



Hillside Copper Mine
Coastal and Marine Management Plan
Program for Environment Protection and Rehabilitation (PEPR)

COASTAL AND MARINE MANAGEMENT PLAN

DRAFT

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Revision History

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1.0	12/7/2017	Draft - Technical
2.0	18/7/2017	Management Review
3.0	20/7/2017	Distributed to HMCV website & DPC

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Definition of Terms

ACR	Annual Compliance Report
AQMP	Air Quality Management Plan
BOM	Australian Government – Bureau of Meteorology
DSD	Department of State Development, South Australia
EFS	Extended Feasibility Study announced by Rex Minerals in May 2015
EML	Extractive Minerals Lease 6439
EMS	Environmental Management System
GSV	Gulf St Vincent
GWMP	Ground Water Management Plan
HMCV	Hillside Mine Community Voice
IS14001:2004	Environmental management systems – Requirements with guidance for use
LoM	Life of Mine
ML	Mineral Lease 6438
MLP	Mining Lease Proposal
CMMP	Coastal and Marine Management Plan
MPL	Miscellaneous Purpose Licence 146 (infrastructure corridor)
ppt	Grams of salt per kilogram of sea water
RSF	Rock Storage Facilities
SWMP	Surface Water Management Plan
TSF	Tailings storage facility
YP	Yorke Peninsula
YPC	Yorke Peninsula Council

1. INTRODUCTION

Rex Minerals Limited plans to develop and operate the Hillside Mine, situated 12 kilometres south of the township of Ardrossan. Conventional open cut mining techniques will be employed using trucks and excavators to deliver ore to a processing plant that will produce a copper concentrate.

This Plan provides a description of the measures to be implemented by the Hillside Mine to manage the impacts on the coastal and marine ecosystem and comply with the conditions outlined within the ML, EML and MPL conditions and other statutory requirements.

1.1 ENVIRONMENTAL MANAGEMENT SYSTEM

Rex Minerals is committed to minimising the impact of its operations on the local environment and community, and is developing a comprehensive Environmental Management System (EMS), that will be based on the International Standard 14001:2004. This CMMP is a component of the Hillside Mine EMS.

1.2 OBJECTIVES

The objective of this Plan is to provide the framework for:

- ensuring compliance with all relevant statutory requirements;
- Rex Minerals Policies and Standards;
- implementing tools and practices to manage and minimise the impact of mining activities on the coastal and marine environment;
- providing details on marine monitoring responsibilities; and
- maintaining an effective response mechanism to deal with issues and complaints.

2. MARINE CONDITIONS

The conditions for Hillside Mine ML state that Rex Minerals must comply with all State and Commonwealth legislation and regulations applicable to the proposed mining activities in particular:

- Environment Protection Act 1993
- Harbors and Navigation Act 1993
- Marine Parks Act 2007

There are no conditions for the marine environment on the EML and MPL.

3. MARINE OUTCOMES

The following Hillside Mine ML clause (Sixth Schedule) relates to Coastal and Marine Outcomes:

26. The Tenement Holder must ensure that there is no loss of abundance and diversity of marine flora and fauna from contaminants and dust deposition resulting from mining operations during and post mine completion.

4. BASELINE MEASUREMENTS AND MODELLING

Gulf St Vincent (GSV) is characterised by relatively high mean salinities ranging from 35.5 to 42.0 ppt and temperatures above 26°C in summer (Bye, 1976). The majority of the coastline is sheltered with low wave energy, weak currents, and extensive areas of quiet water shallows.

Low annual rainfall and high summer temperatures combined with relatively shallow waters, particularly on the expansive intertidal flats, mean that evaporation rates exceed fresh-water input. This results in higher seawater salinity in the upper reaches of GSV than in the southern, Kangaroo Island end. Gulf waters have a limited exchange with the Southern Ocean in the Investigator Strait.

Net clockwise water circulation in the GSV is “in” at the surface and “out” along the bottom, which is opposite to that of classical estuarine circulation. For this reason, GSV is referred to as a reverse (or inverse) estuary. Upper Gulf waters are typically turbid as a result of the input of suspended carbonate matter from the south, which is transported northwards along the long-shore drift to the upper Gulf area (Shepherd & Sprigg, 1976).

