Gold Mine Developments on Lake Lefroy

WMC Resources Ltd (St Ives Gold)

Report and recommendations
of the Environmental Protection Authority

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Summary and recommendations

WMC Resources Ltd (St Ives Gold), proposes to develop a series of gold mining pits, associated waste rock dumps, access infrastructure and mining support facilities on Lake Lefroy, a naturally occurring salt lake approximately 7 km southeast of Kambalda. This report provides the Environmental Protection Authority's (EPA's) advice and recommendations to the Minister for the Environment on the environmental factors relevant to the proposal.

Section 44 of the *Environmental Protection Act 1986* (EP Act) requires the Environmental Protection Authority (EPA) to report to the Minister for the Environment on the environmental factors relevant to the proposal and on the conditions and procedures to which the proposal should be subject, if implemented. In addition, the EPA may make recommendations as it sees fit.

Relevant environmental factors

In the EPA's opinion, the following are the environmental factors relevant to the proposal, which require detailed evaluation in the report:

(a) Nature conservation values – poor representation of salt lake ecosystems in the conservation estate and the possibility that Lake Lefroy may contain unique environmental values making it worthy of inclusion into the State's conservation estate;

(b) Rehabilitation – avoidance of long-term impacts on landform and lake hydrology;

(c) Groundwater quality – effects of pit dewatering and groundwater contamination from mining activities;

(d) Surface water quality - contamination of surface water and effects on aquatic fauna habitat; and

(e) Lake Lefroy – effects of landform changes on lake hydrology and associated ecosystems.

Conclusion

The EPA has considered the proposal by WMC Resources Ltd (St Ives Gold) to develop a series of gold mining pits, associated waste rock dumps, access infrastructure and mining support facilities on Lake Lefroy. In essence the proposal comprises a number of essentially similar mine pits over time which can be managed using a generic and progressively updated Environmental Management Program (EMP). In considering this proposal, the EPA is aware that although at the completion of mining a series of pits will have been developed, at any one time over the life of the project, the environmental impacts on the lake system should primarily be confined only to areas where mining is currently occurring. Rehabilitation of previously mined areas generally occurs as new mining pits are developed. Accordingly, the EPA has suggested a mechanism to allow for some flexibility in the sequencing of mining pit development provided the proponent details in its EMP the environmental planning and management for each of the pits as they are developed. The adequacy of the environmental planning and management will be reviewed by appropriate Government agencies with statutory authority for the project.

The EPA has concluded that the proposal is capable of being managed to meet the EPA's objectives provided there is satisfactory implementation by the proponent of the proponent's commitments and the recommended conditions set out in Appendix 5 and summarised in Section 6.

Recommendations

The EPA submits the following recommendations to the Minister for the Environment:

1. That the Minister notes that the proposal being assessed is for development of a series of gold mining pits, associated waste rock dumps, access infrastructure and mining support facilities.
2. That the Minister considers the report on the relevant environmental factors as set out in Section 3.
3. That the Minister notes that the EPA has concluded that the proposal is capable of being managed to meet the EPA's objectives provided there is satisfactory implementation by the proponent of the recommended conditions set out in Appendix 5, and summarised in Section 6, including the proponent's commitments.
4. That the Minister imposes the conditions and procedures recommended in Appendix 5 of this report.
5. That the Minister notes under 'Other advice' the EPA's comments regarding representation of salt lake ecosystems in the State's conservation reserves system.

Conditions

Having considered the proponent's commitments and information provided in this report, the EPA has developed a set of conditions which the EPA recommends be imposed if the proposal by WMC Resources Ltd (St Ives Gold) to develop a series of gold mining pits, associated waste rock dumps, access infrastructure and mining support facilities on Lake Lefroy is approved for implementation. These conditions are presented in Appendix 5. Matters addressed in the conditions include the following:

(a) that the proponent shall fulfil the commitments in the Consolidated Commitments statement set out as an attachment to the recommended conditions in Appendix 5;

(b) that the proponent be required to prepare and implement an EMP that will be reviewed and updated on an annual basis. The EMP will detail, among other things, mining and rehabilitation plans for each pit and report the proponent's implementation of the program. The adequacy of the proponent's environmental planning and management will be reviewed by Government agencies with statutory responsibility for the project;

(c) that the proponent be required to prepare, make publicly available and implement a Final Decommissioning and Rehabilitation Plan to present the results from a review of closure planning conducted at least two years prior to the anticipated date of completion of mining; and

(d) where an additional site(s) or a variation to the proposed location of existing site(s) is identified within the project area and the proponent can demonstrate to the satisfaction of the EPA that the environmental impacts of mining at the particular site(s) are substantially the same as those sites previously indicated, mining may occur provided that all other requirements of the proposal are met. The Department of Environmental Protection (DEP) on behalf of the EPA will be responsible for assessing the significance of the environmental impacts and the adequacy of the proponent's environmental management measures and for providing formal written advice that the condition has been satisfied. Documentation prepared by the proponent as part of its requirement to satisfy this condition and the written advice of the DEP will be available on the public record.

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1. Introduction and background

This report provides the advice and recommendations of the Environmental Protection Authority to the Minister for the Environment on the environmental factors relevant to the proposal by WMC Resources Ltd (St Ives Gold), to develop a series of gold mining pits, some with underground portals and mining, on Lake Lefroy, a naturally occurring salt lake 7 km southeast of Kambalda (Figure 1).

St Ives Gold has been mining at Lake Lefroy since 1981. The EPA has previously considered new mining developments proposed by St Ives Gold on a mine by mine basis. This approach did not adequately address the cumulative environmental impacts that might occur from successive developments. It was considered that a strategic assessment of the environmental impacts from developing the known mining deposits within the project area defined by the proponent was required. St Ives Gold has already identified 13 deposits that are likely to be developed as gold mining pits. Development and mining of the pits requires dewatering to the lake, and construction of waste rock dumps and access infrastructure. The project will be supported by existing central administration, workshops, contractor's compounds and processing facilities. Some additional access infrastructure, workshop facilities and contractor's compounds may also be established to service mining of the new pits.

Further details of the proposal are presented in Section 2 of this report. Section 3 discusses environmental factors relevant to the proposal, and Section 4 provides for a degree of flexibility in the selection of minesites. Section 5 provides Other advice of the EPA. The Conditions and commitments to which the proposal should be subject, if the Minister determines that it may be implemented, are set out in Section 6. Section 7 presents the EPA's Conclusions and Section 8, the EPA's Recommendations.

Appendix 1 contains a list of individuals and organisations which provided submissions on the proposal. Appendix 2, is a list of references used in the preparation of the report. Appendix 3 provides a summary of the process of identifying relevant environmental factors and Appendix 4 is a summary of the assessment of the relevant environmental factors. The recommended environmental conditions and proponent's consolidated commitments are included as Appendix 5.

Appendix 6 contains a summary of submissions and the proponent's response to submissions and is included as a matter of information only and does not form part of the EPA's report and recommendations. Issues arising from this process and which have been taken into account by the EPA appear in the report itself.

2. The proposal

WMC Resources Ltd (St Ives Gold) has identified a project area and a number of sites for gold mine developments on Lake Lefroy. Thirteen sites have already been identified for development of open-cut gold mining pits, some with underground portals and mining. Approximately 21 million tonnes (Mt) of ore and 414 Mt of overburden will be mined during the life of the project. Waste rock dumps, access infrastructure and mining support facilities such as workshops and contractor's compounds will be associated with the mining developments. Administration, central maintenance and processing of ore will occur at the existing St Ives Gold operations to the south of the lake. The project area considered in the assessment and the approximate location of the identified resources are shown on Figure 2.

The main characteristics of the proposal are summarised in Table 1 below. A detailed description of the proposal is provided in Section 1 of the Public Environmental Review (PER) titled *'Gold Mine Developments on Lake Lefroy'*, WMC Resources Ltd (St Ives Gold), September 1999.

