. This problem cannot be overcome on YP as we totally rely on rainwater for broad acre farming.

App 5.10A pg 5

As contingency, excess water disposal options have been considered and will be implemented if required. They include:

- Utilisation of in pit bores to allow the pit dewatering volumes to be more consistent year to year;
- Temporary storage in the pit during times of peak flow;
- Temporary storage in the 100 ML tails dam seepage storage pond area;
- Evaporation using mechanical means such as evaporators;
- Utilisation of in pit bores that can be used in the summer months to advance dewatering and thus reduce the flows short term in the winter months;
- Utilisation of pit perimeter bores to form a cut off bore field between the Gulf St Vincent and the pit with discharge to Gulf St Vincent;
- Discharge of excess pit water to the Gulf St Vincent;
- Disposal of excess water via an injection bore field; and
- Grouting the aquifer to reduce inflows.

These contingencies should be investigated further in the next stage of the study if required.

REX need to do a thorough investigation over 12 months on the complete hydrology of the Yorke Peninsula to ensure that removing huge amounts ground water will not reduce the agricultural potential of the entire area.

Please refer to Gilbert & Sutherland attached hydrology report.

4) Surface Hydrology

5.9 SURFACE WATER

5.9.1 Surface Topography and Existing Catchments

Given its flat topography, much of Yorke Peninsula has little drainage definition (NYNRM Board 2009). The Surface Hydrology Report (Appendix 5.9-A) presents a study of the existing surface water regime for the Hillside Project. The land surrounding the proposed ML area is relatively flat. Slopes in the western section of the proposed ML are generally less than 1.5%, and increase to approximately 3% toward the east around existing channelised drainage paths.

The road past the Hillside mine is one of the steepest hills on the Yorke Peninsula! That's why it's called Hillside!

Once run off catchments are full what happens with another large rain event! How much toxic mine waste will enter the gulf given there are several gullies running through the ML.

There is high potential for contaminated water to enter the Gulf – as copper is highly toxic to marine life this could have a significant impact on the health of the Gulf.

If contaminated water enters the Gulf, given the northward flow of gulf water along the western side of the Gulf, and the slow flushing of the upper reaches of the Gulf, the contaminated water could stay in the Gulf in excess of 200 days, with severe detrimental effects on the marine ecology of the upper Gulf St Vincent. Rex has not conducted a scientific study on this issue.

Ref Associate Professor Jochen Kaempf, Flinders University 2013 "An independent assessment of the Hillside Copper Mining Proposal"

High levels of suspended solids in the near-shore waters can smother seagrass and reduce the amount of sunlight reaching their leaves....." no mention is made of the toxic effect copper (salts) has on the seagrass population.

The MLP fails to consider the risks associated with leaching of uranium (and associated nuclides) into the gulf waters. The marine environment is a recognised National Benthic Habitat and Endangered Macroalgae Area (Marine Park14, Map 5a) as well as a commercial and recreational fish nursery (Marine Park 14, map 12a)

Questions therefore arise concerning the risks to these sensitive marine areas and to the potential impact on the fish nursery, when the area is subjected to chemical pollution of the nature previously described.

5) Uranium

Page 8-238 Section 8-Environmental and Social Impact...

It is interesting to note the report talks about "average" uranium concentrations from Hillside zones. What is missing is the distribution of the uranium throughout the drill sites and specifically in the location of the mine. An average over the whole prospect is meaningless.

The report identifies "there are discrete zones of elevated uranium concentration. The peak uranium concentration returned from all resource drill hole assays is 10,000ppm." Obviously in others, the results were zero.

This section then goes on to discuss the potential impacts (pp 8-240) but omits to consider **the accumulative effects over the life of the project, and beyond.**

The beyond is equally important, if one reads the mine rehabilitation process envisaged by the Company. The unanswered question is the ultimate chemical composition of what is left, especially in the pit, which will fill with water, water which will have the capacity to migrate to the marine environment.

More concerns are:

- o that operators in the open cut mine and in the concentrator plant could be exposed to radiation, and that many of these workers could be locals;
- o that elevated uranium could end up in the concentrate streams which will be slurried to the port and exported (you may be aware that BHP Billiton attempted to get permission to export uranium-bearing concentrate from Olympic Dam to China but there was a considerable backlash and the proposal didn't proceed);
- o Rex is clearly in possession of the information about the distribution of uranium in the ore, having had to complete detailed ore-body modelling in order to determine the economics of the proposed operation as part of its pre-feasibility study, but has not made it clear in the MLP as to how this matter will be managed safely and effectively.

The analysis reports for the waste rock dumps are interesting at the end of Appendix 5.8B. The samples were submitted by the client (REX). It seems they have put up core samples to be tested. From these they have given a 7-10m core sample at a depth of their choosing. If you look at page 13 of 22 it shows uranium. Hole HDD-016 is tested from 458-467m which is benign waste (Gabbro). If it was tested at 512-515m it would have shown uranium at 955ppm or 509-527m 297ppm. (REX ASX Quarterly report for period ending 31 Dec. 2008) These analysis' determine the consistencies of the waste rock dumps. My question is why is REX allowed to submit the core samples of their choosing thus possibly giving false consistencies of potentially dangerous minerals in their waste rock dumps ie uranium, serpentine, tremolite, sulphides ect.

DIMITRE should thoroughly investigate the process of self submitting core samples as it is open to manipulation of consistencies of all kinds of minerals including uranium, fibrous

materials and sulphides. These samples determine the composition of billions of tonnes of waste rock dumps which could pollute the gulf for years to come.

When I mentioned high grade uranium I was basically laughed at by Patrick Say & James Watson at a CCG meeting. They were intimidating and said there was only a meter of it in one hole. The MLP states that:

Whilst the Hillside deposit has low overall average concentrations of uranium mineralisation, there are discrete zones of elevated uranium concentration. The peak uranium concentration returned from all resource drill hole assays is 10 100 ppm. Less than 100 samples (out of a total of approximately 197 000 samples drill samples assayed) returned results exceeding 1000 ppm uranium.

The updated Mineral Resource – the sixth in 3 years – includes all drilling results received up to 6 June 2013 inclusive of 598 diamond holes and 245 RC holes for a total of 234 000 m.

The grade of this uranium could be anywhere from 1000ppm to 10099 ppm!

If REX have drilled 843 holes & there is only one positive uranium result per hole over 1000ppm (because the uranium is so scarce) then that equates to 11.5% of all holes having high or very high grade uranium. Obviously this is not mentioning anything under 1000ppm ie Hole HDD016 has grades of up to 955ppm.

REX need to give a complete and thorough report on the location and exact amount of radioactive minerals that exist at Hillside. This is an important public health issue.

The question must be asked will REX or the State Government be responsible for paying compensation for increased incidences of cancer related illnesses in the area.