The tidal range at the entrance of GSV is about 1m increasing to 3m at the upper reaches of the Gulf (Schulter, et al., 1995). The most defining tidal patterns of GSV are the periods of dodge tides; a South Australian term for flat neaps, that is when neap tides have minimal rise or fall over a 24 hour period. GSV experiences dodge tides for 1-2 days twice a month. Kangaroo Island at the mouth of the Gulf slows tidal flushing; it takes 80-100 days for Gulf waters to completely flush through. Wind waves rather than currents are the main modifying factor for the eastern coast of Yorke Peninsula (Edyvane, 1999).

The seagrass communities growing on the sand substrates in the Hillside Mine survey area were dominated by species from the *Posidonia* genus; *P. sinuosa*, *P. angustifolia* and *P. australis*, (COOE, 2011). The seagrass communities identified and mapped in the baseline survey are shown in Figure 1.

The lower intertidal zone was composed of patches of *Zostera* (*Z. tasmanica*) and *P. australis*. The deeper subtidal waters (water depth greater than -7m) consisted of sparse to medium dense mixed communities of *Halophila*, *Zostera* and *Posidonia* seagrass and sparse filter feeders such as Razorfish (*Pinna bicolor*), sponges, soft corals (*Gorgonia* sea fans - order *Alcyonacea*) and hydroids.

There was very little reef habitat recorded throughout the survey area. Of the reefs recorded, these habitats consisted of rock boulders and broken bottom reef with sparse macroalage and filter feeding communities. The marine habitats were dominated by seagrass communities that are widespread in the Upper GSV.

Status of the coastal and marine environment identified in the baseline survey of 2011:

- intertidal and coastal habitats: these habitats consist of cliff face intersected with gullies supporting vegetation and coastal birds and fauna, including 47 plant and 11 bird species identified in the baseline survey;
- subtidal habitats: predominantly a sandy bottom supporting seagrass communities and rocky reefs;
- the seagrass communities in 2011 consisted of extensive areas of dense and healthy *Posidonia*, *Halophila* and *Zostera* communities with filter feeders such as razorfish, sponges, soft corals and hydroids;

- subtidal sediment characteristics were generally sandy with some fines. Chemical analysis found elevated concentrations of metals including copper, zinc, arsenic and cobalt around the wharf and elevated hydrocarbons in the diesel and heavy fuel range (C15 to C28) just off Rogues Point.