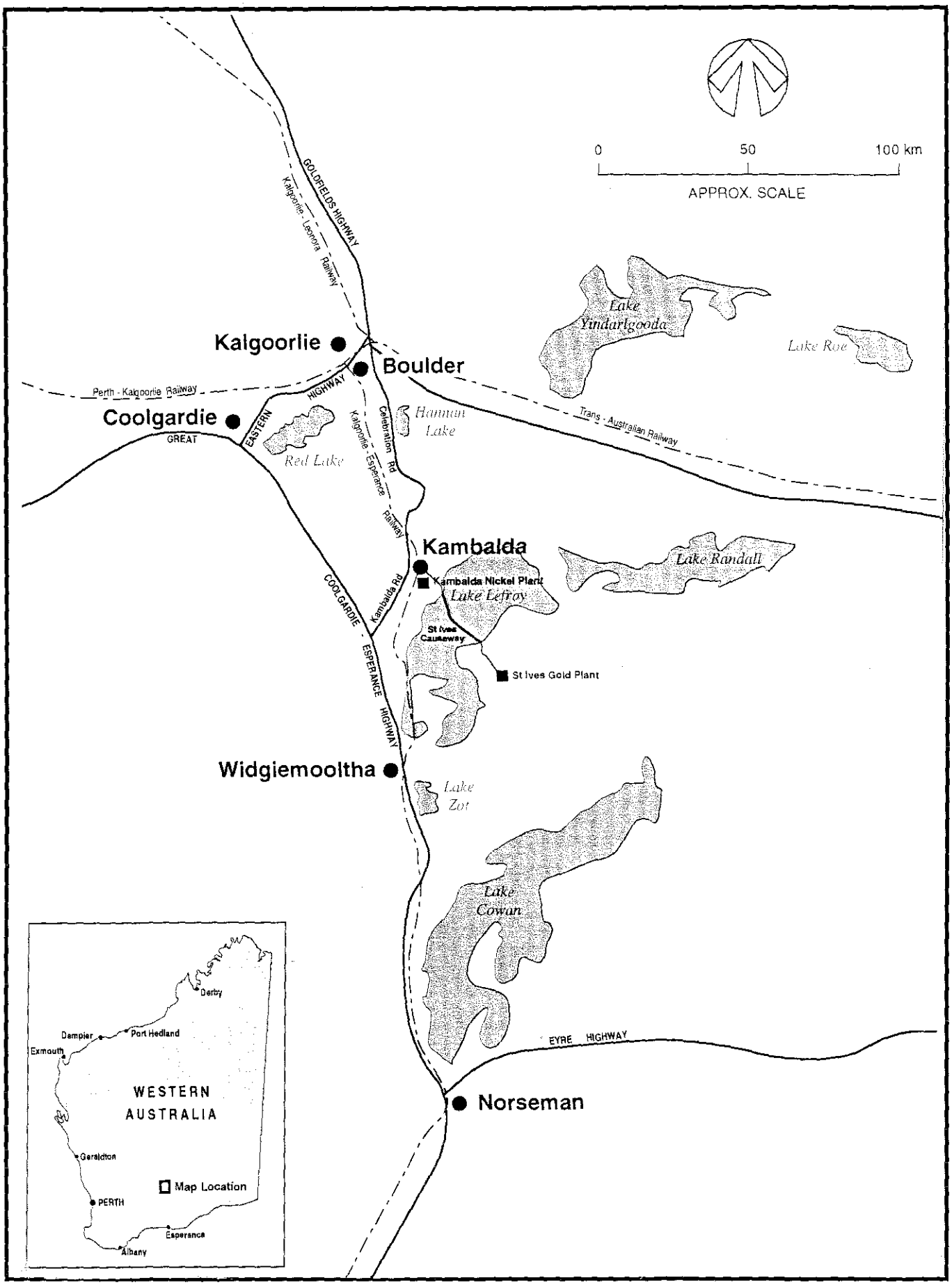

Figure 1. Location Plan, Gold Mine Developments on Lake Lefroy

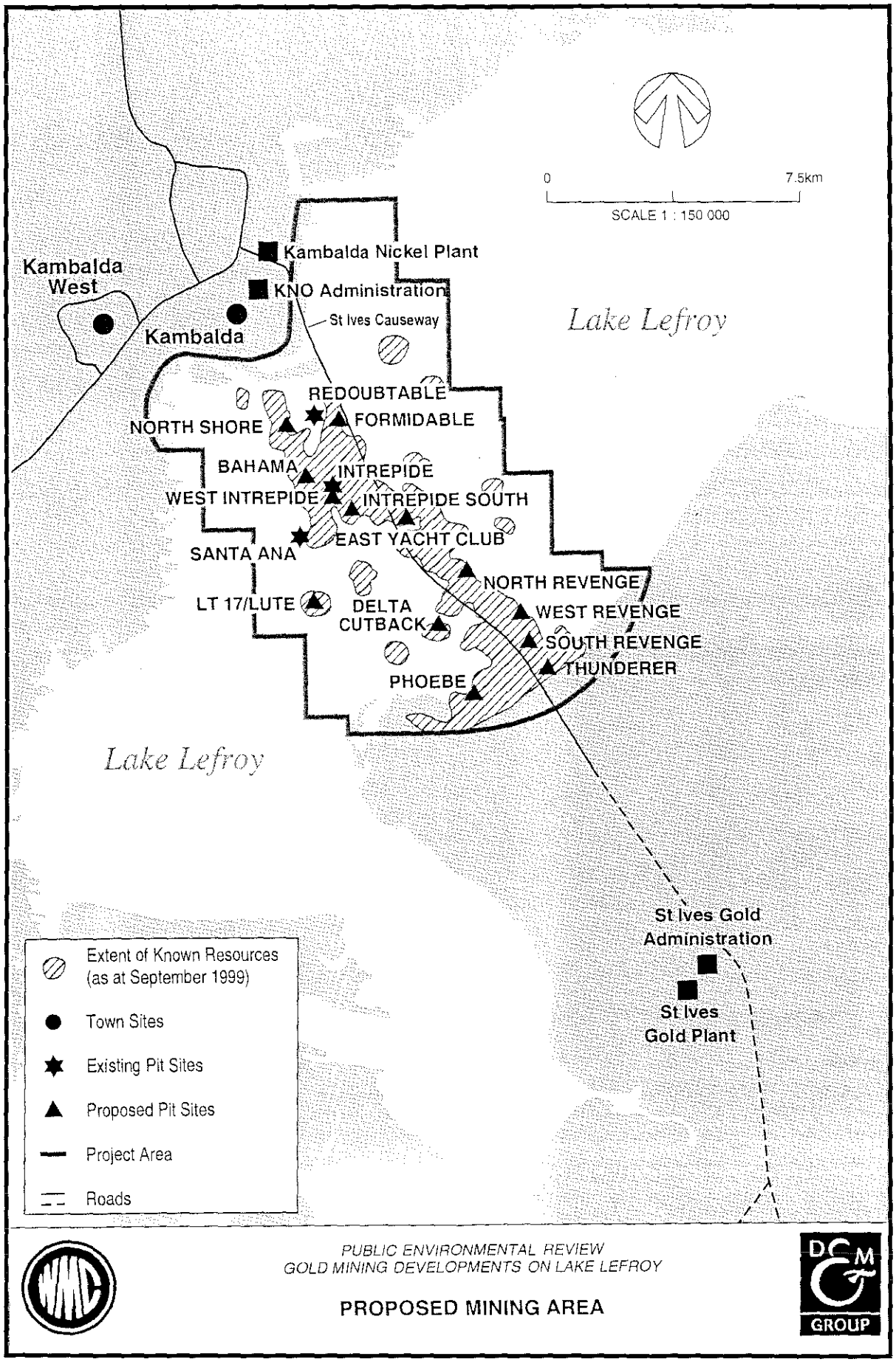

Figure 2. Gold Mining Sites and Project Area

Table 1. Key Characteristics Table

Element	Quantities/Description
Life of project	Approximately 10 years
Mining method	Open pit mining using conventional drilling, blasting, loading and hauling techniques. Underground mining may be conducted at some deposits.
Mining rate	Approximately 21 million tonnes of ore and 414 million tonnes of overburden will be mined during the ten year life of the project. The annual mining rate will vary dependant on the sequence of mining pits.
Mine operation	Continuous operation
Size of ore bodies	Approximately 435 million tonnes of ore and overburden
Strip ratio	Approximately 20:1
Depth of mining	30 - 150 metres
Dewatering volume rate (range)	4000 - 5000 Kilolitres per day for each pit
Approximate area of disturbance within the project area (including access)	805 hectares
List of major components and expected areas of disturbance over the life of the project • open pits • overburden dumps • infrastructure (bunds, causeways, roads, settlement ponds, ore pads etc) Total	 240 hectares 400 hectares 165 hectares 805 hectares

3. Relevant environmental factors

Section 44 of the *Environmental Protection Act 1986* (EP Act) requires the EPA to report to the Minister for the Environment on the environmental factors relevant to the proposal and the conditions and procedures, if any, to which the proposal should be subject. In addition, the EPA may make recommendations as it sees fit.

The identification process for the relevant factors is summarised in Appendix 3.

It is the EPA's opinion that the following are the environmental factors relevant to the proposal which require detailed evaluation in this report:

(a) Nature conservation values – poor representation of salt lake ecosystems in the conservation estate and the possibility that Lake Lefroy may contain unique environmental values making it worthy of inclusion into the State's conservation estate;

(b) Rehabilitation – avoidance of long-term impacts on landform and lake hydrology;

(c) Groundwater quality – effects of pit dewatering and groundwater contamination from mining activities;

(d) Surface water quality - contamination of surface water and effects on aquatic fauna habitat; and

(e) Lake Lefroy – effects of landform changes on lake hydrology and associated ecosystems.

The above relevant factors were identified from the EPA's consideration and review of all environmental factors (preliminary factors) generated from the PER document and the submissions received, in conjunction with the proposal characteristics.

Details on the relevant environmental factors and their assessment is contained in Sections 3.1 - 3.5. The description of each factor shows why it is relevant to the proposal and how it will be affected by the proposal. The assessment of each factor is where the EPA decides whether or not a proposal meets the environmental objective set for that factor.

A summary of the assessment of the environmental factors is presented in Appendix 4.

3.1 Nature conservation values

Description

Lake Lefroy is located in the Coolgardie Biogeographic Region. The lake is presently not part of the conservation reserves system. At a State level, salt lake ecosystems are generally poorly represented in the conservation reserves system.

The Lake Lefroy system or specific areas of the lake may contain environmental values that may make the lake worthy of inclusion in the conservation reserves system at a later date.

The majority of the project is located on the lake bed. The proponent has conducted a series of ecological investigations which indicate the lake bed is virtually devoid of vegetation and has a limited aquatic fauna present that is not considered unique. Fringing areas of the lake do support aquatic flora (*Schizothrix sp.*-algal mats) and aquatic invertebrate fauna, and terrestrial vegetation which provides habitat for fauna.

Development of 2 of the 13 pits, Phoebe and Thunderer, will result in disturbance of approximately 3 ha of these fringing areas. The site of proposed development of the Thunderer and Phoebe pits has been disturbed by previous sand mining and mine water discharge activities. The proponent has concluded from field surveys that the area of algal mats and fringing vegetation affected by this proposal represents a small portion of the total available habitat that is found on Lake Lefroy.

The proponent has conducted Declared Rare Flora (DRF), Priority species and Threatened fauna searches of the areas proposed for disturbance. No species in these categories were located.

Submissions

The Department of Conservation and Land Management (CALM) commented on the poor representation of salt lakes and their fringing vegetation in the Coolgardie Biogeographic Region conservation reserves. From the information provided by the proponent, CALM considered that Lake Lefroy may have specific conservation values worthy of protection. CALM also considered that it was likely that significant fauna species and Declared Rare Flora (DRF) were present in the area because it has previously been found in regional vegetation surveys of land surrounding and fringing the lake, that the vegetation is in good condition. In CALM's view this indicates Lake Lefroy may have high conservation value.

Assessment

The area considered for assessment of this factor is the Coolgardie Biogeographic Region.

The EPA's environmental objective for this factor is to ensure that nature conservation values are adequately represented at the local and regional level.

The proponent, in its response to CALM's submission, sought to clarify the results of the vegetation survey (referred to by CALM) that identified the lake system vegetation as being in good condition. The proponent identified that the survey noted areas of fringing vegetation around the existing mining operations (the subject of this assessment) were not considered in good condition. The EPA notes that no DRF, Priority species and Threatened fauna were recorded from searches of the fringing areas of the lake where disturbance is proposed (Thunderer and Phoebe pits).

It is also noted that ecological investigations have identified that the lakebed, the area mostly affected by mining disturbance, does not support significant or diverse populations of aquatic or terrestrial flora and fauna. However, undisturbed fringing and shoreline areas of the lake do support such populations, and the proponent has concluded that these areas should be protected from further mining disturbance. Three hectares of fringing areas are proposed to be disturbed by development of the Phoebe and Thunderer pits. It is noted that this 3 ha area has already been disturbed to some extent by existing mining operations and this has resulted in a reduction of its conservation values. The proponent has included a commitment to ensure that, except for the areas proposed for development of the Thunderer and Phoebe pits (approximately 3 ha), shoreline and fringing areas will be protected from the impacts of mining. In particular, shoreline areas will be protected from the impacts of discharge water by ensuring discharges are located away from and do not drain to these areas.

The EPA notes that Lake Lefroy is not presently included in the conservation reserves system. With regard to CALM's comments that salt lakes and their fringing vegetation are not well represented in the conservation reserves of the Coolgardie Biogeographic Region, the EPA has provided under 'Other Advice' some additional comments regarding representation of salt lakes in the State's conservation reserves system.

Summary

Having particular regard to:

(a) Lake Lefroy is not presently included in the conservation reserves system;

(b) mining operations are mostly confined to the lake bed that is virtually devoid of aquatic flora and fauna and hence, is not considered to have significant conservation value;

(c) lake fringing areas support populations of aquatic flora and fauna and terrestrial vegetation. Approximately 3 ha of fringing areas of the lake will be disturbed by mining. The area proposed for disturbance has already been affected by existing mining, does not contain DRF, Priority flora species or Threatened fauna and represents a small portion of the total available habitat of this type that is found on Lake Lefroy and hence, loss of this small area is also not considered to have significant environmental impact; and

(d) other than the 3 ha of fringing area proposed for disturbance, the proponent has included a commitment to protect shoreline and fringing areas from the impacts of mining by ensuring discharges are located away from and do not drain to them,

it is the EPA's opinion that there are no significant impacts on nature conservation values as a result of the proposal, and therefore the EPA's environmental objective for nature conservation values is unlikely to be compromised provided that the proponent's commitments are made legally enforceable and are implemented.

3.2 Rehabilitation

Description

Mining will result in disturbance of the lake bed to develop access causeways, mining pits, waste rock dumps and other support infrastructure. Dewatering discharges have potential to disturb hydrological and ecological processes of the lake and shoreline areas. Although some mining pits will be backfilled as successive pits are developed, others, at the completion of mining, may remain as voids. The proponent has included a commitment to progressively rehabilitate areas disturbed by mining operations to ensure they remain in a safe and stable condition and, where appropriate, are revegetated. The proponent has also included a commitment to prepare mining and rehabilitation plans for each pit and these will be documented and reported against in an EMP prepared prior to ground disturbing activities. The EMP will be reviewed and updated on an annual basis or as new pits are proposed.

In order to develop a mining and rehabilitation strategy, the proponent has conducted a series of hydrogeological and ecological investigations. It has been determined that with regard to mining voids, the lake sediments do not slump significantly and that water levels in mining voids will return to near surface. The proponent has proposed additional geotechnical studies to assess the stability of pit walls post mining and will use the results to develop management procedures and closure plans for final mining voids.

Submissions

Public submitters expressed concern at the prospect of mining voids remaining at the completion of mining and the implications on public safety and functioning of the lake system. In particular, it was considered that decisions on leaving mining voids should not be made until the results of hydrogeological investigations presently being conducted by the proponent are available. Submitters were concerned that construction of structures such as bunds and waste dumps were likely to cause impacts on the stability of the lake bed sediments and that this required further investigation by the proponent.

Submitters expressed support for the proponent's intention to, where possible, use existing infrastructure and to construct waste rock dumps to mimic naturally occurring islands on Lake Lefroy.

Although support was expressed for the proponent's commitment to undertake rehabilitation on a progressive basis, it was considered that the final rehabilitation plan proposed by the proponent in its commitment should be made publicly available.

Assessment

The area considered for assessment of this factor is the area of Lake Lefroy disturbed by mining (approximately 800 ha).

The EPA's environmental objective for this factor is to:

- ensure the proposal area, and any other area affected by the proposal, is rehabilitated to a standard consistent with the intended post mining long-term land use;
- establish stable, sustainable landforms consistent with the surroundings and ecosystem maintenance; and
- ensure that risk is managed to meet the Department of Minerals and Energy (DME) requirements in respect of public safety.

The intention of the proponent to rehabilitate disturbed areas on a progressive basis and to develop waste rock dumps to mimic the naturally occurring islands of Lake Lefroy is supported by the EPA. The proponent is presently rehabilitating several waste rock dumps (part of the existing approved mining operations) consistent with this objective and this has provided it with the opportunity to develop and demonstrate rehabilitation techniques.

The EPA notes that the proponent has indicated its intention to backfill some mining voids, however, the proponent also indicates that the number of, and extent to which mining voids are backfilled is dependent on mine scheduling arrangements and the sequencing of individual mining developments within the project area.

It is noted that preliminary hydrogeological investigations indicate that lake sediments (abutting mining voids) are unlikely to slump significantly. Slumping of voids can increase the risk to public safety. The remaining open voids will fill with water to within close proximity of the lake's surface.

The EPA considers that it is desirable to maximise backfilling of mining pits. It is acknowledged, however, that backfilling may be constrained in some cases by operational limitations. It is the view of the EPA that the onus is on the proponent to demonstrate through the proposed EMP and annual reporting process that all reasonable consideration has been given to backfilling of mining voids in the development of mining plans, so as to ensure voids are backfilled as new pits are developed and thereby limit the number of voids remaining at the completion of mining. Noting that the proponent is proposing to conduct additional investigations into the stability and management of mine voids, the EPA considers that if further investigations show that voids are not able to be managed in an environmentally acceptable manner, then the option of backfilling voids from waste rock dumps remains open.

Mining voids, particularly in close proximity to areas that are readily accessible to the public (such as near to the causeway) require the greatest consideration and commitment to backfilling for public safety reasons. The EPA notes that with respect to compliance with safety obligations for management of final mining voids, the mining operations are subject to the requirements of the *Mines Safety and Inspection Act 1994* administered by the DME. The DME will review the adequacy of void management proposed by the proponent with respect to public safety. In addition, it is noted that the Mines Safety and Inspection Act will require the proponent to bund mining voids that have not been backfilled. The EPA considers that where these bunds are substantial and represent a significant feature of the landscape, the proponent should ensure that they are rehabilitated to a standard consistent with that proposed for the waste rock dumps.

It is noted that, due to the likely changes in the mining schedule and sequence of developments over the life of the project, the proponent has committed to preparing an EMP that will be reviewed and updated on an annual basis. The EMP will include, among other things, detailed mining and rehabilitation plans for each successive mining development. The preparation and implementation of an EMP and its review on an annual basis provides opportunities for the proponent to:

- examine the potential for backfilling on a pit by pit basis;
- incorporate current best practice rehabilitation methods;
- incorporate the results of the ongoing research investigations into future plans; and
- report the results of rehabilitation performance monitoring.