6) Fibrous Material

The most likely cause of potentially asbestiform mineral formation at Hillside is due to the retrograde replacement of clinopyroxene (diopside) by either serpentine or the amphibole minerals tremolite and actinolite (Teale 2012). The serpentine observed at Hillside is not fibrous. In rare instances the observed tremolite has a length to width ratio of up to 20:1, but these acicular grains are often encased in quartz. Where observed and investigated, the acicular tremolite comprises less than 2% of any sample (Teale 2012). Laboratory analysis of a range of samples most likely to yield asbestiform minerals was commissioned

□ □ 6 Concluding remarks and recommendations

Results of the first round of waste rock sampling and analysis indicate a relatively benign waste rock character associated with the Hillside project.

Fibrous Material

Skarns containing amphiboles, serpentine and talc minerals should be further investigated for minor fibrous minerals (mineral phase) such as Asbestiform Actinolite, Chrysolite, Crocidolite etc. Apparently, the present campaign for mineralogical analyses shows insignificant presence of asbestos or asbestiform minerals. Assuming the analyses of existing Skarn samples are limited for gaining an understanding of the fibrous characteristics of the waste rock, MP recommends further investigation during the feasibility stage. It is clear from this that further investigation of these dangerous minerals is essential.

In the YP Country Time on 29/10/13 REX have stated:

Will there be any toxic dust?

This is a valid and understandable concern. Many people live within kilometres of the proposed mine and many crops are grown nearby. Dust suppression is critical and an integral aspect of mining operations. However the composition of the dust will not have any health impacts as there is no asbestos present, uranium will be managed and there is no sulphur being released into the atmosphere. There are no foreseen issues with contamination of rainwater tanks, but we recognise that any residents in the area would appreciate transparent reassurance. Part of our monitoring will include regular testing and transparent reporting of water tanks.

This appears to be a misleading statement as there is potentially fibrous material as described above. REX must further investigate these dangerous minerals.

7) Slurry Pipeline

World best practice would dictate that a toxic (to marine life) copper slurry pipeline should be placed above the ground. There should be full concrete bunding along the full length of the pipeline. A pipe rupture could leak into the gulf with devastating results. There are numerous gullies along this section of the coast. The pipe line should be inspected daily for leaks which is impossible when underground.

8) REX'S Environmental Record

REX's environmental record is nothing short of shoddy. In November 2010 it came to my attention that REX were dumping their drill tailings in an old effluent pond near Ardrossan & near our house. They were using trucks with Minlaton Septic written on the side. As the old ponds are still used for dumping pumped out town septic pits the REX trucks didn't draw any attention until my neighbour noticed the different colour & odour. At the time REX were promoting their uranium deposits to their shareholders. As I was concerned about the minerals in this dump I complained to our local council. They said it was only drill mud & was ok until I explained what might be in it. They did not realize the implications until then & stopped REX immediately. I believe the council had the drill tailings analysed. The first two photos are of the first drill tailings dam. (photo 1 & 2) Immediately following the disallowance of the first dam REX set up more at Hillside in an existing farm dam & also excavated a new dam which was of course in a gully or water course. One they lined with 3 meter wide black plastic strips (a great seal) & the other was just excavated & filled with tailings. See photos. Rainfall following the use of these dams was as follows: December 41.5mm, January 2mm, February 53mm, March 102mm. These are large rains causing water to overflow the already full dams & naturally down the watercourse & into the sea, remembering the toxicity of copper to marine life the health of the gulf was already threatened back then with REX's cost saving measures. (photos 3, 4 & 5) Photo 9 shows the original dams in 2004 & the new dams now. Note that the old dams have been filled over.

Photos 6, 7 & 8 are drilling associated incompetence on my property & complete disregard for the environment. Photo 8 shows a mound of precious top soil which was removed without my knowledge or permission. It was agreed they would not come on after rain & the top soil would not be removed. I was away at the time.

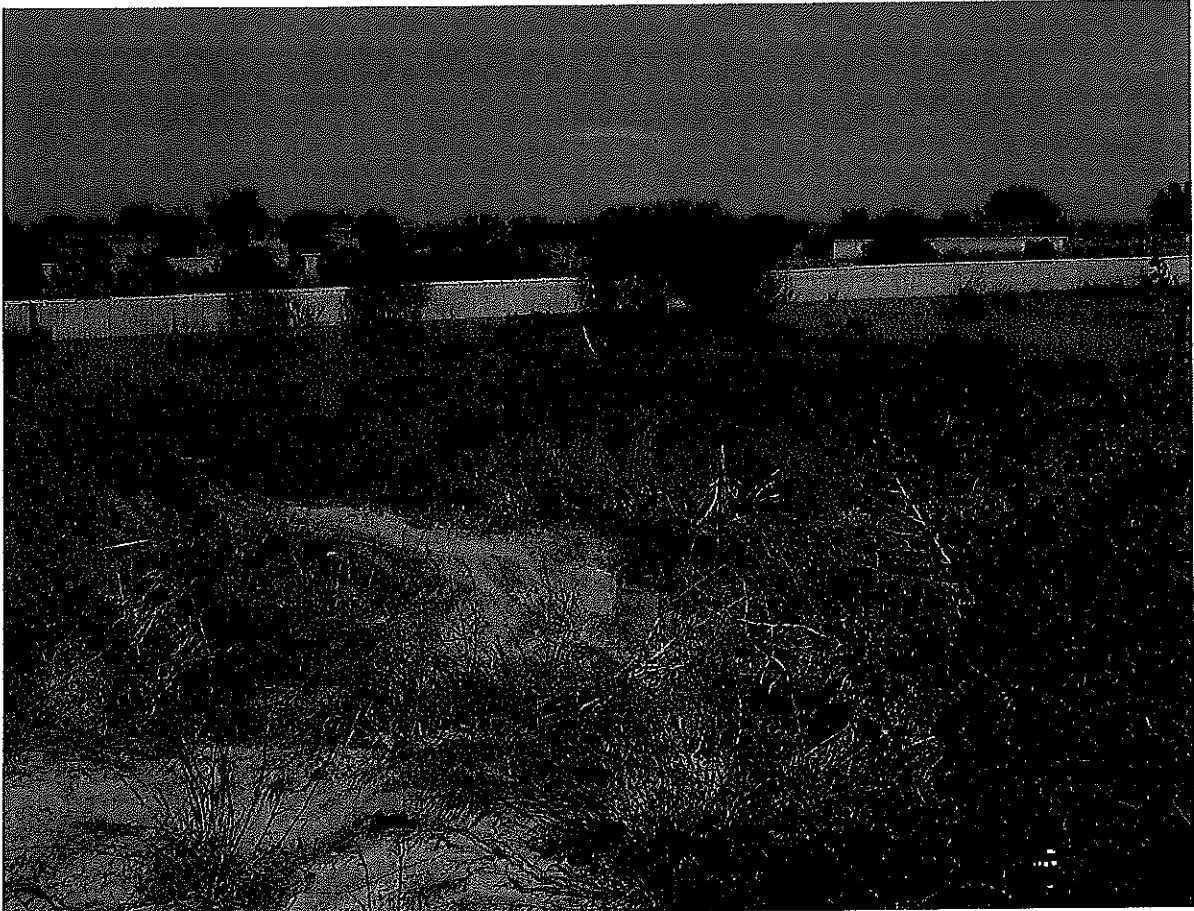
REX requested to come on my property and drill again in September 2012 and said they'd changed their ways & learnt by their mistakes. I pointed out that they had made a mess on the side of the road after wet weather 200m from our property just 8 weeks before.