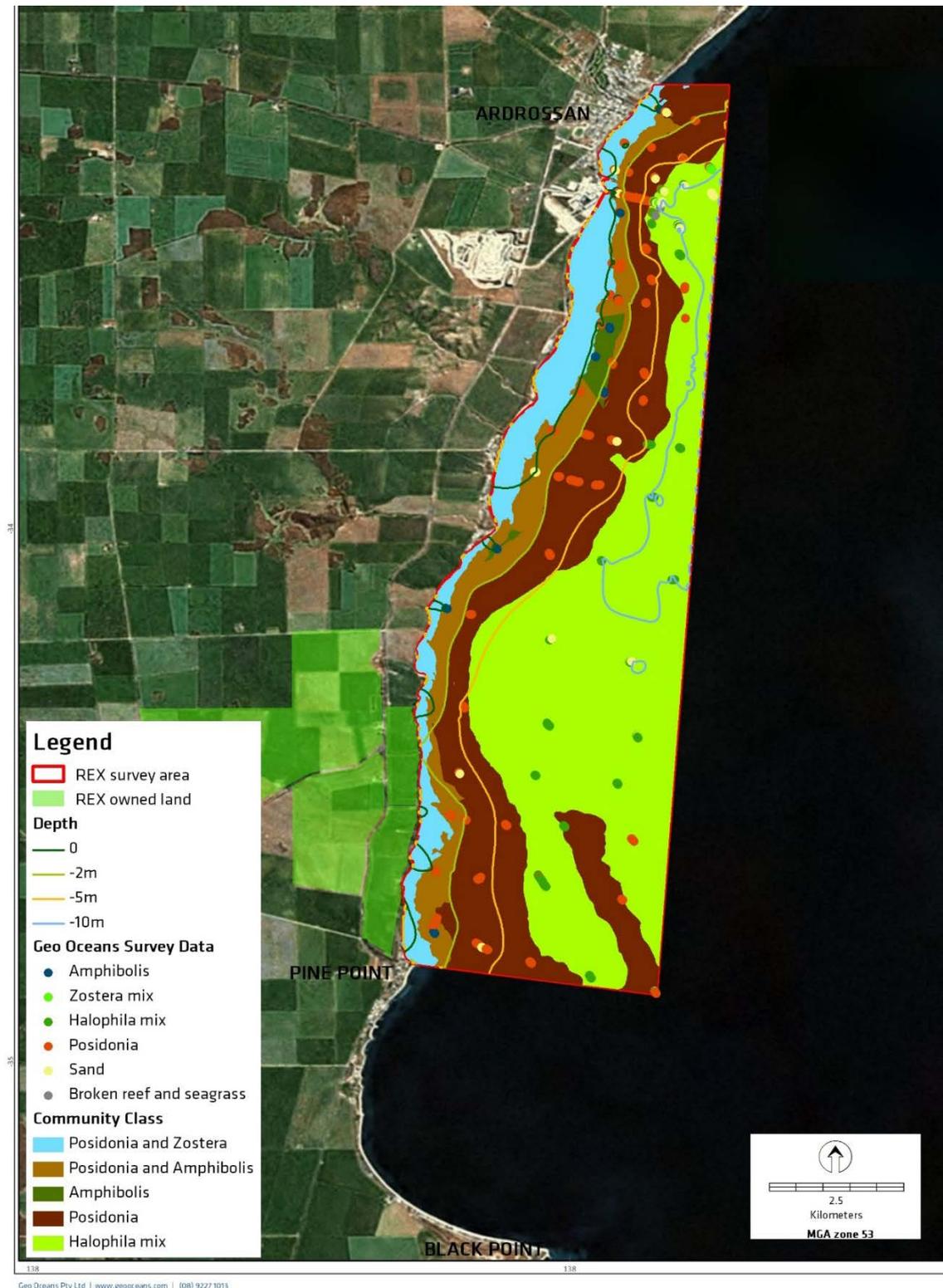


Figure 1: Baseline Survey of Seagrass Community Distributions

5. UNCERTAINTY ASSESSMENT

Key assumptions made in predicting marine impacts by the Hillside Mine and in recommending mitigation and management controls are:

- all potentially contaminated runoff from the mine footprint will be contained within the RSF and will be reporting the pit or engineered ponds;
- runoff from the outer surface of the RSF may contain sediment but no potentially harmful contaminants;
- the surface water management system will trap sediments and prevent their release to the natural drainage system in the area.

6. KEY RISKS

The proposed mining activities will not be using the Port at Ardrossan, as in the original mine design, all concentrate will be processed on the Hillside Mine ML and no discharges to the sea are anticipated. Therefore, the risks from marine transport and loading at Ardrossan have been engineered out of the current mine plan.

Sediment bearing runoff from exposed surfaces may impact the coastal strip and nearby marine habitats, stormwater runoff potentially containing sediment from the mine may enter the sea and adversely affect coastal and seagrass communities by increasing water turbidity and sediment deposition. The engineered sumps, drains and diversions will considerably reduce the level of risks of contaminated surface water reaching the marine environment (SWMP).

The main impacts on the marine environment would be reduced seagrass productivity from potential suspended particles and changing of marine substrates and associated habitats.

Actual effects on seagrass communities are likely to be insignificant if sediment and dust inputs to the water column are adequately controlled.

The risk of soluble metals such as copper entering the marine environment via surface or ground water flow was investigated. The investigations including a groundwater model, found that the risk for copper and other metals, and nutrients to reach the marine environment is low to negligible (GWMP).

The risk of dust dispersion from RSF, TSF and other exposed surfaces reaching the marine environment is low after dust suppression measures and progressive rehabilitation are implemented (AQMP).

7. MARINE CONTROL MEASURES

Control measures for dust and airborne contaminants have been addressed in the AQMP.

Control measures will be implemented to prevent sediments leaving the mine site, particularly with the presence of surface water runoff points adjacent to the site, as provided in the SWMP. Any suspended sediments that may arise despite mine control measures would disperse offshore with the finer particles moving out further from the coastline.

Monitoring of coastal and marine flora and fauna will help to detect any changes in mine-derived pollutants, and provide a measure of the success of the control measures implemented.

7.1 PRO-ACTIVE

The engineered water diversion system and sumps and progressive rehabilitation will provide the primary control measures for preventing sediment and dust reaching the coastal and marine environment.