The EPA supports the preparation and implementation of an EMP by the proponent. It is recommended that it becomes a condition of the project proceeding to enable institutional arrangements to be established between the DME, CALM, Water and Rivers Commission (WRC), and the DEP with regard to reviewing the adequacy of the proponent's proposed environmental management measures and their ongoing implementation.

The EPA notes the proponent's commitment to conduct a review of its planning and closure requirements for final closure of the project prior to the completion of mining. The EPA also notes the concerns raised in public submissions that the final plan should be publicly available. Accordingly, the EPA recommends the proponent provides details of the review in a Final Decommissioning and Rehabilitation Plan that will be made publicly available to the satisfaction of the EPA.

Summary

Having particular regard to the:

(a) proponent's obligation to comply with the Mines Safety and Inspection Act with respect to safety of mining voids remaining at the completion of mining;

(b) importance of limiting the number of open voids remaining at the completion of mining to ensure the hydrological and ecological processes of the lake, and public safety, are not compromised;

(c) results of initial hydrogeological and geotechnical investigations that indicate lake sediments are stable and any voids remaining in the lake at the end of mining will not slump and hence public safety will not be compromised ;

(d) proponent's commitment to conduct additional geotechnical investigations to determine management of final mining voids;

(e) existing development of rehabilitation techniques and processes to construct waste dumps to mimic naturally occurring islands on Lake Lefroy; and

(f) proponent's commitment to progressive rehabilitation and to investigate the use of lake sediments as a potential growth medium,

it is the EPA's opinion that the proposal can be managed to meet the EPA's environmental objective for Rehabilitation provided:

- the proponent's commitments are made legally enforceable;
- the EMP that details, among other things, mining and rehabilitation plans, is applied as a condition of the project proceeding (draft condition 6) to enable institutional arrangements to be established between the DME, CALM, WRC and the DEP with regard to ensuring compliance with the EPA's objectives and reviewing the adequacy of the proponent's proposed environmental management measures and their implementation; and
- the proponent prepares, makes publicly available and implements a Final Decommissioning and Rehabilitation Plan to present the results of its proposed review of closure planning (draft condition 7).

3.3 Groundwater Quality

Description

Mining developments will be dewatered using in-pit sumps and/or bores. Preliminary hydrological investigations show that groundwater is hypersaline (>170 000 ppm TDS) and, exhibits similar physical and chemical properties to water on the lake's surface. Groundwater is at or near the lake surface.

The exact quantity of groundwater likely to be encountered during mining of each pit is not yet known but it is predicted that discharge from a typical pit will be in the order of 4400 kL/day. Based upon discharge records of existing mining operations and groundwater studies, the proponent has estimated that the groundwater abstracted from existing mining represents 0.7% of the total volume of natural inflow into the lake in any one year. The majority of existing dewatering output is pumped to the lake surface and recycled naturally to groundwater. As a result of this recycling effect and the proximity of groundwater to the surface of the lake, groundwater draw down is confined to a small area around the mining pits. Detailed hydrological modelling to determine the quantity and quality of groundwater likely to be extracted and require discharge is proposed by the proponent as each pit is developed. The proponent has included a commitment to report the results of hydrological investigations and proposed management of groundwater in the EMP.

The proponent has conducted overburden characterisation studies that indicate overburden has little or no sulphide content and hence, a low potential for acid generation and a consequential low possibility of groundwater contamination. Any sulphide minerals such as pyrite that do occur are generally associated with zones of mineralisation (ore) and are volumetrically very small. The distribution of sulphide and carbonate minerals within fresh Archaean bedrock(waste rock associated with the ore) can be quite variable. The proponent has advised that due to this variability it conducts acid generation testwork as part of its routine metallurgical analysis and the results are used to develop strategies to monitor and isolate any high sulphide material as part of day-to-day mining operations.

Mining activities such as refuelling, regular maintenance and equipment failures that occur in pits have potential to cause hydrocarbon contamination of groundwater.

Submissions

The WRC advised that the proponent will be required to prepare a groundwater operating strategy and be required to maintain its existing groundwater abstraction licence. The WRC considers that dewatering discharge to the lake's surface requires careful scrutiny given the potential for properties of the groundwater to vary at different sites across the lake. The WRC supports the proponent's commitment to continue its water monitoring program that is presently in place for the existing approved mining operations and highlighted the importance of continued careful monitoring of groundwater returned to the lake surface. The WRC advised that the monitoring results submitted as part of the proponent's obligations to comply with its existing groundwater abstraction licence are reviewed by the WRC.

Public submitters expressed concern at the likely presence of sulphide-bearing materials and hence, the potential for acid rock drainage (ARD) from waste rock dumps. A submitter noted that the proponent generally considered mining pits would not be deep enough to encounter sulphides, however clarification was sought as to the range of depths over which the proponent was likely to encounter sulphide bearing-materials.

Assessment

The area considered for assessment of this factor is Lake Lefroy.

The EPA's environmental objective for this factor is to maintain the quality of groundwater to ensure that existing and potential uses, including ecosystem maintenance are protected.

The existing approved mining operations on Lake Lefroy are already subject to a groundwater abstraction licence issued by the WRC. The EPA notes the proponent's obligations to abstract groundwater according to the conditions of its licence. The WRC also requires the proponent to prepare a groundwater operating strategy. The strategy will address the overall management of the groundwater resource by the proponent to ensure its sustainable use. Sustainable use of this resource includes ensuring that groundwater abstraction does not significantly impact the lakes ecosystem. With regard to ecosystem maintenance, the EPA notes that groundwater draw down is contained to areas around mining pits and is therefore not considered to have regional impacts. In addition, as groundwater is hypersaline, fringing vegetation around the lake is unlikely to be dependent on the groundwater. As new mining pits are developed, the proponent will be required by the WRC to determine the quantity and quality of groundwater to be abstracted, monitor the impacts of groundwater abstraction and modify the groundwater operating strategy as appropriate.

It is noted that overburden has little or no sulphides and hence, this material has a low potential for acid generation when stored in waste rock dumps. Sulphide-bearing materials are however, present in waste rock associated with the ore. This material is also stored in the waste rock dumps and hence there is some potential for acid generation from the waste rock dumps if these sulphide-bearing materials are not appropriately stored. The proponent has advised that routine characterisation of waste rock (associated with the ore) will identify materials that are likely to require specialist disposal practices such as segregation, encapsulation or storage with other materials of sufficient buffering capacity. As sulphide material is associated with ore and such materials represent only about 5% of all materials mined, there should be adequate quantities of

other material available to safely encapsulate or otherwise manage sulphides. The EPA considers that where routine testing identifies potentially acid generating materials, the specialist management procedures proposed by the proponent should be reported in the EMP recommended as a condition of the project proceeding. The DME and the DEP will review the adequacy of the proponent's proposed measures to manage acid generating materials. The groundwater and surface water monitoring programs required by the WRC and DEP licences respectively will monitor the effectiveness of the proposed management to prevent contamination of groundwater. If monitoring identified that additional or remediation management measures are required the EMP will be required to be modified. The additional or remediation measures will then be implemented as part of the proponent's obligations to comply with its statutory DEP and WRC licences.

The EPA notes that mine discharge water has similar physical and chemical properties to the lake's surface water. There is potential for the quality of groundwater to vary as pits are developed in different areas of the lake. In response to this issue, the proponent has included a commitment to conduct further hydrogeological investigations to determine the dewatering requirements of the proposed mine pits as they are developed and report the results and proposed management of groundwater in the EMP. Noting that the WRC requires the groundwater operating strategy to be updated as appropriate, the WRC groundwater abstraction licence approval process will address the adequacy of the additional hydrological assessments and the proposed groundwater management strategy proposed for each pit. With regard to monitoring of groundwater discharged to the lake's surface, the proponent's existing DEP licence issued under the provisions of the EP Act will be subject to review as new mining pits are developed and limits will be set on the quantity and quality of groundwater discharged. The licence will include limits relating to hydrocarbons to ensure management of hydrocarbons in the mining pits is effective.

Potential environmental impacts from mine dewatering on the surface water and ecological processes of Lake Lefroy are discussed under the factor 'Surface water quality'.

Summary

Having particular regard to:

(a) the results of characterisation studies that indicate overburden materials have little or no sulphide content and hence, have a low potential for acid generation;

(b) the proponent's commitment to conduct routine testing of waste rock to determine its acid generating potential and, for materials that are identified as acid generating, the proponent's capacity to implement specialist disposal strategies such as isolation or encapsulation;

(c) the proponent's obligation to comply with the requirements of its groundwater abstraction licence (issued by the WRC) and the WRC's requirement that the proponent prepare a groundwater operating strategy to its satisfaction. The groundwater operating strategy will address cumulative impacts from developing individual pits and the management of those impacts. The strategy will also address management of the groundwater resource to ensure ecosystem maintenance;

(d) hydrological investigations indicating that the estimated volume of groundwater abstracted and discharged represents a small proportion (0.7%) of the estimated total volume of natural inflow into the lake each year;

(e) the results of hydrogeological investigations that indicate groundwater has similar physical and chemical characteristics to the lake's surface waters;

(f) the proponent's commitment to conduct detailed hydrological modelling and report its proposed groundwater management strategy for each pit in the EMP. The WRC groundwater abstraction licence approval process will address the adequacy of the hydrological assessments and the proposed groundwater management strategy for each pit; and

(g) groundwater discharged to the lake surface is licensed under the requirements of Part V of the EP Act and this licence will set limits on the quantity and quality of groundwater discharged,

it is the EPA's opinion that the proposal can be managed to meet the EPA's environmental objective for Groundwater provided:

- the proponent's commitments are made legally enforceable;
- the proponent reports the summary results of hydrological investigations for individual mining pits and the proposed management of groundwater in the EMP recommended as a condition of the project proceeding (draft condition 6);
- where routine waste rock characterisation monitoring identifies acid generating materials, the management strategy proposed by the proponent is reported in the EMP. The adequacy of the proposed strategy will be reviewed by the DME and the DEP (draft condition 6);
- the groundwater licensing process addresses management of the groundwater resource to ensure ecosystem maintenance and incorporates abstraction and operating controls to prevent contamination of groundwater from hydrocarbons and acid generating materials; and
- the pollution licensing system incorporates water discharge controls to prevent contamination of the groundwater from hydrocarbons and acid generating materials.

3.4 Surface water quality

Description

Mining developments will be dewatered using in-pit sumps and/or bores. It is proposed to discharge this water to the lake's surface. Water discharged to the surface has the potential to affect the hydrological and ecological processes of the lake.

The proponent has conducted a series of hydrological and ecological investigations which confirmed lake surface waters are hypersaline. Groundwater proposed for discharge has similar physical and chemical properties to surface water. Water quality sampling during a cyclonic flooding event also confirmed that the surface waters remain hypersaline and did not fall below 170 000 ppm TDS due to the presence of a thick salt crust on the lake's surface. Hydrogeological investigations estimated the volume of salt present in the lake's top sediments to be in the order of 94 million tonnes (Mt). The proponent has concluded that the volume of salt added to the lake's surface by discharge water (2.4 Mt per annum) is not significant when compared to the total volume of salt present in the lake sediments, the thick salt crust present on the lake's surface, or in the hypersaline waters that prevail in the lake.

Ecological studies determined the presence and abundance of aquatic species on the lake and investigated the likely effect that discharges may have on them. In particular, discharged groundwater may affect populations of aquatic invertebrates on the lakebed and shoreline areas of Lake Lefroy. Investigations confirmed the aquatic fauna found are not unique to Lake Lefroy. Shoreline areas were identified as being of higher conservation value than the lakebed as they support significantly greater populations and, a greater species diversity of aquatic invertebrates and flora.

The lake's fringing terrestrial vegetation may also be affected by inundation caused by mine water discharges. The proponent has included a commitment to protect shoreline areas and fringing terrestrial vegetation from the impacts of mine water discharges and mining.

Submissions

Concerns were raised regarding the possible impacts that discharging to the lake may have on the surface water in the lake and the consequential effects on aquatic flora and fauna, and terrestrial vegetation fringing the lake.

Assessment

The area considered for assessment of this factor is Lake Lefroy.

The EPA's environmental objective for this factor is to maintain the quality of surface water to ensure that existing and potential uses, including ecosystem maintenance are protected.

The EPA notes the results of surface water and aquatic fauna monitoring that indicate the surface waters of Lake Lefroy are hypersaline (>170 000 ppm TDS) and do not support significant or unique populations of aquatic fauna, whereas shoreline areas have greater species diversity.

Investigations conducted by the proponent indicate Lake Lefroy remains saline, even during periods of high inflow. These results are considered important as this indicates that Lake Lefroy does not exhibit a 'fresh water phase', known to occur in other salt lake systems. The absence of a fresh water phase is considered to be due to the thick salt crust on the lake. This 'fresh water phase' has previously been demonstrated to be an important trigger of increased biological productivity. Discharge of hypersaline mine water onto salt lakes during a 'fresh water phase' has been known to significantly affect invertebrate species adapted to completing their life cycle in the short period when fresh water conditions prevail on a lake. It has been concluded that discharges to the lakebed proposed by the proponent are unlikely to significantly alter surface water quality or affect aquatic invertebrate fauna as the species found are not unique, are not present in significant numbers and are not dependent on the 'fresh water phase'.