I have many more photos of various drill sites etc.

Rex's environmental record does not render a lot of confidence when considering they may be in control of a large mine with huge environmental responsibilities.



1) REX's first tailings dam only 1.6 km from the town of Ardrossan & 1.3 km from our house. Dec. 2010



2) REX's first drill tailings dam (note the dead trees & brown slurry). Dec. 2010



3) Makeshift drill tailing dams with gully & gulf behind.



4) Hillside Tailings dam



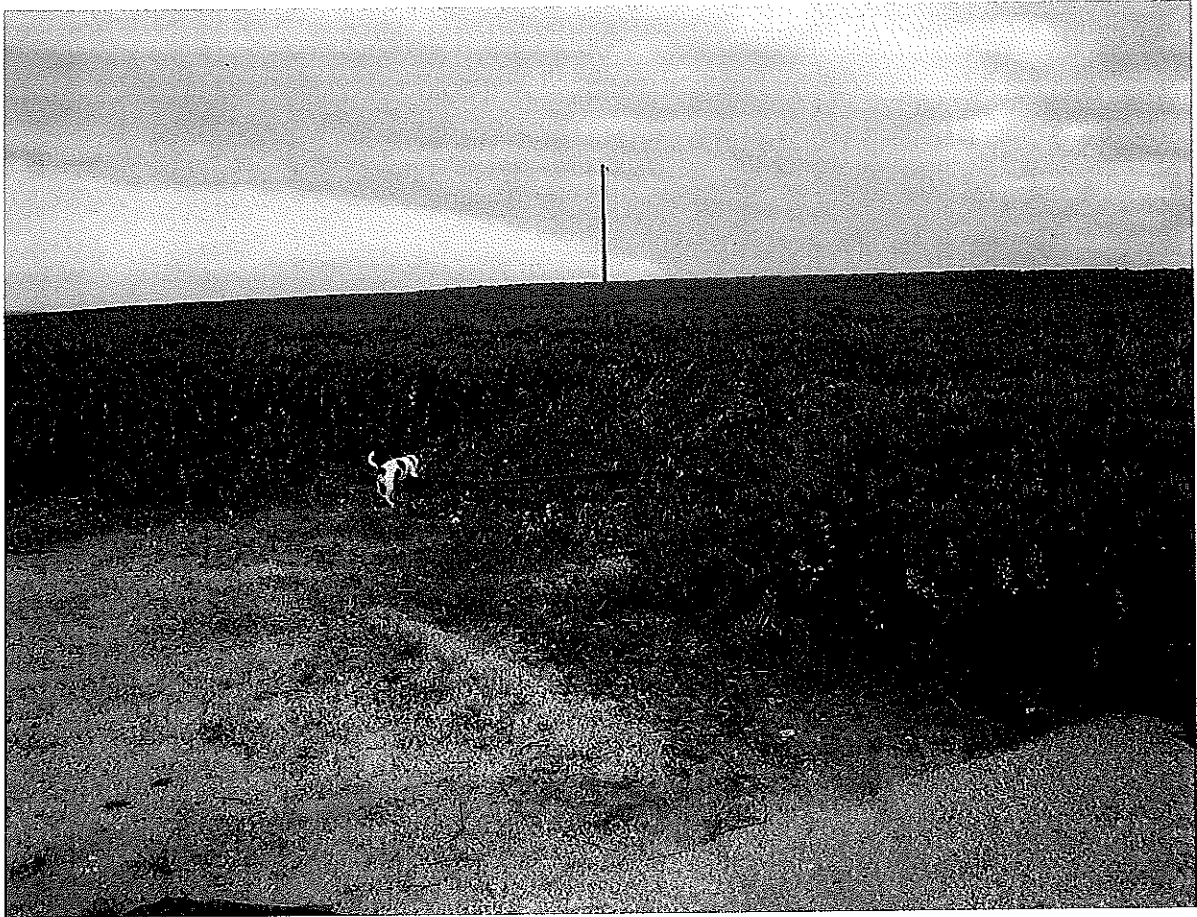
5) Hillside drill tailings dam. Note the gully & gulf in the back ground.



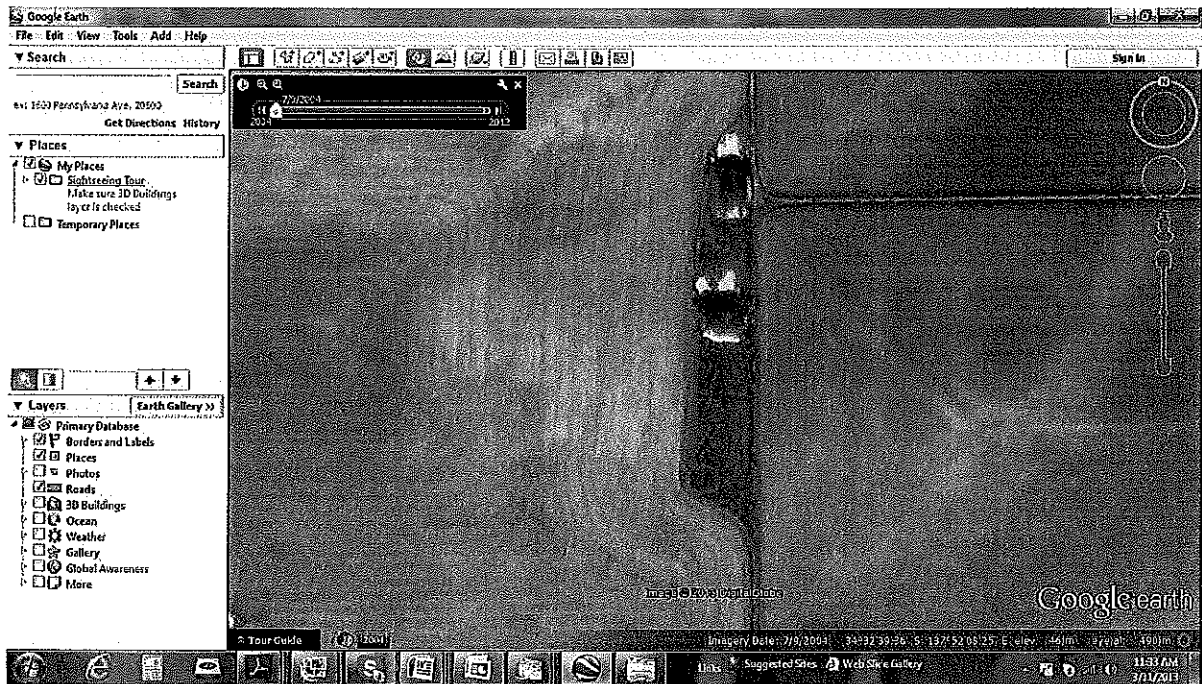
6) A mess in the crop!



7) Bogged & bogged again! I was away when this happened. This section will not grow a crop.



8) Five to ten tonne of topsoil removed from the drill pad. The ground is still affected.



9) View of the Dams before & after REX.