7.2 MITIGATION MEASURES

There are no direct mitigation measures for the marine environment as no planned mining activities will interact with the coastal or marine environment. Upstream mitigation measures that act to prevent impacts on the marine environment include the SWMP and the AQMP.

A marine monitoring program will be implemented to verify the effectiveness of surface water contamination and dust prevention measures.

8. CONSULTATION

The coastal and marine baseline studies were presented to community through community consultation meetings including the HMCV. Rex Minerals continues this communication through the HMCV, and results of monitoring program will be included in the ACR.

9. RESPONSE PROCEDURES

Should marine monitoring find trends that signal potential marine impacts, that are attributable to mining activities, Hillside Mine management will be immediately notified, and an investigation mining activities will be undertaken to identify the potential source and implement corrective measures. Likely corrective measures will consist of modifications to the relevant upstream operational response procedures, and to the AQMP, GWMP or the SWMP. Should the impact be outside the scope of the management plans that address the potential causes of contaminates on the marine environment, then Hillside Mine management will consult with a marine specialist to investigate and recommend remedial action.

A response procedure or contingency plan is not required for the CMMP as any potential impact on the marine ecosystem will be addressed by upstream operational responses.

10. MONITORING PROGRAM

The proposed monitoring program is designed to track changes to the coastal and marine habitats close to the Hillside Mine. The coastal and marine ecological baseline surveys undertaken for the MLP (COOE, 2011) form a basis of the proposed monitoring program.

10.1 RATIONAL FOR THE MONITORING PROGRAM

The proposed construction and operational activities of the Hillside Mine have the potential to impact the coastal and marine environments near to the Project site. The current mine plan excludes activities at Port Ardrossan and will therefore be excluded from the monitoring program. The baseline environmental surveys for the coastal and marine habitats at Port Ardrossan have already been established.

The monitoring objective is:

- to demonstrate that there is no loss of abundance and diversity of marine flora and fauna from contaminants and dust deposition resulting from mining operations during and post mine completion.

Without the Port Ardrossan activities, any potential risk to the coastal and marine environment would be through suspended sediments and contaminants in surface runoff waters or dust deposition. The AQMP

and SWMP will be the primary measures for demonstrating that the marine environment is being protected from contaminated waters or dust.

The proposed coastal and marine monitoring program is designed to provide supporting evidence to the assumption that contaminants and dust from mining activities do not have a detectable impact on the coast and marine environment.

10.1.1 Abundance of Marine Flora and Fauna

The highest risk from potential contaminants and dust deposition is to seagrass health. Suspended particulates from dust deposition or sediment bearing runoff will have a direct impact on sedentary marine organisms. Seagrass is one of the most sensitive sedentary marine organisms to suspended particulates because light attenuation will reduce photosynthesis and therefore bioproductivity.

The primary aims of the seagrass monitoring program are to:

- determine the species composition and density of the seagrass communities;
- assess the condition of seagrass communities.

The program will be conducted annually by a marine scientist using the baseline sampling sites and modified methodology appropriate for the operational and post closure phase of mining. Sampling sites R1 to R5 that were set-up as long term seagrass monitoring sites during the Baseline Survey will be used as seagrass health monitoring sites.

Table 1 provides the GPS coordinates of the permanent monitoring sites and mapped in Figure 2. Sites R1 to R3 are in the potential impact zone and sites R4 and R5 are in a transition zone or control sites.

Table 1: Coordinates of Marine Monitoring Sites

Site	Zone	Easting	Northing
R1	53 H	766707.68 m E	6171206.43 m S
R2	53 H	766516.70 m E	6173773.05 m S
R3	53 H	765654.93 m E	6176562.44 m S
R4	53 H	767605.00 m E	6179034.17 m S
R5	53 H	768731.08 m E	6181129.76 m S