It is noted that shoreline areas have been identified as providing important habitat for aquatic fauna and aquatic flora (*Schizothrix sp.*-algal mats), which act as a refuge for species from the hostile hypersaline environment of the lake bed. Hydrological studies indicate the mine water discharges will be confined to the areas where a thick salt crust prevails (lakebed) and hence, have no impact on these shoreline habitats. The EPA notes the proponent's commitment to identify areas of algal mats (and other environmentally sensitive shoreline habitats) that may potentially be affected by mining operations, in particular, by discharge of groundwater. The proponent's commitment includes the preparation of a map identifying environmentally sensitive areas to be protected. The commitment addresses the selection of disposal sites for mine water discharges that are away from, and do not drain to areas of algal mats. It also addresses the protection of these areas from other disturbance by defining management procedures that specify principles relating to access to sensitive shoreline habitats. The map identifying environmentally sensitive areas, the selection of discharge sites and the effectiveness of the management measures to protect the identified areas will be reported by the proponent in the EMP.

The licence issued by the DEP will require the proponent to seek approval to discharge at the proposed locations and will specify the location, quantity and quality of water discharged to the lake's surface. The annual review of the EMP conducted by DME, CALM, WRC and the DEP will assess effectiveness of the implementation of the environmental management measures designed to protect sensitive shoreline habitats, in particular, the protection of areas of algal mats.

Summary

Having particular regard to:

(a) results of investigations indicating the volumes of salt added to the surface of the lake (by dewatering) are not significant when compared to the volume that already exists in the sediments, naturally occurring lakebed salt crust or surface waters;

(b) results of water sampling that indicate groundwater and surfacewater have similar physical and chemical properties and hence, discharged mine water will not significantly alter the quality of the lake's surfacewater;

(c) results of aquatic fauna investigations that indicate the hypersaline surfacewater of the lake does not support unique or significant populations;

(d) the proponent's commitment to protect shoreline habitats and fringing areas known to support populations of aquatic flora and fauna, and terrestrial vegetation, from the impacts of discharge water by ensuring that discharges are located away from and do not drain to these areas; and

(e) the DEP licence required by Part V of the EP Act will set limits on the quantity and quality of groundwater ,and specify the location of discharge points,

it is the EPA's opinion that the proposal can be managed to meet the EPA's environmental objective for surfacewater quality provided:

- the proponent's commitments are made legally enforceable; and
- the management measures to protect shoreline and fringing areas of the lake are documented, their effectiveness is monitored, and, a requirement to modify environmental management measures on the basis of monitoring is incorporated in the EMP recommended as a condition of the project proceeding (draft condition 6).

3.5 Lake Lefroy

Description

The environmental factor 'Lake Lefroy' considers the overall impacts of the mining proposal on the function and ecology of the lake system.

Lake Lefroy is a naturally occurring salt lake with an estimated surface area of 554 km^2(55400 ha). Mining and related activities have the potential to affect the lake's hydrological and ecological processes. These effects may include, among other things:

- physical disturbance of the lake bed sediments by construction of access infrastructure, mining and associated facilities;
- localised and widespread impacts on aquatic flora and fauna, if present, from discharge of groundwater to the lake's surface;
- impacts on vegetation and fauna habitat fringing the lake; and
- alteration of the hydrological regime and surface water flows of the lake caused by mining pits, access infrastructure and waste rock dumps.

The proponent's PER includes information from a series of investigations aimed at defining the impacts from developing individual pits and to further define cumulative impacts that may result from mining and rehabilitating successive pits in the project area. The investigations have also identified areas of the lake that are of high environmental value which should be protected from the impacts of mining because they support populations of aquatic flora and fauna. These fringing areas of the lake have also been identified as supporting terrestrial flora and providing fauna habitat. The proponent has included commitments to manage the impacts of mining on the lake bed, rehabilitate on a progressive basis and protect important shoreline and fringing areas of the lake from mine water discharges and disturbance.

Submissions

Submitters raised concerns that mining would affect the hydrological and ecological processes of the lake resulting in a significant impact on the viability and functioning of Lake Lefroy. Concerns included:

- the cumulative area of direct disturbance (approximately 800 ha) may represent a significant portion of the lake's surface;
- mining pits and waste rock dumps may cause a significant alteration to surface water flows and the hydrology of the lake;
- discharge of mine water resulting in changes to the quality and quantity of water on the lake and the consequential effects on aquatic flora and fauna, and terrestrial vegetation fringing the lake; and
- the landform of the lake will be altered by waste rock dumps (new islands) and mining pits. Rehabilitation of the areas affected by mining will need to be adequate to ensure that, in the long term, there is no significant alteration to the functioning of Lake Lefroy.

Assessment

The area considered for assessment of this factor is Lake Lefroy and its shoreline margins.

The EPA's environmental objective for this factor is to maintain the integrity, functions and environmental values of Lake Lefroy. The impacts on Lake Lefroy, the results of investigations and the proposed mitigating measures from developing the series of mining pits have previously been discussed under the above factors Nature conservation values, Rehabilitation, Surface water quality and Groundwater quality.

When considering the combined consequences of the impacts and the proposed measures to mitigate them on the environmental values and function of Lake Lefroy, the EPA considers the key points to note are:

- Lake Lefroy has an estimated area of 554 km^2 (55400 ha);
- existing mining has already affected approximately 500 ha within the defined project area;
- the area to be affected by direct disturbance from mining operations as a result of this proposal is approximately 800 ha or 1.55% of the lake, and is considered small in relation to the size of the lake;
- rehabilitation of mined areas is progressive, limiting the total area opened for mining at any one time;
- Lake Lefroy is hypersaline (>170 000 ppm TDS) and remains hypersaline even during periods of major inflows of water into the lake;
- groundwater proposed to be discharged to the surface of the lake has similar physical and chemical properties to surface waters. Hence, the mine discharge water is unlikely to significantly alter the quality of existing surface waters;
- the results of aquatic invertebrate sampling indicates the areas most likely to be disturbed by mining or affected by the mine water discharges do not support significant or unique populations of aquatic invertebrate fauna due to the presence of a thick salt crust and the hypersaline nature of the lake water;
- lake fringing areas support populations of aquatic flora and fauna and terrestrial vegetation. Approximately 3 ha of fringing areas of the lake will be disturbed by mining. The area proposed for disturbance has already been affected by existing mining, does not contain DRF, Priority flora species or Threatened fauna and represents a small portion of

the total available habitat of this type that is found on Lake Lefroy and hence, loss of this small area not considered to be significant in terms of conservation value;

- other than the 3 ha of fringing area proposed for disturbance, the proponent has included a commitment to protect shoreline and fringing areas within the project area from the impacts of mine water discharges and mining;
- waste dumps will form islands around which lake waters should continue to flow without undue hindrance;
- the proponent has proposed rehabilitation strategies and methods aimed at ensuring areas affected by mining are satisfactorily rehabilitated rendering them safe and encouraging the re-establishment of a self sustaining ecosystem;
- the proponent will prepare an EMP that will be reviewed and updated on an annual basis or as required. It will provide details of individual mining pit developments and propose measures to mitigate against identified impacts. Performance against previous planning commitments will be reported on an ongoing basis. This will provide a mechanism to incorporate the results of ongoing research investigations and adapt planning and rehabilitation strategies as required. The EMP and annual updates will be assessed by the DME, WRC, CALM and DEP to ensure compliance with the EPA's objectives and, if required, the EMP would be modified accordingly; and
- as mining nears completion, the proponent will be required to undertake a review of the project and develop a program to ensure all areas disturbed by mining are satisfactorily rehabilitated. This Final Decommissioning and Rehabilitation Plan will be reviewed by the DME, WRC CALM and DEP and is recommended to be made publicly available.

The EPA in its assessment has considered the environmental impacts from developing a series of gold mining pits in a defined project area. As part of the assessment the EPA has also considered the environmental impacts of developing individual pits as well as considering cumulative impacts that may result from implementing the full proposal. The EPA has concluded that the environmental impacts are capable of being managed so as not to compromise the function and ecology of Lake Lefroy.

Summary

Having particular regard to:

(a) the expected area of mining disturbance (800 ha or 1.55% of the lake) within the defined project area is considered small in relation to size of Lake Lefroy (55400 ha);

(b) the results of investigations that indicate the lakebed proper (the primary location of mining disturbance) does not support unique or significant populations of aquatic invertebrates because of the thick salt crust on the lake;

(c) the proponent's commitments to protect shorelines and fringing areas identified as having higher conservation value because they do support populations of aquatic flora and fauna, and terrestrial vegetation, from the impacts of mining disturbance and mine water discharges by ensuring discharges are located away from and do not drain to these areas;

(d) the results of investigations that indicate mine water discharges have similar physical and chemical properties to surfacewater, hence, discharged mine water will not significantly alter the quality of the lake's surfacewater; and

(e) the proposed progressive rehabilitation of areas disturbed by mining,

it is the EPA's opinion that the proposal is capable of being managed to meet the EPA's environmental objective for Lake Lefroy provided:

- the proponent's commitments are made legally enforceable;
- the EMP that details, among other things, mining and rehabilitation plans is applied as a condition of the project proceeding (draft condition 6) to enable institutional arrangements to be established between the DME, CALM, WRC and the DEP with regard to ensuring compliance with the EPA's objectives and reviewing the adequacy of the proponent's proposed environmental management measures and their implementation; and
- the proponent prepares, makes publicly available and implements a Final Decommissioning and Rehabilitation Plan to present the results of a review of closure planning (draft condition 7).

4. Identification of alternative and additional sites

It is important to note that the proponent has, to the best of its current available knowledge, identified the approximate number and location of pits in the defined project area. It is possible that further orebodies will be identified by future exploration. The EPA considers that in this case, a key definer of the proposal is the project area. In adopting an approach to assessment that identifies mining pits that can reasonably be expected to be developed, the EPA acknowledges that in all probability some flexibility will be required during the implementation of the proposal to accommodate variations in the location and number of pits that may eventually be developed within the project area.

It is therefore the opinion of the EPA that where an additional site(s) or a variation to the proposed location of existing site(s) is identified within the project area and the proponent can demonstrate to the satisfaction of the EPA that the environmental impacts of mining at the particular site(s) are substantially the same as those sites previously indicated, mining may occur, provided that all other requirements of the proposal are met .

To address the likelihood of additional or alternative sites being proposed within the project area, the EPA recommends draft condition 8 (Appendix 5) requiring the proponent to consider the environmental impacts of the mining pits and propose environmental management measures before submitting documentation detailing its intention to mine as part of the EMP reporting process. The DEP on behalf of the EPA will be responsible for assessing the significance of the environmental impacts and the adequacy of the proponent's environmental management measures and for providing formal written advice that the condition has been satisfied. Documentation prepared by the proponent as part of its requirement to satisfy this condition and the written advice of the DEP will be available on the public record.

5. Other advice

There is presently only limited research available on the biology and function of saline wetlands. The biological processes that occur in saline wetlands are fundamentally the same as those that occur in freshwater wetlands, but involve a different suite of flora and fauna species. As further research is completed, such as that conducted in support of this and other EPA assessments, it is becoming apparent that saline wetlands vary and there is only a limited knowledge of the plants and animals that inhabit these environments. Increasingly, saline wetlands are acknowledged for the important habitat they provide, their largely unknown biodiversity and their role in breeding events of a number of species, particularly water birds.

The EPA notes that in support of the objective to establish a system of protected areas, the Western Australian Government released its 'Wetlands Conservation Policy for Western Australia' in July 1997. This policy establishes a commitment to identify, maintain and manage the State's wetland resource, including the full range of wetland values. Presently, saline wetlands are poorly represented in the conservation estate at a State level.

The EPA supports the addition of representative saline wetlands to the conservation estate. It is however, considered that there is an increasing urgency to identify and secure representative examples. Otherwise, the impacts from discharges to these wetlands, physical disturbance of the wetlands and their surrounds as well as impacts on their supporting catchments will result in irreparable damage and, in some cases, the loss of these important wetland ecosystems before they can be secured.

6. Conditions and commitments

Section 44 of the *Environmental Protection Act 1986* requires the EPA to report to the Minister for the Environment on the environmental factors relevant to the proposal and on the conditions and procedures to which the proposal should be subject, if implemented. In addition, the EPA may make recommendations as it sees fit.

In developing recommended conditions for each project, the EPA's preferred course of action is to have the proponent provide a statement of commitments to ameliorate the impacts of the proposal on the environment. The commitments are considered by the EPA as part of its assessment of the proposal and, following discussion with the proponent, the EPA may amend or seek additional commitments.

The EPA recognises that not all of the commitments are written in a form which makes them readily enforceable, but they do provide a clear statement of the action to be taken as part of the proponent's responsibility for, and commitment to, continuous improvement in environmental performance. The commitments, modified if necessary to ensure enforceability, then form part of the conditions to which the proposal should be subject, if it is to be implemented.

The EPA may also impose conditions for matters not addressed by commitments or where it is considered further clarification may be required.

6.1 Proponent's commitments

The proponent's commitments as set in the PER and subsequently modified, as shown in Appendix 5, should be made enforceable.

6.2 Recommended conditions

Having considered the proponent's commitments and the information provided in this report, the EPA has developed a set of conditions which the EPA recommends be imposed if the proposal by WMC Resources Ltd (St Ives Gold) to develop a series of gold mining pits, associated access infrastructure and waste rock dumps on Lake Lefroy is approved for implementation.

These conditions are presented in Appendix 5. Matters addressed in the conditions include the following:

(a) that the proponent be required to fulfil the commitments in the Consolidated Commitments statement set out as an attachment to the recommended conditions in Appendix 5;

(b) that the proponent be required to prepare and implement an EMP that will be reviewed and updated on an annual basis. The EMP will detail, among other things, mining and rehabilitation plans for each pit and report the proponent's implementation of the program. The adequacy of the proponent's environmental planning and management will be reviewed by Government agencies with statutory responsibility for the project;

(c) that the proponent be required to prepare, make publicly available and implement a Final Decommissioning and Rehabilitation Plan to present the results from a review of closure planning conducted at least two years prior to the anticipated date of completion of mining; and

(d) where an additional site(s) or a variation to the proposed location of existing site(s) is identified within the project area and the proponent can demonstrate to the satisfaction of the EPA that the environmental impacts of mining at the particular site(s) are substantially the same as those sites previously indicated, mining may occur provided that all other requirements of the proposal are met. The DEP on behalf of the EPA will be responsible for assessing the significance of the environmental impacts and the adequacy of the proponent's environmental management measures and for providing formal written advice that the condition has been satisfied. Documentation prepared by the proponent as part of its requirement to satisfy this condition and the written advice of the DEP will be available on the public record.