9) Noise, Vibration & Odour

Vibration will be a nuisance for the people of the area with blasting, trucks, drills ect.

Noise on calm days & nights will be annoying for both locals and tourists. It appears that the rezoning requested by REX to the local council from agricultural land to a mining zone was because of their inability to reduce the noise levels around the mine. If REX cannot meet regulatory noise standards in a popular tourist area they should not be mining. They should not be inconveniencing long term residents by rezoning land. REX say that they withdrew their rezoning application when in fact it was forced upon them because the council had three councillors with a conflict of interest. (REX shares).

The 380 ha tailings dam will give off a terrible odour in the prevailing winds which will be smelt in all the coastal towns.

10) Mine Contamination

The MLP stated that the dumps, plant area's and haul roads will be dust suppressed with water from the mine and sea water.

After completion of the mining activities, the entire mine site will not be suitable for agricultural pursuits as the soil will be salt laden and consequently barren.

The Hillside mine area may well resemble a moonscape after mining has completed.

Radon Gas

It is common for this area, the mining site, to have inversion layers at certain times of the year with the mine at the stage of being open cut the faces of the mine will be exposed to sun light. Warm air rising and hitting the inversion layer possibility carrying radon gas with it will flow back down to the lowest point, being heavy it will then concentrate in one area being Pine Point's flat area commonly known as Billygoat Flat.

Rex MUST

- Provide proper and costed rehabilitation plans, not just statements saying that they will abide by EPA guidelines.
- Explain how they will extract the thousands of tonnes of salt, dumped by the water trucks, from the mine site to enable plant growth.
- * Provide proof that Radon Gas will not emanate from the mine during heating while inversion layers are present.

It must be noted that the relocated Coast road is within the >10mm/s zone and within the >120db air overpressure zone.

Refer app 8.3B

Compliance criteria for ground vibration and air overpressure impacts have been based on guidelines detailed in Australian Standard 2187.2 - 2006. The guidelines are designed to limit human discomfort at a sensitive site based on long term blasting activities and recommend the following:

- Ground Vibration - 5mm/s for 95% blasts per year, with a 10mm/s maximum unless agreement is reached with the occupier that a higher limit may apply; and*
- Air Overpressure - 115dBL for 95% blasts per year, with a 120dBL maximum unless agreement is reached with the occupier that a higher limit may apply.*

REX MUST

- Explain why the relocated coast road is still within the non compliance area in relation to vibration and air over pressure as per Australian Standard 2178.2 - 2006.

12) Boorfields & Offices

I could not find any other reference in the MLP regarding the administration and multi purpose buildings location apart from the excerpt below. The exact location of these buildings is not identified, apart from being near the Borefield.

As the office buildings are also planned to be on the coastal side of the Yorke highway, they will contravene the Coastal land zone regulations.

As it appears that the reinjection borefield is planned to run through the centre of section 49 (refer figure 8 below, app 5B pg) this will have a significant impact on cropping activities and will reduce available arable land due to the bores, buried pipelines, associated equipment and access tracks.

Rex has failed to provide any detail on their plans for Section 49, apart from "no precise activities" and "minor impact on land" It appears that withholding information is a key part of Rex's communication strategy with their Community consultation selective at best.

The capabilities of the injection borefield appear to be based on the performance of 1 well only, WBTH 013 which is bored into the coastal granite on the north eastern side of the proposed pit. Modelling an injection Borefield utilising the data from only 1 well does not lend itself to accurate outputs from the model.

Ref pg 340 MLP

"Rex is also proposing to construct a borefield (Section 6.8.7), administrative and multi-purpose buildings designed to accommodate a number of key functions for Hillside Project operations. This will include site office/administrative buildings including amenities and a carpark to house Rex's administrative personnel. This infrastructure will occupy approximately 2.2 ha. The multi-purpose buildings will be designed to accommodate a number of key functions for Hillside Project operations. It will comprise a reception area, meeting rooms, offices, conference room with training facilities, a kitchen and a common room for Rex personnel and contractors. The proposed location will make it easily accessible and more inviting to the public and thereby ideal for use as visitor information centre.

Road Underpass

It is proposed to construct a road underpass under Yorke Highway for underground access between the administration/visitor buildings and the Hillside mine site. This will ensure safe access to the site on the western side of Yorke Highway (100 km/hr speed limit)."

5.10 Special Culverts Pg 89 DAC Development number 544/G017/13 & 544/G018/13

Special culverts have been provided at the following locations:

□□ *Pine Point Road Deviation, ch1730. A 2400 x 1500 RCBC has been provided as a stock crossing to enable the farmer to safely herd his sheep from one side of the road to the other, without having to physically cross the road and interact with the traffic. This culvert will also act as a drainage culvert, albeit that it is "oversized" for this function. The area between the road reserve boundary and the culvert headwall will be fenced and gated to keep the sheep within the desired area.*

□□ *Port Wakefield – Yorketown Road, ch 4200. This portion of the new alignment crosses a deep gully in which two culverts will be installed – one for drainage purposes (a 1200 dia pipe) and the other for vehicular access purposes (a 4200 x 3000 RCBC). The vehicular access culvert will enable Rex Minerals personnel to move between administration buildings located on the eastern side of road and the operational area of the mine, without having to interact with highway traffic.*

Rex must;

- Explain how they can construct a 2.2 hectare visitor centre on the eastern side of Yorke Highway, contravening Coastal Land zone regulations.
- How they can plan a borefield based on the performance of only 1 well.
- How a 10 well borefield, right down the centre of section 49 is classed as "minor impact on land"

13) Yorke Highway

Section 6, pg 341 MLP states that Rex will not allow coastal access via the southern easement during the life of the mine, and that the northern access will be maintained. As Rex have no control over the northern access, it is currently on privately owned land, they have no authorisation to make this statement.

Rex Must

- Retract this statement from the MLP

14) Rehabilitation

REX's plans to rehabilitate the mines end by covering waste dumps with top soil, planting a few trees, fencing off & leaving a huge pit full of toxic water is not worlds best practice and certainly does not meet community standards.

6.9.6.4 Access for future mining

The South Australian government (DMITRE) requires that access for any future mining or reprocessing is maintained. The haul roads to the open pit will remain open and used as drainage channels. The underground entrance and air shafts will be sealed with concrete which could be removed with some effort should reopening the mine be required in the future. However, a complete geotechnical and hydrological risk assessment will be required before any future mining was to take place

Does this mean that DIMITRE have ordered REX to leave the pit open?

REX must completely fill in the pit & tailings dam with the waste rock dumps, recover with topsoil and return the mine back to as near as possible original condition. This is the only standard the community will expect. Due to Hillside's position near the gulf, in prime agricultural land the potential for an ecological disaster is ever present. REX is a small, inexperienced exploration company with relatively small assets. If it gets financiers to start a mine it will not have amounts in reserve. If they go into receivership who will bare the cost of the above rehab requirements. I believe a bond of \$400,000,000 should be placed on this project to ensure correct rehab is carried out to community expectations. In my opinion this location is every bit as important as putting a mine in Kakadu except we have a lot more people living here. They are not mining in the out back (as they thought when they came on our properties with their machinery). REX have a moral, social, & environmental responsibility to the thousands of people living on the Yorke Peninsula & the hundreds of thousands of tourists that visit each year.