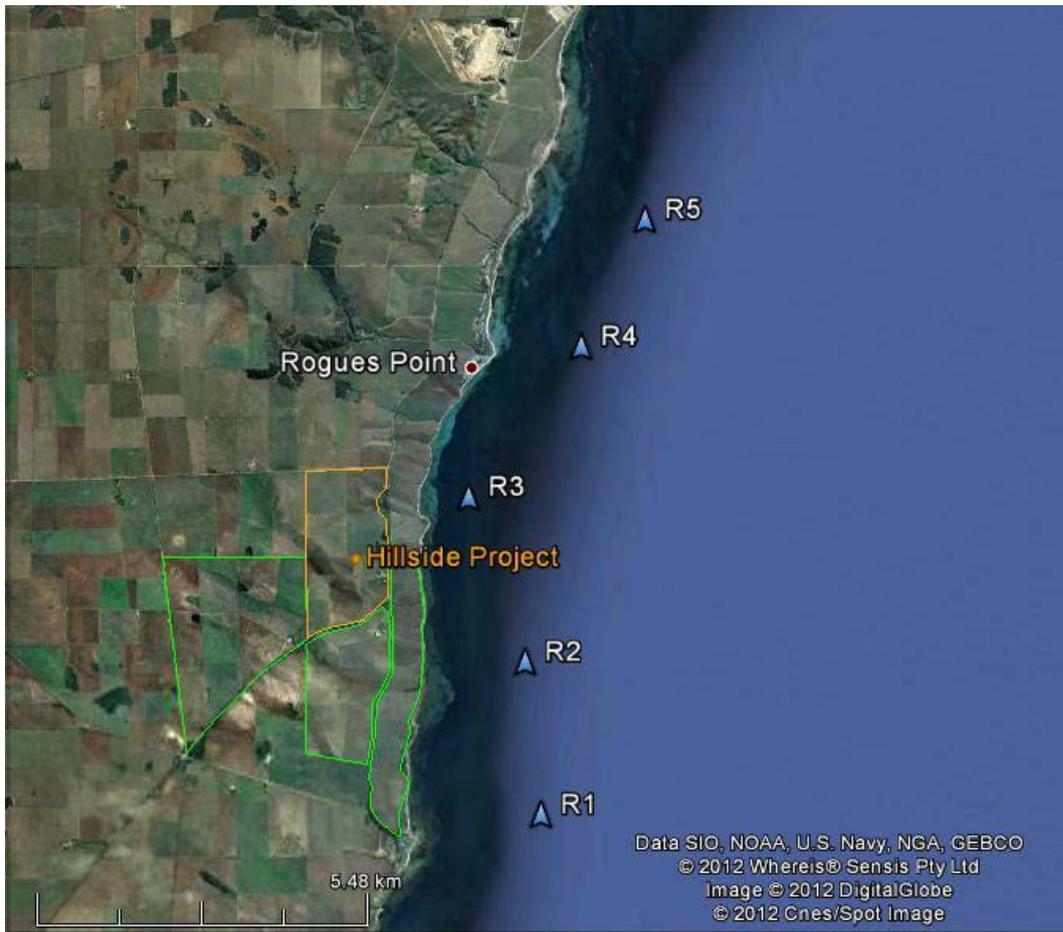


Figure 2: Seagrass Monitoring Sites

The permanent underwater monitoring sites were established using a sub-surface buoy extending 1m above the seafloor as a photographic target. The buoys were attached to 1m nylon cord and secured to the seafloor using stainless steel anchors hammered into the substrate, Figure 3.



Figure 3: Site R5 permanent marker, in dense *Posidonia sinuosa*

The monitoring activities proposed at each dive site will consist of the following:

- Photographs of the seagrass at each site, taken 1.5m due south of each buoy from a height of 1.5m above the seafloor using a digital underwater camera.
- A 50m measuring tape is randomly laid out on the seafloor. A scientific diver will swim along the tape and record the types of seagrass occurring within 1m of the tape and make an estimate of the percentage cover of each seagrass species.
- Representative photographs of the seagrass communities will be taken along each transect.
- The seagrass *Posidonia sinuosa* will be harvested from three randomly placed 25cm x 25cm quadrats by cutting the seagrass leaves off where the leaves join the rhizome (usually at the level of the substrate). The leaves will be placed in labelled plastic bags and frozen prior to analysis in the laboratory.
- In the laboratory excess water will be removed from seagrass samples by allowing to passively dry for 30 minutes. The wet weight of combined samples from each site will be measured.
- The length of seagrass leaves will also be measured to determine the mean length and standard deviation of seagrass leaves at each site.

10.1.2 Diversity of Marine Flora and Fauna

Diversity of marine flora and fauna was mapped during the baseline survey using underwater video transects using georeferenced frames. This methodology was appropriate for marine mapping of baseline conditions; in the annual marine monitoring program it is proposed to lower a video camera at randomly selected locations between Pine Point and Rogues Point to identify the seagrass species and marine habitat type.