It should be noted that other regulatory mechanisms relevant to the proposal are the:

- requirements of the DME for the proponent to comply with the provisions of the Mines Safety and Inspection Act with respect to public safety and management of mining voids, waste dumps, decommissioning of plant infrastructure and final rehabilitation ;
- requirements of the WRC for the proponent to comply with the provisions of the Rights in Water and Irrigation Act and to maintain a groundwater abstraction licence;
- requirements of CALM for the proponent to comply with the provisions of the Wildlife Conservation Act with respect to disturbance of DRF Priority flora species and Threatened fauna;
- requirements of the DEP for the proponent to comply with the provisions of the EP Act and maintain a licence to discharge groundwater and manage dust; and
- requirements of the Aboriginal Affairs Department (AAD) for the proponent to comply with the provisions of the Aboriginal Heritage Act.

7. Conclusions

The EPA has considered the proposal by WMC Resources Ltd (St Ives Gold) to develop a series of gold mining pits, associated waste rock dumps, access infrastructure and mining support facilities on Lake Lefroy. In essence the proposal comprises a number of essentially similar mine pits over time which can be managed using a generic and progressively updated EMP. In considering this proposal, the EPA is aware that although at the completion of mining a series of pits will have been developed, at any one time over the life of the project, the environmental impacts on the lake system should primarily be confined only to areas where mining is currently occurring. Rehabilitation of previously mined areas generally occurs as new mining pits are developed. Accordingly, the EPA has suggested a mechanism to allow for some flexibility in the sequencing of mining pit development provided the proponent details in the EMP its environmental planning and management for each of the pits as they are developed. The adequacy of the environmental planning and management will be reviewed by appropriate Government agencies with statutory authority for the project.

The EPA has concluded that the proposal is capable of being managed to meet the EPA's objectives provided there is satisfactory implementation by the proponent of the proponent's commitments and the recommended conditions set out in Appendix 5 and summarised in Section 6.

Recommendations

The EPA submits the following recommendations to the Minister for the Environment:

1. That the Minister notes that the proposal being assessed is for development of a series of gold mining pits, associated waste rock dumps, access infrastructure and mining support facilities.
2. That the Minister considers the report on the relevant environmental factors as set out in Section 3.
3. That the Minister notes that the EPA has concluded that the proposal can be managed to meet the EPA's objectives provided there is satisfactory implementation by the proponent of the recommended conditions set out in Appendix 5, and summarised in Section 5, including the proponent's commitments.
4. That the Minister imposes the conditions and procedures recommended in Appendix 5 of this report.
5. That the Minister notes under 'Other advice' the EPA's comments regarding representation of salt lake ecosystems in the State's conservation reserves system.

Appendix 1

List of submitters

Government Departments:

Department of Conservation and Land Management (CALM)

Water and Rivers Commission (WRC)

Aboriginal Affairs Department (AAD)

Individual:

Conservation Council of Western Australia

Appendix 2

References

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Chaplin, S. (1999) *Aquatic invertebrates. In Baseline Ecological Study of Lake Lefroy: Long Term Reference and Monitoring Sites*. Report to WMC Resources Ltd (St Ives Gold). Ed by J.M. Osborne and N.J. Dunlop. School of Environmental Biology, Curtin University of Technology, Bentley WA.

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CSIRO Land and Water (1998) *The Hydrology of Lake Lefroy. A Progress Report to Western Mining Corporation*. Unpublished report prepared for WMC Resources Limited, November 1998.

WMC Resources Ltd (St Ives Gold) (1999) *Public Environmental Review - Gold Mine Developments on Lake Lefroy*. WMC Resources Ltd (St Ives Gold), September 1999.

EPA (1999) *Red October Gold Project, 80 km south of Laverton*. Environmental Protection Authority Bulletin 936, June 1999.

Appendix 3

Summary of identification of relevant environmental factors

Summary of identification of relevant environmental factors.

Preliminary Environmental Factor	Proposal Component and Possible Impact	Government Agency and Public Comments	Identification of Relevant Environmental Factors
		BIOPHYSICAL	
Nature conservation values	The project area is not presently included in conservation reserves or agreements. Salt lakes and their fringing vegetation are generally poorly represented in the conservation estate. Lake Lefroy may contain significant conservation values.	**CALM:** Salt lakes and their fringing vegetation are poorly represented in the conservation reserve system in the Coolgardie Biogeographic Region. CALM continues to investigate opportunities to include representative areas of all land types and landforms within each biogeographic region into a system of management that has nature conservation as a primary objective (including conservation reserves and management agreements). Within the Coolgardie Biogeographic Region (and in all rangeland bioregions), lake systems and their fringing vegetation continue to be a high priority for securing conservation management arrangements. Lake Lefroy and its surrounds appear to have significant, specific conservation values. It is recommended that St Ives Gold undertake further investigations to compare the nature conservation values of Lake Lefroy with similar wetland types in the Coolgardie Biogeographic Region.	**Considered to be a relevant environmental factor.**
Vegetation communities – impacts from direct disturbance	Flora and vegetation surveys of the project area have been conducted. The majority of the project is located on the bare lake bed. Vegetation disturbance is confined to less than 3 ha associated with the development of the Thunderer and Phoebe pits	No comments received.	Vegetation clearing is limited to the proposed location of the Phoebe and Thunderer pits (< 3 ha). Vegetation surveys conducted in the project area indicated the vegetation impacted by the development of the Phoebe and Thunderer pits is not unique and has been previously disturbed by sand mining and discharging of mine water activities. Given the previous disturbance and the small area of impact, the proposed clearing is not considered significant. **Factor does not require further EPA evaluation.** (Refer also the factors of 'Rehabilitation' and 'Declared Rare Flora').
Declared Rare (DRF) and Priority flora – impacts from direct disturbance	Flora and vegetation surveys of the project area have been conducted. The majority of the project is located on the lake bed. Vegetation disturbance is	**CALM:** It is not clear form the information provided in the PER whether the areas requiring vegetation removal have been specifically searched for rare flora. A number of rare flora species are likely to occur in the vegetation types found within the project area.	The proponent confirmed in its response to submissions that a baseline survey of the project area was conducted in 1993. *Acacia kalgoorliensis* has been recorded in the project area but will not be affected by the project. In addition, a number of surveys specifically searching for *Pityrodia scabra* have been conducted in the Lake Lefroy

Preliminary Environmental Factor	Proposal Component and Possible Impact	Government Agency and Public Comments	Identification of Relevant Environmental Factors
	confined to less than 3 ha associated with the development of the Thunderer and Phoebe pits. Several DRF species are likely to be associated with the vegetation types proposed for disturbance. *Pityrodia scabra* (DRF) is known to colonise disturbed areas.	The area proposed for clearing (Thunderer and Phoebe pits) has been subject to previous sand mining activities. *Pityrodia scabra* (DRF) is known to occur in disturbed areas and is likely to be found in the areas proposed for clearing.	area. *P. scabra* has been found to occur in areas containing mining infrastructure (consistent with disturbance of the areas). The company has developed a management plan to manage potential impacts from operational activities on the species. Searches for DRF and Priority species around the Thunderer and Phoebe pits were conducted in June 1998 and January 1999. No DRF or Priority species were recorded. The proponent has included a commitment to undertake an additional survey prior to the commencement of construction activities to determine if species have become established since the previous survey. The results will be reported in the Environmental Management Program (EMP),prepared by the proponent and if DRF or Priority species are located, approval to disturb would be subject to the requirements of the *Wildlife Conservation Act 1950*. **Factor does not require further EPA evaluation.**
Aquatic flora	Salt lakes (Playas) support algal mats (*Schizothrix sp.*). These areas are know to be highly biologically productive. Approximately 2.4 ha of algal mats will be disturbed.	**Public**: Playas support algal mats (*Schizothrix sp.*). The 2.4 ha of algal mats affected by the proposal may be considered by some to be a minor figure when compared to the total area of available habitat. However, the PER does not confirm if other projects on Lake Lefroy are likely to also have an impact on other areas of the algal mats. It is difficult to consider the impacts from this proposal on the algal mats without knowing what the cumulative impacts from other operations are likely to be.	The proponent in its response indicated that they were not aware of any other active exploration or mining activities apart from its own and a subsidiary company mining nickel. Mining operations are located away from the edges of the lake where algal mats are likely to occur except for the 2.4 ha of disturbance specified in the PER. The area of algal mats affected by this proposal represents a small portion of the total available habitat that is found on Lake Lefroy (as indicated by field surveys). The proponent has included a commitment to protect plant communities (including aquatic flora) inhabiting the shoreline from mine water discharges. **Factor does not require further EPA evaluation.** Refer also the factor 'Groundwater quality'
Terrestrial Fauna	Clearing may potentially cause a loss and degradation of fauna habitat. Other impacts may occur from introduced feral fauna species, changed fire	**CALM:** The information regarding non-avian fauna appears sound, and conclusions acceptable provided the clearing does not extend further than indicated in this document. Impact on fauna would have to be reconsidered should there be any proposals for further extension to disturbance.	The information presented in the PER is indicative of the areas and types of terrestrial fauna habitat likely to be affected by the proposal. Although there will be some variation in the boundaries of areas affected as the individual mining developments are proven, the overall impacts will remain consistent with those described in the

Preliminary Environmental Factor	Proposal Component and Possible Impact	Government Agency and Public Comments	Identification of Relevant Environmental Factors
	regimes, noise and vibration disturbance and restrictions to fauna movement.	Many of the wetland types specified in Table 3.12 are incorrect and could be misleading. This appears to be due to typographical errors. An amended table, based on the paper by Chapman and Lane (1997), has been provided to the proponent. Appendix K of the PER, fauna habitat assessment criteria, is a useful concept. Whilst it could be argued that the criteria are subjective, environmental impact assessment decisions could benefit from this type of approach. However, in this context, a number of changes to the criteria are recommended: exclusion of criterion 3 - this criterion does not seem to be particularly relevant; and a criterion that includes cumulative impacts on similar habitat types by all land uses in the bio-region should be included.	PER. The proponent will provide detail of the individual mining pit developments, the associated impacts on fauna habitat and proposed management measures in an Environmental Management Program prepared on an annual basis. The proponent in its response to submissions confirmed it has revised the table 3.12 referred to in the PER. **Factor does not require further EPA evaluation.**
Aquatic fauna (invertebrates)	Potential loss of habitat from mining disturbance. Changes to surface water quality from mine water discharges has the potential to affect the survival and life cycle of invertebrates. The proponent has undertaken an invertebrate sampling program and examined the likely impact of mine water discharges on surface water quality.	**Public:** Impacts on aquatic fauna are not limited to the areas of physical disturbance from mining operations. They extend to areas affected by mine water discharged to Lake Lefroy. Aquatic fauna are known to be important to the breeding events of other species, particularly water birds.	**Considered to be a relevant environmental factor and is discussed under the factor 'Surface water quality'**
Specially Protected (Threatened) fauna	Field surveys conducted to identify Specially protected fauna within the area considered to be potentially impacted.	No comments received.	No specially protected fauna were located during field surveys. **Factor does not require further EPA evaluation.**
Lake Lefroy	The area of the lake directly disturbed by mining totals approximately 800 ha. Mine water discharges may affect a larger area of Lake	**Public:** The area of direct disturbance from mining (approx. 800 ha) may represent a significant portion of the lake's surface. Mining pits and waste rock dumps have the potential to alter movements of water across the lake and other subsurface hydrological processes.	**Considered to be a relevant environmental factor.**

Preliminary Environmental Factor	Proposal Component and Possible Impact	Government Agency and Public Comments	Identification of Relevant Environmental Factors
	Lefroy. The ecological and hydrological processes of the lake may be affected by mining activity.	The discharge of mine water to the lake bed may result in changes to the quality and quantity of water on the lake. Changes to water quality and quantity have the potential to impact invertebrate species important as a food source for a range of other avian and non-avian fauna. The Landform of the lake will be altered by waste rock dumps (new islands) and mining pits. Rehabilitation of the areas affected by mining will need to be adequate to ensure that in the long term there is no significant alteration to the function of the Lake Lefroy ecosystem.	
Landform	It is estimated approximately 420 ha (0.7%) of the lakes surface will be converted into islands. Mine voids will cover approximately 155 ha (0.3%).	**Public:** The proposal to leave open voids on the lake bed is of concern. Open voids may affect the form and structure of the lakebed. It is noted that research is being undertaken by the proponent with regard to pit stability and it is considered that this research should be completed before any decisions on whether to leave voids permanently open are taken. The CSIRO study referred to in the PER may provide some information to clarify this matter. Management approaches of the proponent must be flexible enough to incorporate the research findings.	**Considered to be a relevant environmental factor and discussed under the factor 'Rehabilitation'.**
Rehabilitation	The total estimated area of impact is expected to be 800 ha. Waste Rock dumps will be rehabilitated to mimic naturally occurring lake islands. Backfilling of some voids will occur, however a series of mining pits will remain at the end of mining. Open voids have the potential to alter the hydrological processes of the lake. There is a risk of erosion and sedimentation of the lake bed from mining and rehabilitation	**Public:** The proposal to leave voids open at the completion of mining is of concern. Hydrological investigations considered important in deciding if it is appropriate to leave voids in the lake bed have yet to be completed. The proponent should not be proposing to leave voids until the results of these investigations are available. The commitment of the proponent to rehabilitate on a progressive basis is supported. It is noted that the proponent intends to prepare plans for the rehabilitation and final closure of the project two years prior to the project's completion. Will the final plans be made available for a public consultation period? The proponent's intention to develop waste rock dumps into islands is supported in principle. It is noted that the proponent has committed to using existing infrastructure on the lakebed wherever possible and to remove	**Considered to be a relevant environmental factor.**