Do we know the correct amount of acid producing sulphides in the waste rock dumps given REX have submitted their selected core samples for analysis. These core samples need to be looked at again? Acid forming sulphides could leak into the gulf forever. Who bares the cost of rehabilitation 10,20,50 or 100 years from now. Not REX's problem – YES IT IS.

15) Agriculture v Mining

While mining produces large amounts of money for generally short periods, agriculture keeps producing forever. Despite what mining companies say old mines do not turn back into viable agricultural land (especially IOCGU) mines. I work at the Klein point mine & see their cropping attempt in the bottom of their quarry. It is never half as good as the crops around the mine & that is only a limestone quarry.

In the dollars of today with 3.8 tonnes/ha of wheat @ \$300 per tonne 3030 hectares will produce 3.45 million dollars. With the added profit of grazing sheep in the summer we could add a further \$300,000 bringing the total up to 3.75 million. The equivalent has been produced for the last 135 years which shows an amount of 506.25 million, the land is still producing after 135 years so after another 1000 years it would have produced 4256.25 million and still producing.

REX say they are making a profit of 2500 million in 15 years but if the price of copper plummets the mine may not be viable. Once the mine has ended the land is rendered barren & unlikely to return any profits from agriculture or mining forever.

REX have stated they have 50 other prospective sites & intend to aggressively pursue these projects & build haul roads to Hillside. Obviously their footprint will become much larger as they take up more & more farming land & that is not counting the farm land that they have effected with their drilling over the last six years.

Some grain figures from the Yorke Peninsula

Crop	Kilograms produced	% of State total
Wheat	480,000,000	13.5 %
Barley	477,500,000	25%
Durum	90,700,000	50 %
Lentils	68,500,000	70%
Canola	52,000,000	13.5 %
Peas	32,550,000	28 %
Beans	16,800,000	16 %
Chickpeas	12,000,000	55 %

A dollar value for this:

Wheat \$144,000,000

Barley \$119,375,000

Durum \$29,024,000

Lentils \$41,100,000

Canola \$31,200,000

Peas \$10,416,000

Beans \$6,384,000

Chickpeas \$6,600,000

Total \$388,090,000

This figure is going to be greatly reduced with extra mines, haul roads & the devastating effect of the water table dropping with the pit in flows at Hillside being 38,000,000 Litres per day.

- The community is left to cope with the aftermath, of a closed mine including permanent loss of productive agricultural land and potentially an environmental legacy in the form of a mine site inadequately rehabilitated and continuing to produce contamination, requiring ongoing maintenance which could run into millions of dollars.

16) Community Consultation

The REX CCG has been used by REX for it's own means. After only 3 meetings the CCG were asked to complete a survey on all aspects of the Hillside project. The members of the CCG did not know that the results of the survey were being used in the MLP to reflect community expectations & understandings.

This information provided the basis for the conceptual mine closure plan. This plan was then taken back to the CCG for comment and also shown more widely during site tours and other consultation opportunities as detailed in Section 7. Rex is confident that the conceptual mine closure plan reflects the expectations and outcomes of the CCG and the regional community as shown below in Figure 6.9-6.

The graphs in fig 6.9.2&3 & all other community consultation graphs are only taken from the early CCG survey. The comment on the site tours and other community consultation opportunities were not taken into consideration. It appears that REX's community consultation only involved 14 people to represent thousands of people.

These surveys are a complete misrepresentation of the communities expectations and understandings of the mine.

REX has formed a CCG but has not been forthcoming in presenting the information to the greater community. I asked REX (at a CCG meeting) why they did not put their CCG minutes on their web site and they replied it was ASX sensitive. I then asked how is it that the Kanmantoo CCG's minutes is on Hillgrove's web site. REX's reply was they are a mine and we are not ! These are the type of answers that you are continually getting from REX.

One of the CCG members asked how REX could achieve accurate underground water observations by going down only 200m with their observation bores when the underground mine was going to be 700m deep. They said they had drilled down 850m. I asked where that was written in the MLP. The answer they gave was it's in the MLP.

I had the opportunity to meet with James Nagel from REX 2 days later and once again asked where the 850m observation water bores were in the MLP. He took our email address and 3 weeks on has not supplied any information.

REX's community consultation effectiveness can be gauged by the number of people at the 3 public meetings in the local area. One hundred people at Pine Point, (organised by the Pine Point Progress Association) 300 people at Ardrossan (Yorke Peninsula Land Owners Group) and 150 at Ardrossan at REX's meeting (5 days before the MLP submissions were due).

These people were starved of information which is why so many people attended the meetings.

REX advertised their Ardrossan meeting from 3.30pm until 5.30pm but left 15 minutes early while questions were still wanting to be asked.

17) MLP Anomalies

How does the tailings dam become much bigger in year 12 from year 5 in Fig 7 & 8 on pg 16 & 18 in the Operational Noise Assessment?

Why is there no noise emitted from the north & east of the northeast waste rock dump and northeast of the southern waste rock dump in Map 1-2 in the Operational Noise Assessment?

Why does it say that the rifle range would be a factor when the club has been disbanded for over two years?

Why have REX used the Shultz Reserve at Whyalla for a base line dust study when they botched their own data?

6.9.6.4 Access for future mining

The South Australian government (DMITRE) requires that access for any future mining or reprocessing is maintained. The haul roads to the open pit will remain open and used as drainage channels.

Is this the case & if so why is DIMITRE forcing REX to leave the pit open?

Dams Several disused farm dams. All dams observed to be dry. Dams not important for stock since the supply of mains water.

There are many dams in the area & some are still used.

18) Tourism

1.1.2 Tourism

- In 2009-2010 there were 883,000 visitors to Yorke Peninsula.
- Total tourism expenditure was estimated at \$166 million, resulting in 1,100 jobs.
- Given its proximity to Adelaide, its natural beauty and varied attractions, tourism has the potential to grow significantly in coming years.
- Like agriculture, tourism will generate sustainable, long-term economic returns for the Peninsula.
- Hillside extends along 8 kms of prime coastal beaches, in close proximity to major tourist and holiday settlement locations. These settlements and the tourists they attract will not remain viable following the establishment of an ugly, polluting open-pit mine.
- Proximity to a mine will inevitably result in significant reductions in property values, and an out-movement of families seeking a quiet rural and coastal lifestyle.

We know what the current economic returns are from agricultural and tourism and have hard data to predict future returns. We have no such clarity when it comes to mining. So far, all we have to go on are promises – promises of jobs, of better infrastructure etc. But there is no guarantee that any of this will eventuate. We are trading what we know for what we are simply promised by companies whose primary aim is to make as much profit for their (mainly foreign) shareholders as possible.

19) Social

This project will have a primarily negative impact upon the socio-economic fabric of the region.