Figure 1 shows that significant seabed diversity can occur within each habitat type for example, sandy bottom will occur within an area classified as *Posidonia*. Therefore, the video camera will be allowed to traverse a distance of approximately 50m as the boat drifts over the bottom. At each randomly selected site the seagrass species and seabed type and an approximate ground cover percentage will be recorded using the same classifications system as the baseline.

A photo-point and walk-over survey of the coastal foreshore will be undertaken between Pine Point and Rogues Point. Six permanent photo points will be established to track the ongoing erosion of the foreshore, cliffs and gullies. This is intended to provide a historic record to demonstrate that mining activities do not have an impact on the coastal and marine habitats bordering the mine tenement boundary. Rehabilitation of the coastal hinterland between the cliffs and the main road with concurrent weed and pest control should have a positive impact on the coastal ecosystem.

10.1.3 Frequency of monitoring

Both the seagrass health (indicator of abundance) and seabed type (indicator of diversity) will be monitored around the same time each year to minimise the effect of seasonal variation. An annual walk-over and photo-point survey will be conducted to validate the assumption of no impact on the cliff and foreshore ecosystem.

An artificial reef was installed north of Rogues Point, in 2016. This significant activity may have impacted the marine habitats mapped during the baseline surveys of 2011. Therefore, the first marine monitoring event will be undertaken before any Hillside Mine construction activities commence to confirm that the baseline conditions have not been effected by this major marine activity.

11. REPORTING

Seagrass health and seabed classification data will be analysed and compared to baseline conditions and historic surveys to detect trends. The results will be reported in the ACR.

The results of the coastal habitat photo monitoring and visual survey will be reported with the Seagrass and Marine Habitat Annual Monitoring Report.

12. PERFORMANCE INDICATORS

To demonstrate that there are no adverse effects on the coastal and marine ecosystem the marine monitoring needs to show that the baseline conditions for seagrass health and seabed habitat have not been adversely effected by mining activities.

The baseline data, validated by a pre mine commencement survey, will be used to measure performance over the Hillside Mine life and post closure. No significant change is expected from the baseline indicator values other than can be reasonably explained by seasonal variation and natural ecological habitat creep, particularly that attributable to climate change.

13. CONTINUAL IMPROVEMENT

Rex Minerals will apply the best practice principals to mining and environmental management. The operating procedures and monitoring programs will be reviewed and improved as new technology or better methods develop over time.

14. REVIEW

The Plan will be reviewed annually, and updated if required to ensure that the monitoring is generating robust information to detect any changes to the coastal or marine environment.

15. REFERENCES

- Bye, J. A. T., 1976. Physical oceanography of Gulf St Vincent and Investigator Strait. In: C. R. Twidale, M. J. Tyler & B. P. Webb, eds. *Natural History of the Adelaide Region*. Adelaide: Royal Society of SA Inc.,.
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16. APPENDICES

Appendix 1: Correspondence Records

Key relevant communications with DSD, HMCV, YP Council and the community relating to this management plan are detailed below.

Date	Communication with	Action or Outcomes
06/03/2017	HMCV	Presentation on COOE Baseline Marine Survey.
20/07/2017	HMCV	Distribution of draft Plan to HMCV website.
20/07/2017	DPC	Draft plan sent to DPC.

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Appendix 2: Coastal and Marine Management Plan Requirements Checklist

Condition	Requirement	Section
Rex Minerals Hillside Mine Mineral Lease Conditions (ML 6438) Sixth Schedule		
Coastal & Marine Outcome		
26	The Tenement Holder must ensure no loss of abundance and diversity of marine flora and fauna from contaminants and dust deposition resulting from mining operations, during operations and post mine completion.	3, 4, 7, 10
Condition	Requirement	Section
Rex Minerals Hillside Mine Extractive Mineral Lease Conditions (EML 6439) Sixth Schedule		
Coast & Marine Disturbance Outcome		
There are no conditions for the marine environment on the EML and MPL.		
Condition	Requirement	Section
Rex Minerals Hillside Mine Miscellaneous Purposes Licence Conditions (MPL 146) Second Schedule		
Coast and Marine Outcome		
There are no conditions for the marine environment on the EML and MPL		