Preliminary Environmental Factor	Proposal Component and Possible Impact	Government Agency and Public Comments	Identification of Relevant Environmental Factors
	activities. Causeways, access roads and areas disturbed for infrastructure require rehabilitation.	it as it becomes unnecessary. Has the proponent considered the effect this type of infrastructure may have on the lakebed? In particular, the effects on the geological form and structure of the lakebed. For example, the possible effect that structures, such as bunds and waste dumps, could have on creating mud waves around the structures and the possibility that they may force groundwater to the surface. If these impacts have not been considered, is any research into these effects proposed?	
POLLUTION			
Particulates/ Dust	Dust generation from ore extraction, mobile equipment movements, crushing, concentration and loading.	No comments received.	The proponent has detailed measures to limit dust generation associated with mining activities including the use of water sprays on access roads and causeways. The proponent's existing EP Act, Part V licence will apply to the proposal. This licence specifies management and limits to control dust generation. **Factor does not require further EPA evaluation**
Greenhouse gases	Greenhouse gases (CO_2) will be emitted. Approximately 44 kg of CO_2 is generated per tonne of ore milled, totalling 906 000 t over the ten year life of the project.	No comments received.	The proponent has indicated that the design of the mine incorporates planning measures to reduce greenhouse emissions such as: • limiting haulage distance; • reducing haulage gradients to reduce engine loads and hence fuel consumption; and • to utilise a competitive tendering process to ensure use of efficient machinery. **Factor does not require further EPA evaluation.**
Groundwater quality	Mining developments will be dewatered using in-pit sumps and/or bores. There is potential for acid generating material to be present in the orebody. Mining activities can contaminate the groundwater with hydrocarbons.	**WRC**: The proposed gold mining developments are located within the Goldfields Groundwater Area. The Waters and Rivers Commission (WRC) advised that the proponent will be required to maintain a groundwater abstraction licence. The WRC will require the preparation of an operating strategy prior to issuing the groundwater licence. The dewatering process is an area that requires careful scrutiny. Given the potential for properties of the water to vary at different sites, it is essential that water returned to the lake is carefully monitored. The proponent's commitment to continue its water monitoring program is supported.	**Considered to be a relevant environmental factor.**

Preliminary Environmental Factor	Proposal Component and Possible Impact	Government Agency and Public Comments	Identification of Relevant Environmental Factors
		Public: The potential, however minor, for acid generation is of concern. It is noted that St Ives Gold generally consider that pits will not be deep enough to encounter sulphides and that there are some difficulties in determining the presence of sulphides at these greater depths. St Ives Gold estimates depths of between 30 - 150 metres for pits. As the depth of pits is unknown, does the expectation of not coming into contact with sulphide bearing bedrock extend across this range or, if not, at what point might it be expected that the pits come into contact with sulphides?	
Surface water quality	Discharge of pit dewatering to the surface of Lake Lefroy has the potential to alter water quality and increase salt loads on the lake. Water quality may be affected by spillage of contaminants such as oils used in mining operations. Changes to water quality can affect the survival of aquatic fauna (invertebrates).	**Public:** Concerns were raised regarding the possible impacts that discharging to the lake may have on the surface water in the lake and the consequential effects on aquatic flora and fauna and terrestrial vegetation fringing the lake.	**Considered to be a relevant environmental factor.**
SOCIAL SURROUNDINGS			
Public health and safety (risk and hazard)	Open pits, waste rock dumps and mining infrastructure pose a threat to public safety during the operation and following decommissioning of the mine.	No comments received.	Public safety relating to management of mining areas managed under the requirements of the *Mines Safety and Inspection Act 1995*. **Following decommissioning, public safety is considered to be a relevant environmental factor and discussed under the factor "Rehabilitation".**
Road transportation	Ore and overburden will be transported within the project area via haul trucks. Ore is transported to the mill via road trains. Light vehicle access is also required.	No comments received.	Vehicle movements will be restricted to haul roads and access tracks within the project area, and to the existing St Ives Gold causeway. Details of ongoing access requirements will be specified in the EMP prepared by the proponent on an annual basis. **Factor does not require further EPA evaluation as management commitments are considered**

Preliminary Environmental Factor	Proposal Component and Possible Impact	Government Agency and Public Comments	Identification of Relevant Environmental Factors
			sufficient to control impacts.
Recreation	Recreational uses of the lake include walkers, photographers and motorbike users.	No comments received.	Recreational uses of the lake will not be affected except in the project area where access to operational areas will be restricted for reasons of public safety. **Factor does not require further EPA evaluation**
Aboriginal culture and heritage	No ethnographic or archaeological sites of Aboriginal significance identified from surveys.	**AAD**: The Aboriginal Affairs Department (AAD) noted that archaeological surveys and ethnographic consultations have not identified any sites of significance. If no sites are affected by the proposed gold mine developments then the proponent has no obligations to fulfil under the provisions of the *Aboriginal Heritage Act 1972*. Copies of the heritage reports referred to in the PER document had not been lodged with the AAD.	The proponent has advised that copies of the reports have been forwarded to the AAD. The EPA notes the comments of the AAD that the proponent has no additional obligations under the *Aboriginal Heritage Act 1972* unless sites of significance are to be disturbed. **Factor does not require further EPA evaluation.**

Appendix 4

Summary of environmental factors, EPA advice and recommendations

Summary of Environmental Factors, EPA Advice and Recommendations.

Relevant Factor	Relevant Area	EPA Environmental Objective	EPA Assessment	EPA Advice
Nature conservation values	Coolgardie Biogeographic region	Ensure that nature conservation values are adequately represented at the local and regional level.	CALM commented on the poor representation of salt lakes and their fringing vegetation in the Coolgardie Biogeographic Region conservation reserves. From the information provided by the proponent, CALM considered that Lake Lefroy appeared to have specific conservation values worthy of protection. CALM also considered that it was likely that significant fauna species and Declared Rare Flora (DRF) were present in the area because it has previously been found that the vegetation of the lake system is in good condition. In CALM's view this indicates Lake Lefroy has high conservation value. **Proponent commitments** • To protect plant communities inhabiting the shoreline from the impacts of mine water discharges. • To minimise physical disturbance to playas and claypans on the shores of Lake Lefroy. **Discussion** The proponent in its response sought to clarify the results of the vegetation surveys that identified the lake systems vegetation as being in good condition. The proponent identified that the survey referred to by CALM noted that the existing mining areas (the subject of this assessment) were not considered in good condition. In addition, the biological investigations conducted by the proponent over several years have not identified the presence of DRF or Threatened fauna species in the areas proposed to be disturbed (3 ha). It is noted that ecological investigations have identified that the lakebed, the area mostly affected by mining disturbance, does not support significant or diverse populations of aquatic or terrestrial flora and fauna. Undisturbed fringing and shoreline areas of the lake do support such populations, and the proponent has concluded that these areas should be protected from further mining disturbance. Three hectares of fringing areas are proposed to be disturbed by development of the Phoebe and Thunderer pits. It is noted that this 3 ha area has already been disturbed to some extent by existing mining operations and this has resulted in a reduction of its conservation	Having particular regard to: • Lake Lefroy is not presently in the conservation reserves system; • mining operations are mostly confined to the lakebed that is virtually devoid of aquatic flora and fauna and hence, is not considered to have significant conservation value; • lake fringing areas support populations of aquatic flora and fauna and terrestrial vegetation. Approximately 3 ha of fringing areas of the lake will be disturbed by mining. The area proposed for disturbance has already been affected by existing mining, does not contain DRF, Priority flora species or Threatened fauna and represents a small portion of the available habitat of this type that is found on Lake Lefroy and hence, loss of this small area is also not considered to have significant environmental impact; and • other than the 3 ha of fringing area proposed for disturbance, the proponent has included a commitment to protect shoreline and fringing areas from the impacts of mining by ensuring discharges are located away from, and do not drain to them, it is the EPA's opinion that there are no significant impacts on nature conservation values as a result of this proposal, and therefore the EPA's environmental objective for nature conservation values is unlikely to be compromised provided that the proponent's commitments are made legally enforceable and are implemented.

Relevant Factor	Relevant Area	EPA Environmental Objective	EPA Assessment	EPA Advice
			values. The proponent has included a commitment to ensure that, except for the areas proposed for development of the Thunderer and Phoebe pits (approximately 3 ha), shoreline and fringing areas will be protected from the impacts of mining. In particular, shoreline areas will be protected from the impacts of discharge water by ensuring discharges are located away from and do not drain to these areas. The EPA notes that Lake Lefroy is not presently included in the conservation reserves system. With regard to CALM's comments that salt lakes and their fringing vegetation are not well represented in the conservation reserves of the Coolgardie Biogeographic Region, the EPA has provided under 'Other Advice' some additional comments regarding representation of salt lakes in the State's conservation reserves system.	
Rehabilitation incorporating Landform and, Risk and Hazard	Area of lake Lefroy disturbed by mining (approximately 800 ha)	1.1 Ensure proposal area, and any other area affected by the proposal, is rehabilitated to a standard consistent with the intended post mining long-term land use. 1.2 Establish stable, sustainable landform consistent with surroundings and ecosystem maintenance. 1.3 Ensure that risk is managed to meet the DME's	Areas disturbed by mining require rehabilitation. The EPA notes the concerns expressed at the prospect of mining voids remaining at the completion of mining. **Proponent commitments** • Prior to the commencement of mining the proponent will prepare an Environmental Management Program (EMP) that will provide further details on the design and layout of the individual mining developments planned for the first 12 months of operation and the environmental management measures that will apply to these developments. The EMP will be updated annually to provide a review of the previous 12 months activities and to provide additional detail of the mining developments (and relevant environmental management measures) planned for the next 12 months. • Two years prior to the completion of the project, the proponent will review its planning for the closure and rehabilitation of the project. the findings of the review will be presented in the EMP. • Not to construct infrastructure on naturally occurring island on the lake. • Conduct an investigation into the use of lake sediments as a growth medium in rehabilitation. • To rehabilitate disturbed areas on a progressive basis.	Having particular regard to the: • proponent's obligation to comply with the Mines Safety and Inspection Act with respect to safety of mining voids remaining at the completion of mining; • importance of limiting the number of open voids remaining at the completion of mining to ensure the hydrological and ecological processes of the lake and public safety are not compromised; • results of initial hydrogeological and geotechnical investigations that indicate lake sediments are stable and any voids remaining at the end of mining will not slump and hence, public safety will not be compromised; • proponent's commitment to conduct additional geotechnical investigations to determine the management of final mining voids; • existing development of rehabilitation techniques and processes to construct waste

Relevant Factor	Relevant Area	EPA Environmental Objective	EPA Assessment	EPA Advice
		requirements in respect of public safety.	• To conduct additional geotechnical investigations into the stability of pit walls post-mining. The findings will be used to develop management procedures and closure plans for final mining voids. **Discussion** The intention of the proponent to rehabilitate disturbed areas on a progressive basis and to develop waste rock dumps to mimic the naturally occurring islands of Lake Lefroy is supported by the EPA. The proponent is presently rehabilitating several waste rock dumps (part of the existing approved mining operations) consistent with this objective and this has provided it with the opportunity to develop and demonstrate rehabilitation techniques. The EPA notes that the proponent has indicated its intention to backfill some mining voids, however, the proponent also indicates that the number of, and extent to which mining voids are backfilled is dependent on mine scheduling arrangements and the sequencing of individual mining developments within the project area. It is noted that preliminary hydrogeological investigations indicate that lake sediments (abutting mining voids) are unlikely to slump significantly. Slumping of voids can increase the risk to public safety. The remaining open voids will fill with water to within close proximity of the lake's surface. The EPA considers that it is desirable to maximise backfilling of mining pits. It is acknowledged, however, that backfilling may be constrained in some cases by operational limitations. It is the view of the EPA that the onus is on the proponent to demonstrate through the proposed EMP and annual reporting process that all reasonable consideration has been given to backfilling of mining voids in the development of mining plans. Mining voids, particularly in close proximity to areas that are readily accessible to the public (such as near to the causeway) require the greatest consideration and commitment to backfilling for public safety reasons. The EPA notes that with respect to compliance with safety obligations for management of final mining voids, the mining operations are subject to the requirements of the *Mines Safety and*	dumps to mimic naturally occurring islands on Lake Lefroy; and • the proponents commitment to progressive rehabilitation and to investigate the use of lake sediments as a potential growth medium, it is the EPA's opinion that the proposal can be managed to meet the EPA's environmental objective for Rehabilitation provided: • the proponents commitments are made legally enforceable; • the EMP that details, among other things, mining and rehabilitation plans, is applied as a condition of the project proceeding (draft condition 6) to enable institutional arrangements to be established between the DME, CALM, WRC and the DEP with regard to ensuring compliance with the EPA's objectives and reviewing the adequacy of the proponent's proposed environmental management measures and their implementation; and • the proponent prepares, makes publicly available and implements a Final Decommissioning and Rehabilitation Plan to present the results of its proposed review of closure planning.