The main areas of concern from the Proposal are as follows:

- (1) The impact on landowners/householders adjacent to the mine
 - a. Reduction in land and property values
 - b. Noise and light pollution from round the clock mining activity and heavy vehicle movements, 24 hours a day, 7 days a week.
 - c. Vibrations from the blasting causing damage to homes and other buildings
 - d. Reduction in the aesthetic value with compromised views
- (2) Roads
 - a. Issues of road safety from increased traffic associated with the project, particularly heavy vehicles using roads also shared by rural bus routes
 - b. Ratepayers having to fund the cost of increased road repairs needed
- (3) Health issues
 - a. Increase in respiratory diseases such as asthma, caused by the dust

- b. Toxicity in the groundwater and rainwater tanks impacting health

(4) Pressure upon local services

- a. Rex Minerals quote in their proposal that the workforce will vary between 383 to 1,000 people over the 15 year life of the mine, with a sharp reduction in employment of 40% between years 10 and 11. The increased population through the Rex workforce is only temporary, therefore the area will not qualify for increased provision of health, childcare, education and other associated services, yet they will use the services from time to time.

(5) Property issues

- a. Decrease in property values in the long term due to the proximity of the mine and the long-term inertia on its completion.
- b. Competition for rental and purchase of properties – the SA average wage is \$60,559 (ABS, 2011) whereas Rex quote in their proposal that the average wage at Hillside will be \$100,000+. This puts the general population at risk of not being able to afford homes in the area when competing with Rex employees for property sales or rental applications.

(6) Employment issues

- a. The opportunities created by the mine at Hillside will only be temporary. Rex quote in their proposal that they expect to recruit 33% of their workforce locally, 33% from those living on the Yorke Peninsula but currently working elsewhere, and 33% from outside the region. The “outside” workforce will commute to the site from Adelaide by ferry or bus, and that the workforce will also be sourced from “elsewhere and interstate”.
- b. Competition for employment with established local businesses, who cannot afford to pay the same rates as Rex Minerals. Industries such as agriculture and tourism will be particularly affected, as they also have a highly seasonal, primarily casual employment profile.

(7) Establishment of a camp for 120 people.

- a. The local accommodation providers will miss out, as all temporary/overnight workers & visitors to the site will be housed at the camp.
- b. Social issues such as alcoholism and rubbish associated with large groups of temporary workers being housed together.

Please DIMITRE go over to YP and drive around the proposed mine foot print to gauge the sheer physical size of these operations. It is hard to see from one side to the other. Then drive down to Hill's & Davey's beach to see the potential catastrophic damage to the coastline.

Stewart Lodge
Ardrossan



8 November 2013

Yorke Peninsula Land Owners Group
[REDACTED]

Ardrossan SA 5571

Attention: The Chair – YPLOG Committee

Dear Madam/Sir,

Re: Rex Minerals Hillside Copper Mine project – preliminary independent technical review and comment

The Yorke Peninsula Land Owners Group (YPLOG) commissioned Gilbert & Sutherland Pty Ltd (G&S) to conduct a preliminary review of hydrogeology information contained in reports relied upon by Rex Minerals in its application to the South Australian Government (under the SA Mining Act 1971) for two leases and two licences for its Hillside Copper Mine project, Yorke Peninsula, SA.

Specifically, YPLOG asked G&S to conduct a preliminary review of the Hillside Pre-feasibility Study (Hydrogeology Report), upon which the Rex Minerals Mining Lease Proposal and Management Plan is reliant in relation to the site-specific Hillside/ Ardrossan area, and to prepare concise, Plain English written advice detailing any issues or concerns with the work as a series of dot-points to help inform its response to the SA Government's 'public consultation invitation'.

Scope and approach

This letter addresses the scope of works requested by YPLOG within the limited timeframe available to respond to the public consultation invitation. Our review of the voluminous information presented by the proponent is preliminary in nature, meaning that any and all observations stated herein recognise that additional time and resources would be required to fully investigate, interrogate, test and confirm the work we reviewed to the degree appropriate for a complete third party peer review.

The documents we reviewed were:

- '*Hillside Pre-feasibility Study – Hydrogeology*', prepared by Mining Plus and dated 19/1/2012.

- *'Hillside Project – DFS Groundwater Investigations'*, prepared by Mining Plus and dated 9/5/2013.

Our review has not examined the following aspects of the proposed project:

- Regulatory aspects of any water take/water licences.
- Surface water hydrology.
- Tailings storage facility and any water implications to the environment.
- Waste rock dumps and their water implications to the environment.

In gathering contextual information to inform our review, we identified that the community has stated 'high concern' with the following water and water-related issues:

- Loss of arable land.
- Possibility of groundwater seepage from mine into surrounding groundwater systems, including quality impacts.
- The fate of the final pit void (lake).
- Surface water / groundwater interactions.
- Sustainable water practices.
- Potential contamination as a result of seepage from the tailings storage facility.
- Potential leakage from the buried concentrate pipeline between the mine and the port.

This review recognises the SA Government's role and authority in assessing the proposal and would welcome any enquiry its officers may wish to make in respect of the matters identified and discussed herein.

Our preliminary review findings

The Hillside Project is situated 40 metres above sea level. The reported groundwater (GW) level sits at 30-80 m below ground level and this groundwater is highly saline. Groundwater discharges east into Gulf St Vincent. The proposal states a water demand of 155 to 170 L/s required for processing water, with 70% of that demand to be met from GW.

The documents reviewed cause us to raise concerns in three key areas:

1. **Data limitations** – where the documents fails to cite or provide sufficient, fit-for-purpose data.
2. **Modelling limitations** – where the documents demonstrate that applicable and/or appropriate modelling standards, guidelines or best practice has not been followed.
3. **Reporting limitations** – where the documents make statements or assertions that are unsupported or inadequately supported.

Our dot-point summary of the issues identified within each of these areas is presented below.

Data limitations

- Drill depths did not exceed 200m whereas the pit is to be excavated to approximately 450m and underground operations could extend to 700m. There is no explanation in respect of why the drilling program did not include deeper wells. A deeper investigation bore(s) is required down to some 500 m below ground.
 - None of the drilling targeted the 'seasonal perched Quaternary aquifer', therefore in terms of test pumping and groundwater modelling, any potential impacts to this zone is unknown. This aquifer could be a water source for stock in the area.
 - Wells for test pumping only targeted the deeper aquifer (represented by groundwater model Layer 3) and appeared to be focused on attaining estimates of likely inflow to the pit wall.
 - The sole long-term pump test (conducted at well WBTH005, reported in Appendix A 9.7) is neither reported nor included in the tabulation in Section 4 of the body of the DFS report. The test indicates an acceleration of drawdown with time. There is very little by way of discussion of the implications of this test, other than a brief mention that it was conducted to gain an appreciation of the pumping effects on the fractured aquifer zone. This is perhaps the most important test data within the report and it is left only in the Appendix and not addressed in the body of the report.
 - Hydraulic parameters from test pumping were used to inform the Groundwater (GW) model. Recharge and groundwater levels were not used as inputs.
-
- No baseline data including groundwater hydrographs (i.e. groundwater level fluctuations with time) were apparently available to calibrate the model. Whilst the dilemma of the modeller is recognised, this is a serious omission. Such baseline data should have been collected at an absolute minimum over one complete year and preferably years that included drought-dominated regime and a wetter year.
 - GW test pumping durations were too limited. We understand this limitation may have been a product of finite onsite storage capacities and GW discharge to the environment (regulatory restrictions).
 - The PFS categorically states that wells were installed in all hydrogeological zones. This does not appear to be accurate in that there are no details of wells targeting the 'seasonal perched Quaternary aquifer'.