Relevant Factor	Relevant Area	EPA Environmental Objective	EPA Assessment	EPA Advice
			Inspection Act 1994 administered by the Department of Minerals and Energy (DME). The DME will review the adequacy of void management proposed by the proponent with respect to public safety. The EPA notes that, if the proponent's further investigations show that it is not possible to maintain voids after mining, the option of backfilling voids from waste rock dumps remains open. In addition, it is noted that the Mines Safety and Inspection Act will require the proponent to bund mining voids that have not been backfilled. The EPA considers that where these bunds are substantial and represent a significant feature of the landscape, the proponent should ensure that they are rehabilitated to a standard consistent with that proposed for the waste rock dumps. It is noted that, due to the likely changes in the mining schedule and sequence of developments over the life of the project, the proponent has committed to preparing an EMP that will be reviewed and updated on an annual basis. The EMP will include, among other things, detailed mining and rehabilitation plans for each successive mining development. The preparation and implementation of an EMP and its review on an annual basis provides opportunities for the proponent to: • examine the potential for backfilling on a pit by pit basis; • incorporate current best practice rehabilitation methods; • incorporate the results of the ongoing research investigations into future plans; and • report the results of rehabilitation performance monitoring. The EPA supports the preparation and implementation of an EMP by the proponent. It is recommended that it becomes a condition of the project proceeding to enable institutional arrangements to be established between the DME, CALM, Water and Rivers Commission (WRC), and the Department of Environmental Protection (DEP) with regard to reviewing the adequacy of the proponent's proposed environmental management measures and their ongoing implementation. The EPA notes the proponent's commitment to conduct a review of its planning and closure requirements for final closure of the project	

Relevant Factor	Relevant Area	EPA Environmental Objective	EPA Assessment	EPA Advice
			prior to the completion of mining. The EPA also notes the concerns raised in public submissions that the final plan should be publicly available. Accordingly, the EPA recommends the proponent provides details of the review in a Final Decommissioning and Rehabilitation Plan that will be made publicly available to the satisfaction of the EPA.	
Groundwater quality	Lake Lefroy	Maintain the quality of groundwater to ensure that existing and potential uses, including ecosystem maintenance are protected.	The EPA notes the comments of the WRC regarding the proponent's obligations to maintain a ground water abstraction licence and the concerns expressed at the likely presence of sulphide bearing materials and hence, the potential for acid rock drainage (ARD). The proponent in its response to submissions advised that: • the proponent currently holds a groundwater abstraction licence for its existing operations and is aware of the WRC requirements to prepare an operating strategy; • existing overburden characterisation data shows that the materials have little or no sulphide content and the potential for acid generation is low; • acid generation testwork is conducted as part of routine metallurgical program for the mining operation; • mine water discharges to the lakes surface are subject to the requirements of Part V of the EP Act and the proponent has in place an existing DEP licence that specifies the quantity and quality of water discharged to the lake's surface; and • the groundwater is hypersaline and has physical and chemical properties similar to the lake's surface waters. **Proponent commitments** • To conduct further hydrogeological investigations to determine the dewatering requirements of the proposed pits within the project area. **Discussion** The existing approved mining operations on Lake Lefroy are already subject to a groundwater abstraction licence issued by the WRC. The EPA notes the proponent's obligations to abstract groundwater according to the conditions of its licence. For new mining pits, the proponent will be required by the WRC to determine the quantity and quality of groundwater to be abstracted	Having particular regard to: • the results of characterisation studies that indicate overburden materials have little or no sulphide content and hence, have a low potential for acid generation; • the proponent's commitment to conduct routine testing of waste rock to determine its acid generating potential and, for materials that are identified as acid generating, the proponent's capacity to implement specialist disposal strategies such as isolation or encapsulation; • the proponent's obligation to comply with the requirements of its groundwater abstraction licence (issued by the WRC) and the WRC's requirement that the proponent prepare a groundwater operating strategy to its satisfaction. The groundwater operating strategy will address cumulative impacts from developing individual pits and the management of those impacts. The strategy will also address management of the groundwater resource to ensure ecosystem maintenance; • hydrological investigations indicate that the estimated volume of groundwater abstracted and discharged represents a small proportion (0.7%) of the estimated total volume of natural inflow into the lake each year; • the results of hydrogeological investigations that indicate groundwater has similar

Relevant Factor	Relevant Area	EPA Environmental Objective	EPA Assessment	EPA Advice
			and monitor the impacts of groundwater abstraction. The proponent will also be required to prepare a groundwater operating strategy to manage the groundwater resource. The groundwater strategy will identify and address any cumulative impacts that may result from developing successive mining pits. It is noted that overburden has little or no sulphides and hence, this material has a low potential for acid generation when stored in waste rock dumps. Sulphide-bearing materials are however, present in waste rock associated with the ore. This material is also stored in the waste rock dumps and hence there is some potential for acid generation from the waste rock dumps if these sulphide-bearing materials are not appropriately stored. The proponent has advised that routine characterisation of waste rock (associated with the ore) will identify materials that are likely to require specialist disposal practices such as segregation, encapsulation or storage with other materials of sufficient buffering capacity. As sulphide material is associated with ore and such materials represent only about 5% of all materials mined, there should be adequate quantities of other material available to safely encapsulate or otherwise manage sulphides. The EPA considers that where routine testing identifies potentially acid generating materials, the specialist management procedures proposed by the proponent should be reported in the EMP recommended as a condition of the project proceeding. The DME and the DEP will review the adequacy of the proponent's proposed measures to manage acid generating materials. The groundwater and surface water monitoring programs required by the WRC and DEP licences respectively will monitor the effectiveness of the proposed management to prevent contamination of groundwater. If monitoring identified that additional or remediation management measures are required the EMP will be required to be modified. The additional or remediation measures will then be implemented as part of the proponent's obligations to comply with its statutory DEP and WRC licences. The EPA notes that mine discharge water has similar physical and chemical properties to the lake's surface water. There is potential for the quality of groundwater to vary as pits are developed in	physical and chemical characteristics to the lake's surface waters; • the proponent's commitment to conduct detailed hydrological modelling and report its proposed groundwater management strategy for each pit in the EMP prepared on an annual basis. The WRC groundwater abstraction licence approval process will address the adequacy of the hydrological assessment and the proposed groundwater management strategy for each pit; and • groundwater discharged to the lake surface is licensed under the requirements of Part V of the EP Act and this licence will set limits on the quality and quantity of groundwater discharged, it is the EPA's opinion that the proposal can be managed to meet the EPA's environmental objective for Groundwater provided: • the proponent's commitments are made legally enforceable; • the proponent reports the summary results of hydrological investigations for individual mining pits and the proposed management of groundwater in the EMP recommended as a condition of the project proceeding (draft condition 6); and • where routine waste rock characterisation monitoring identifies acid generating materials, the management strategy proposed by the proponent is reported in the EMP. The adequacy of the proposed strategy will be reviewed by the DME and the DEP (draft condition 6). • the groundwater licensing process addresses management of the groundwater

Relevant Factor	Relevant Area	EPA Environmental Objective	EPA Assessment	EPA Advice
			different areas of the lake. In response to this issue, the proponent has included a commitment to conduct further hydrogeological investigations to determine the dewatering requirements of the proposed mine pits as they are developed and report the results and proposed management of groundwater in the EMP prepared on an annual basis. The WRC groundwater abstraction licence approval process will address the adequacy of the hydrological assessments and the proposed groundwater management strategy proposed for each pit. With regard to monitoring of groundwater discharged to the lake's surface, the proponent's existing DEP licence issued under the provisions of the EP Act will be subject to review as new mining pits are developed and limits will be set on the quantity and quality of groundwater discharged. The licence will include limits relating to hydrocarbons to ensure management of hydrocarbons in the mining pits is effective. Potential environmental impacts from mine dewatering on the surface water and ecological processes of Lake Lefroy are discussed under the factor 'Surface water quality'.	resource to ensure ecosystem maintenance and incorporates abstraction and operating controls to prevent contamination of groundwater from hydrocarbons and acid generating materials; and • the pollution licensing system incorporates water discharge controls to prevent contamination of the groundwater from hydrocarbons and acid generating materials.
Surface water quality including aquatic fauna (invertebrates)	Lake Lefroy	Maintain the quality of surface water to ensure that existing and potential uses, including ecosystem maintenance are protected.	EPA notes: • hydrogeological investigations indicate lake sediments throughout the profile are saline; • groundwater proposed for discharge to the surface of the lake are hypersaline and have similar physical and chemical properties to the lake's surface waters; • results of surface water monitoring indicate the lake's' surface waters are hypersaline; • water quality sampling during a cyclonic flooding event confirmed that surface waters remain saline and did not fall below 170 000 ppm TDS due to the presence of a thick salt crust on the lake's surface; • mine dewatering is estimated to add 2.4 million tonnes of salt per annum to the lakes surface; • the top 1 metre of lake sediments are conservatively estimated to hold 94 million tonnes of salt; • aquatic fauna investigations confirmed; • species on Lake Lefroy are not unique; and	Having particular regard to: • results of investigations indicating the volumes of salt added to the surface of the lake by dewatering are not significant when compared to the volume that already exists in the sediments, naturally occurring lakebed salt crust or surface waters; • results of water sampling that indicate ground and surface water have similar physical and chemical properties and hence, discharged mine water will not significantly alter the quality of the lake's surface water; • results of aquatic fauna investigations that indicate the hypersaline surfacewater of the lake does not support unique or significant populations; • the proponent's commitments to protect shoreline habitats known to support

Relevant Factor	Relevant Area	EPA Environmental Objective	EPA Assessment	EPA Advice
			• there is a low species diversity. Few species were found on the lake proper where there is a heavy salt crust. The majority of aquatic fauna found were associated with shoreline habitat. • hydrological monitoring indicates discharge water is confined to the lake proper were the heavy salt crust is present; and • DEP licence required by Part V of the EP Act will set limits on the quality, quantity and location of discharge water. **Proponent's commitments** To protect shoreline habitat from the impacts of mine water discharges by ensuring that discharge points are located away from and do not drain to these areas. **Discussion** The EPA notes the results of surface water and aquatic fauna monitoring that indicate the surface waters of Lake Lefroy are hypersaline (>170 000 ppm TDS) and do not support significant or unique populations of aquatic fauna, whereas shoreline areas have greater species diversity. Investigations conducted by the proponent indicate Lake Lefroy remains saline, even during periods of high inflow. These results are considered important as this indicates that Lake Lefroy does not exhibit a 'fresh water phase', known to occur in other salt lake systems. The absence of a fresh water phase is considered to be due to the thick salt crust on the lake. This 'fresh water phase' has previously been demonstrated to be an important trigger of increased biological productivity. Discharge of hypersaline mine water onto salt lakes during a 'fresh water phase' has been known to significantly affect invertebrate species adapted to completing their life cycle in the short period when fresh water conditions prevail on a lake. It has been concluded that discharges to the lakebed proposed by the proponent are unlikely to significantly alter surface water quality or affect aquatic invertebrate fauna as the species found are not unique, are not present in significant numbers and are not dependent on the 'fresh water phase'. It is noted that shoreline areas have been identified as providing important habitat for aquatic fauna and aquatic flora (*Schizothrix sp.*-algal mats), which act as a refuge for species from the hostile	populations of aquatic invertebrate fauna, and terrestrial vegetation from the impacts of discharge water by ensuring that discharges are located away from and do not drain to these areas; and • the DEP licence required by Part V of the EP Act will set limits on the quantity and quality of groundwater and specify the location of discharge points, it is the EPA's opinion that the proposal can be managed to meet the EPA's environmental objective for Surface water quality provided: • the proponent's commitments are made legally enforceable; and • the management measures to protect shoreline and fringing areas of the lake are documented, their effectiveness is monitored, and, a commitment to modify the measures on the basis of monitoring is incorporated in the EMP recommended as a condition of the project proceeding.

Relevant Factor	Relevant Area	EPA Environmental Objective	EPA Assessment	EPA Advice
			hypersaline environment of the lake bed. Hydrological studies indicate the mine water discharges will be confined to the areas where a thick salt crust prevails (lakebed) and hence, have no impact on these shoreline habitats. The EPA notes the proponent's commitment to identify areas of algal mats (and other environmentally sensitive shoreline habitats) that may potentially be affected by mining operations, in particular, by discharge of groundwater. The proponent's commitment includes the preparation of a map identifying environmentally sensitive areas to be protected. The commitment addresses the selection of disposal sites for mine water discharges that are away from, and do not drain to areas of algal mats. It also addresses the protection of these areas from other disturbance by defining management procedures that specify principles relating to access to sensitive shoreline habitats. The map identifying environmentally sensitive areas, the selection of discharge sites and the effectiveness of the management measures to protect the identified areas will be reported by the proponent in the EMP. The licence issued by the DEP will require the proponent to seek approval to discharge at the proposed locations and will specify the location, quantity and quality of water discharged to the lake's surface. The annual review of the EMP conducted by DME, CALM, WRC and the DEP will assess effectiveness of the implementation of the environmental management measures designed to protect sensitive shoreline habitats, in particular, areas of algal mats.	
Lake Lefroy	Lake Lefroy and surrounds	Maintain the integrity, functions and environmental values of Lake Lefroy	The impacts on Lake Lefroy, the results of investigations and the proposed mitigating measures have previously been discussed under the above factors Nature conservation values, Rehabilitation, Surface water quality and Groundwater quality. When considering the combined consequences of the impacts and the proposed measures to mitigate them on the environmental values and function of Lake Lefroy, the EPA considers the key points to note are: • Lake Lefroy has an estimated area of 554 km^2 (55400 ha); • existing mining has already affected approximately 500 ha within the defined project area;	Having particular regard to: • the expected area of mining disturbance (800 ha or 1.55% of the lake) within the defined project area is considered small in relation to size of Lake Lefroy (55400 ha); • the results of investigations that indicate the lakebed proper (the primary location of mining disturbance) does not support unique or significant populations of aquatic invertebrates because of the thick