Modelling limitations

The groundwater modelling *per se* is generally sound. However it is limited only to the moderately deep, immediate mine site environment and does not cover the near surface nor the deep geological formations.

The groundwater modelling presented in *Mining Plus – Hillside Pre-feasibility Study – Hydrogeology* dated 19/1/2012 and *Mining Plus – Hillside Project – DFS Groundwater Investigations* dated 9/5/2013 has failed to follow standard groundwater modelling guidelines. This is a serious procedural lapse for such a large, important and environmentally sensitive project.

Other key modelling limitations include:

- The confidence in modelling outcomes is compromised by limited reporting (see below), including lack of justification for a number of modelling assumptions and little discussion of the implications of the project to the environment.
- The permeability of Layer 4 has not been defined by field investigations; it is an assumed value. It appears to be a product of the lack of very deep drilling.
- It is noted that the outputs from the model indicate that Layer 4 is sensitive to changes in permeability and storativity (standard groundwater hydraulic parameters).
- The calibration of the model is questionable as it appears to rely on five bores only; two in the Coastal Granite and three in the pit area. The model has embraced a zone of potentially fractured granites to the north and east of the proposed mine in a zone that appears to have an enhanced permeability. More discussion of this is needed.
- A number of hypothetical cut-off wells have been modelled as intercepting groundwater flows that appear to exploit this zone of higher permeability. These cut-off wells are oriented north north-east of the proposed pit area to intercept 150L/s (essentially the mine processing water use requirement). Their role appears to be to intercept any potentially contaminated underground water migrating beyond the mining lease.
- Theoretically, under the modelling scenario adopted, all underground water leaving the mine site through this zone can be intercepted except in the final two years of mine operation, wherein there is an 11% excess volume. Accordingly, in the final two years of operations, there is a threat of contaminated underground waters leaving the site that has not been addressed.
- Post-closure, the dewatering cone of drawdown does not fully recover to pre-mining groundwater levels. Essentially, the pit (lake) becomes a permanent groundwater sink. Whilst this may, in the short to medium term, assist in restricting off-site migration of any contaminated underground water, there is nonetheless a stated effect for 550 years (the duration of the post-mining model). Whether this impacts on the 'seasonal perched Quaternary aquifer' or any other perched groundwater system remains unknown. If any connections exist, this would have implications for any stock bores in the zone of influence.

Reporting limitations

- Whilst technically sound, the reporting of the test pumping and groundwater modelling is lacking appropriate context. It neither transparently explains the assumptions of the hydrogeological conceptualisation nor does it discuss results in terms of the wider environmental implications.
- The report neglects to address any surface water and groundwater interactions.
- The report neglects to address any near surface waters.
- Inter alia, the report does not address potential impacts to any groundwater dependent ecosystems in the zone of influence.

- It is noted that the Coastal Granites are highly fractured and productive aquifers (up to 10 L/s) and GW discharge quality, as a result of mining, may have potential to exceed the ANZECC water quality guidelines for ecosystems.
- Only the middle two layers of the GWM are verified by field investigations.
 - The deeper 4th layer assumes the rocks are tighter at depth therefore less permeable. This may not necessarily be the case as deep fractures may occur in fault zones in the Yorke Peninsula.
 - The 'seasonal perched Quaternary aquifer' has not been the subject of any field investigations. We recommend that, at a minimum, existing geotechnical logs from drill-holes and/or excavated test pits should be examined and pertinent data extracted (e.g. permeability values) to inform the groundwater modelling (Layer 1).
- Operationally, it is unclear whether the mine is to have a dedicated water supply wellfield (to be drilled east of the proposed pit location of Wells 23-27 – Coastal Granites). This again requires clarification.
- The cone of drawdown will be steep; however there may be linear extensions of less steep but more extensive drawdown along lines of enhanced permeability due to fracturing sympathetic with the regional geological faulting. No discussion of this is offered.
- The water quality in the ore body versus the granite GW systems may be different. If so, a discussion is required as to how the disposal of the dewatered water and interaction between these different quality waters would be managed.
- The reporting results in an apparent disconnect between the high yields intercepted during mineral RC drilling and dedicated water well drilling. This may be because fractures are essentially vertical and therefore wells drilled at the vertical may fail to intercept the more permeable fracture zones (as opposed to mineral holes drilled at angles that may intercept a number of sets of the fracture by their orientation). This leads to some confusion in the conceptualisation of the hydrogeology in that testing is indicating relatively impermeable conditions whilst the mineral drilling suggests that the geological zones can be highly permeability. Further clarification is required.

Specific to the Mining Plus DFS Report, dated 9 May 2013, the following comments are made.

- The well completion summary Table 1 and Figure 1 appear to be a subset of the complete program of wells drilled. No clear reason is given for not including all wells.
- The drilling and test-pumping program is aligned to the pit rock mass, hanging wall and footwall zones only. Reasons are not given for the omission of other geological zones.
- Discussion the results of the test pumping program is perfunctory. The DFS report states that all wells with airlift yield more than 1L/s were tested, but in the pre-feasibility report there were more wells stated that fit this definition. If results were selectively reported, a reason for this is not given.

Recommendations

This review recognises that the effort put into a groundwater modelling study is dependent on timing and budgetary constraints that are generally not known to us. That said, our review identifies a clear need for a third party peer review of the Proponent's groundwater assessment, including the groundwater model. It is open to us to assume that the modellers have satisfied themselves as to the impacts, but have failed to articulate their outcomes to the extent required for the public and decision makers to have confidence in the work.

There are firm guidelines for reviewing groundwater models, but not for the associated groundwater assessments. For this reason, the checklists in the Australian groundwater flow modelling guidelines should be used for both assessments. The appropriate guideline is '*Australian groundwater modelling guidelines*', Waterlines report No 82 - June 2012, published by the Australian Government, National Water Commission ('the guidelines').

The guidelines act as a point of reference, rather than a rigid standard. They seek to provide direction in terms of the scope and approaches common to modelling projects. The guidelines seek to provide a common terminology that can be adopted by all stakeholders typically involved in modelling projects. They are directed at both non-specialist modellers and specialist modellers because they provide a view of the model development process as well as best practice guidance on topics such as:

- reporting
- data analysis
- conceptualisation
- model design
- calibration
- verification
- prediction
- sensitivity analysis and
- uncertainty analysis

to create greater consistency in approaches.

We recommend that the South Australian Government's assessment and approval bodies consider these key recommendations and defer its decision making processes until such time as such a review (conducted in accordance with appropriately defined terms) is presented by the Proponent.

We trust this is acceptable. Please do not hesitate to contact this office if you require any further details or elaboration.

Yours faithfully,

Eric Rooke
Principal Hydrogeologist
BScGeo(Hons) MScHydGeo FGS MIAH

Chris Anderson
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Engineer & Scientist
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By Courier Email Facsimile Post
Enclosures –

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**).

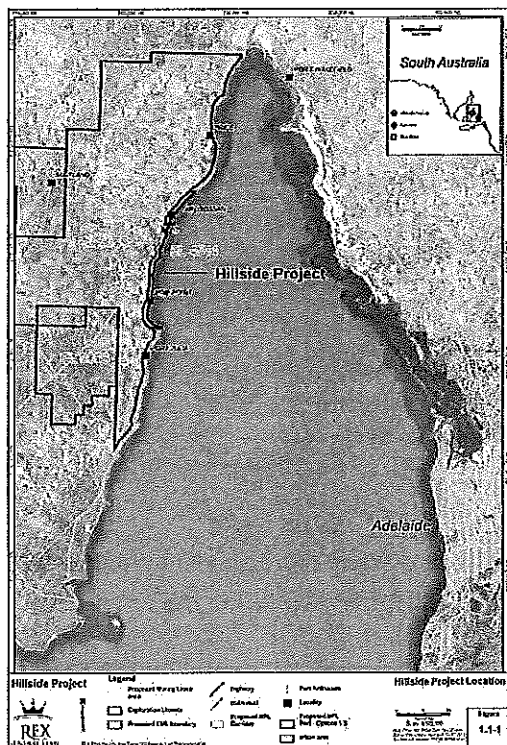
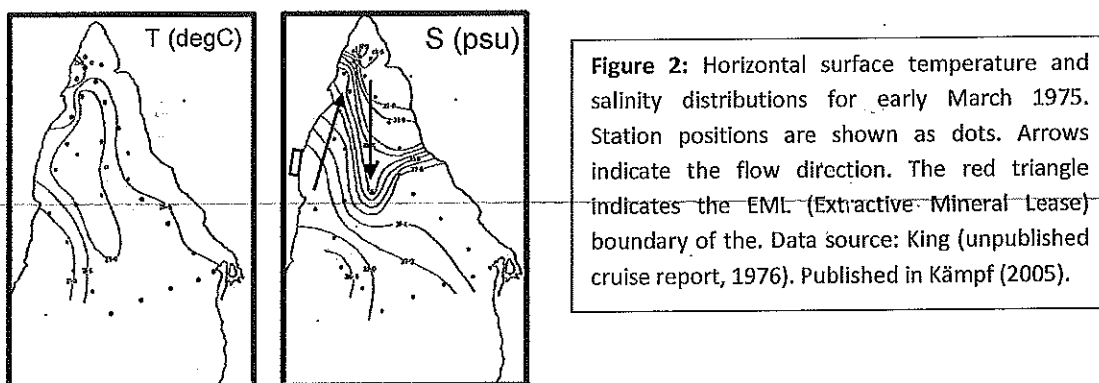


Figure 1: Proposed Hillside Project Location. The red-bounded area indicates the EML (Extractive Mineral Lease) boundary. Taken from the proponent’s proposal.

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.

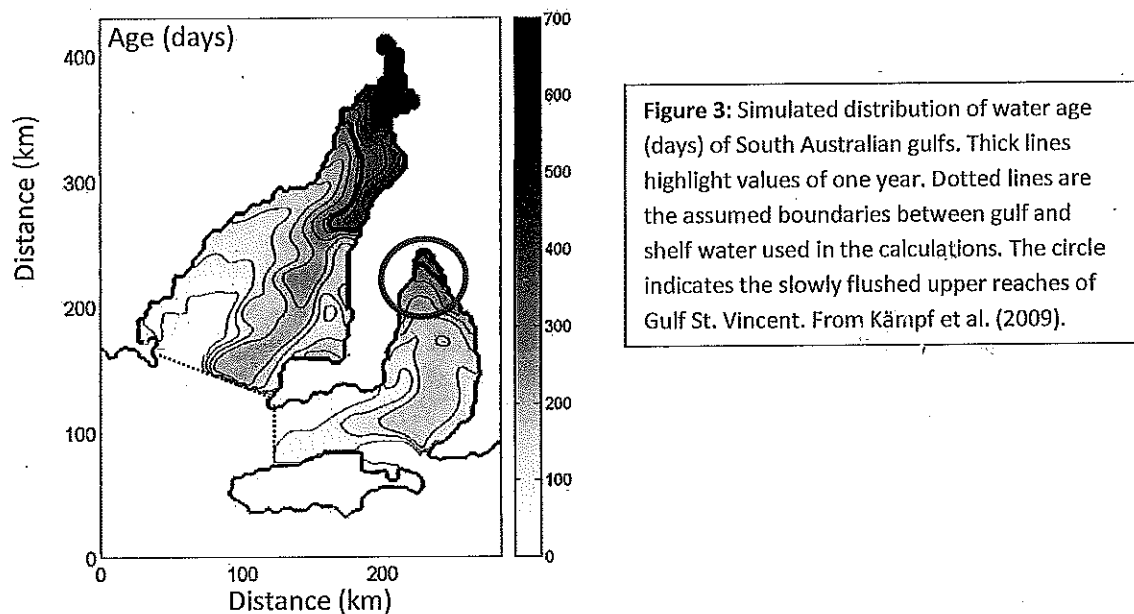


Although the proponent acknowledges the ecologic significance of the upper Gulf St. Vincent, the proponent decided to ignore a number of recent oceanographic studies documenting the circulation (Bye and Kämpf, 2005) and the slow flushing of this region (e.g. Kämpf et al., 2009; Kämpf, 2014). For coastal 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 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.



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.

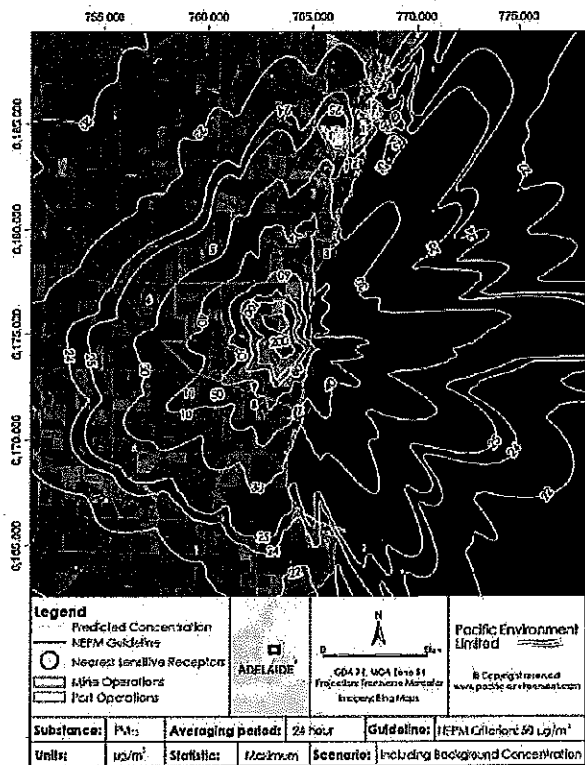


Figure 4: Predicted maximum 24-hour PM₁₀ concentration – including background concentrations with dust emission controls in place. Figure 8.3-2 of the proponent's proposal.

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

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