Relevant Factor	Relevant Area	EPA Environmental Objective	EPA Assessment	EPA Advice
			• the area impacted by direct disturbance from mining operations as a result of this proposal is approximately 800 ha or 1.55% of the lake and is considered small in relation to the size of the lake; • rehabilitation of mined areas is progressive limiting the total area opened for mining at any one time; • Lake Lefroy is hypersaline (>170 000 ppm TDS) and remains so even during periods of major inflows of water into the lake. • groundwater proposed to be discharged to the surface of the lake has similar physical and chemical properties to surface waters hence, the mine discharge water is unlikely to significantly alter the quality of surface water; • the results of aquatic invertebrate sampling indicates the areas likely to be disturbed by mining or impacted by the mine water discharges do not support significant or unique populations of aquatic invertebrate fauna due to the presence of a thick salt crust and the hypersaline nature of the lake water; • lake fringing areas support populations of aquatic flora and fauna and terrestrial vegetation. Approximately 3 ha of fringing areas of the lake will be disturbed by mining. The area proposed for disturbance has already been impacted by existing mining, does not contain DRF, Priority flora species or Threatened fauna and represents a small portion of the total available habitat of this type found on Lake Lefroy and hence, loss of this small area is not considered be significant in terms of conservation value; • other than the 3 ha of fringing areas proposed for disturbance, the proponent has included a commitment to protect shoreline and fringing areas within the project area from the impacts of mine water discharges and mining; • waste rock dumps will form islands around which lake waters should continue to flow without undue hindrance; • the proponent has detailed proposed rehabilitation strategies and methods aimed at ensuring areas impacted by mining are satisfactorily rehabilitated rendering them safe and encouraging the re-establishment of a self sustaining ecosystem; • the proponent will prepare an EMP that will be reviewed and updated on an annual basis. It will provide details of individual	salt crust on the lake; • the proponent's commitments to protect shorelines and fringing areas identified as having higher conservation value because they do support populations of aquatic flora and fauna, and terrestrial vegetation, from the impacts of mining disturbance and mine water discharges by ensuring discharges are located away from and do not drain to these areas; • the results of investigations that indicate mine water discharges have similar physical and chemical properties to surfacewater, hence, discharged mine water will not significantly alter the quality of the lake's surfacewater; and • the proposed progressive rehabilitation of areas disturbed by mining, it is the EPA's opinion that the proposal is capable of being managed to meet the EPA's environmental objective for Lake Lefroy provided: • the proponent's commitments are made legally enforceable; • the EMP that details, among other things, mining and rehabilitation plans is applied as a condition of the project proceeding (draft condition 6) to enable institutional arrangements to be established between the DME, CALM, WRC and the DEP with regard to ensuring compliance with the EPA's objectives and reviewing the adequacy of the proponent's proposed environmental

Relevant Factor	Relevant Area	EPA Environmental Objective	EPA Assessment	EPA Advice
			mining pit developments and propose measures to mitigate against identified impacts. Performance against previous planning commitments will be reported on an ongoing basis. This will provide a mechanism to incorporate the results of ongoing research investigations and adapt planning and rehabilitation strategies as required. The EMP and annual updates will be assessed by the DME, WRC, CALM and DEP to ensure compliance with the EPA's objectives and, if required, modified accordingly; and • as mining nears completion, the proponent will be required to undertake a review of the project and develop a program to ensure all areas disturbed by mining are satisfactorily rehabilitated. The Final Decommissioning and Rehabilitation Plan is recommended to be made publicly available. The EPA has concluded that the environmental impacts are capable of being managed so as not to compromise the function and ecology of Lake Lefroy.	management measures and their implementation; and • the proponent prepares, makes publicly available and implements a Final Decommissioning and Rehabilitation Plan to present the results of a review of closure planning.
Identification of alternative and additional sites	Project area		It is important to note that the proponent has identified the approximate number and location of gold mining pits in the defined project area. It is possible that further orebodies will be identified by future exploration. The EPA considers that in this case a key definer of the proposal is the project area. In all probability some flexibility will be required during the implementation of the proposal to accommodate variations in the location and number of pits that may eventually be developed within the project area. It is therefore the opinion of the EPA, that where an additional site(s) or a variation to the location of existing site(s) is identified within the project area and the proponent can demonstrate to the satisfaction of the EPA that the environmental impacts of mining at the particular site(s) are substantially the same as those sites previously indicated, mining may occur, provided that all other requirements of the proposal are met. To address the likelihood of additional or alternative sites being proposed within the project area, the EPA recommends draft condition 8 requiring the proponent to consider the environmental impacts of the mining pits and propose environmental management measures before submitting documentation detailing its intention to mine as part of the EMP	Recognising that it is possible further orebodies will be identified by future exploration in the project area, it is the EPA's opinion that, where an additional site(s) or a variation to the location of existing site(s) is identified within the project area and the proponent can demonstrate to the satisfaction of the EPA that the environmental impacts of mining at the particular site(s) are substantially the same as those sites previously indicated, mining may occur, provided that all other requirements of the proposal are met. The proponent will consider the environmental impacts of the mining pits and propose environmental management measures before submitting documentation detailing its intention to mine as part of the EMP reporting process. The DEP on behalf of the EPA will be responsible for assessing the significance of the environmental impacts

Relevant Factor	Relevant Area	EPA Environmental Objective	EPA Assessment	EPA Advice
			reporting process. The DEP on behalf of the EPA will be responsible for assessing the significance of the environmental impacts and the adequacy of the proponent's environmental management measures and for providing formal written advice that the condition has been satisfied. Documentation prepared by the proponent as part of its requirement to satisfy this condition and the written advice of the DEP will be available on the public record.	and the adequacy of the proponent's environmental management measures and for providing formal written advice that the condition has been satisfied. Documentation prepared by the proponent as part of its requirement to satisfy this condition and the written advice of the DEP will be available on the public record.

Appendix 5

Recommended Environmental Conditions and Proponents Consolidated Commitments

Recommended Environmental Conditions

Statement No.XXX

STATEMENT THAT A PROPOSAL MAY BE IMPLEMENTED
(PURSUANT TO THE PROVISIONS OF THE
ENVIRONMENTAL PROTECTION ACT 1986)

GOLD MINE DEVELOPMENTS ON LAKE LEFROY

Proposal: The proposal includes gold mining developments within a defined project area on Lake Lefroy a naturally occurring salt lake approximately 7 kilometres southeast of Kambalda. Thirteen sites have already been identified for development of open-cut gold mining pits, some with underground portals and mining. Additional sites may be identified within the defined project area. Waste rock dumps, access infrastructure and mining support facilities such as workshops and contractor's compounds will be associated with the mining developments. Administration, central maintenance and processing of ore will occur at the existing St Ives Gold operations to the south of the lake. The project area, the approximate location of the identified resources, and other data are documented in schedule 1 of this statement.

Proponent: WMC Resources Ltd (St Ives Gold)

Proponent Address: c/- Post Office Kambalda

KAMBALDA WA 6442

Assessment Number: 1250

Report of the Environmental Protection Authority: Bulletin 976

The proposal to which the above report of the Environmental Protection Authority relates may be implemented subject to the following conditions and procedures:

Procedures

1 Implementation

1-1 Subject to these conditions and procedures, the proponent shall implement the proposal as documented in schedule 1 of this statement.

1-2 Where the proponent seeks to change any aspect of the proposal as documented in schedule 1 of this statement in any way that the Minister for the Environment determines, on advice of the Environmental Protection Authority, is substantial, the proponent shall refer the matter to the Environmental Protection Authority.

1-3 Where the proponent seeks to change any aspect of the proposal as documented in schedule 1 of this statement in any way that the Minister for the Environment determines, on advice of the Environmental Protection Authority, is not substantial, those changes may be effected.

2 Proponent Commitments

2-1 The proponent shall implement the consolidated environmental management commitments documented in schedule 2 of this statement.

2-2 The proponent shall implement subsequent environmental management commitments which the proponent makes as part of the fulfilment of conditions and procedures in this statement.

3 Proponent

3-1 The proponent for the time being nominated by the Minister for the Environment under section 38(6) or (7) of the Environmental Protection Act 1986 is responsible for the implementation of the proposal until such time as the Minister for the Environment has exercised the Minister's power under section 38(7) of the Act to revoke the nomination of that proponent and nominate another person in respect of the proposal.

3-2 Any request for the exercise of that power of the Minister referred to in condition 3-1 shall be accompanied by a copy of this statement endorsed with an undertaking by the proposed replacement proponent to carry out the proposal in accordance with the conditions and procedures set out in the statement.

3-3 The proponent shall notify the Department of Environmental Protection of any change of proponent contact name and address within 30 days of such change.

4 Commencement

4-1 The proponent shall provide evidence to the Minister for the Environment within five years of the date of this statement that the proposal has been substantially commenced.

4-2 Where the proposal has not been substantially commenced within five years of the date of this statement, the approval to implement the proposal as granted in this statement shall lapse and be void. The Minister for the Environment will determine any question as to whether the proposal has been substantially commenced.

4-3 The proponent shall make application to the Minister for the Environment for any extension of approval for the substantial commencement of the proposal beyond five years from the date of this statement at least six months prior to the expiration of the five year period referred to in conditions 4-1 and 4-2.

4-4 Where the proponent demonstrates to the requirements of the Minister for the Environment on advice of the Environmental Protection Authority that the environmental parameters of the proposal have not changed significantly, then the Minister may grant an extension not exceeding five years for the substantial commencement of the proposal.

5 Compliance Auditing

5-1 The proponent shall submit periodic Compliance Reports, in accordance with an audit program prepared in consultation between the proponent and the Department of Environmental Protection.

5-2 Unless otherwise specified, the Chief Executive Officer of the Department of Environmental Protection is responsible for assessing compliance with the conditions, procedures and commitments contained in this statement and for issuing formal written advice that the requirements have been met.

5-3 Where compliance with any condition, procedure or commitment is in dispute, the matter will be determined by the Minister for the Environment.

Environmental Conditions

6 Environmental Management Program

6-1 Prior to the commencement of ground-disturbing activities of the first anticipated mining pit, the proponent shall prepare an Environmental Management Program to the requirements of the Environmental Protection Authority on advice of the Department of Environmental Protection, the Department of Minerals and Energy, the Water and Rivers Commission and the Department of Conservation and Land Management.

The Environmental Management Program shall include the following environmental management plans:

1. a baseline plan that identifies the location of currently planned mining developments, the sequence of mining of pits, expected areas of disturbance and a conceptual rehabilitation schedule;

2. a mining plan that details the design and proposed layout of each mining pit, associated waste dumps and access infrastructure that is intended to be developed in the following 12 month period;

3. the environmental management measures to meet the Environmental Protection Authority's objectives;

4. a closure and rehabilitation plan for each pit, its associated waste dumps and access infrastructure that is intended to be developed in the following 12 month period. This plan shall describe :

    - the closure option selected for each pit. Where it is proposed to leave a mining void at the end of mining, demonstrate that the mine planning process has given due regard to the environmental importance of backfilling mining areas;

    - how the closure and decommissioning will be implemented;

    - the rehabilitation objective and completion criteria relevant to the selected closure option; and

    - the monitoring program that will be implemented to determine progress made in achieving the rehabilitation objective;

5. a baseline plan showing shoreline and fringing areas of the lake that are to be protected from the effects of mining, in particular, from the effects of groundwater discharges and physical disturbance;

6. a plan including measures to ensure fringing areas of the lake are not significantly affected or inundated and showing the location of proposed groundwater discharge points; and

7. a plan for managing acid-generating materials if present.

6-2 The proponent shall revise/update the Environmental Management Program required by condition 6-1 on an annual basis or as new pits are developed. Revisions of the Environmental Management Program will be subject to review by the Department of Environmental Protection with advice from the Department of Minerals and Energy, the Water and Rivers Commission and the Department of Conservation and Land Management.

Revisions of the Environmental Management Program shall address the following matters:

1. mining plan(s) for new pits anticipated to be developed in the following 12 month period;

2. closure and rehabilitation plan(s) for each new pit, its associated waste dumps and access infrastructure that are anticipated to be developed in the following 12 month period;

3. review and report on performance in implementing the existing the mining plan(s) referred to in 6-1;

4. review and report performance implementing existing and, closure and rehabilitation plan(s) referred to in 6-1;

5. research proposals, plans, and reports committed to (see schedule 2);

6. present information on compliance with conditions and commitments (see schedule 2);

7. key findings and recommendations of statutory monitoring and compliance reports. Propose measures to implement recommendations; and

8. proposed measures to implement recommendations referred to in 7 above.

6-3 The proponent shall implement the Environmental Management Program and revisions required by condition 6-1 and 6-2 until such time as the Minister for the Environment, on advice from the Environmental Protection Authority, determines that decommissioning and rehabilitation are complete.

7 Final Decommissioning and Rehabilitation Plan

7-1 At least two years prior to the anticipated date of completion of mining or at a time agreed with the Department of Environmental Protection, the proponent shall prepare a Final Decommissioning and Rehabilitation Plan to the requirements of the Environmental Protection Authority on advice of the Department of Environmental Protection, the Department of Minerals and Energy, the Water and Rivers Commission and the Department of Conservation and Land Management.

The objectives of the plan are to:

- render the minesite areas safe and stable; and
- encourage the re-establishment of self-sustaining ecosystems.

The plan shall address:

1. the removal or, if appropriate, retention of plant and infrastructure;
2. final rehabilitation of all disturbed areas to a standard suitable for agreed land use/s; and
3. identification and remediation of contaminated areas, including the provision of evidence of notification to relevant statutory authorities.

7-2 The proponent shall implement the Final Decommissioning and Rehabilitation Plan required by condition 7-1 until such time as the Minister for the Environment, on advice from the Environmental Protection Authority, determines that decommissioning and rehabilitation are complete.

7-3 The proponent shall make the Final Decommissioning and Rehabilitation Plan required by condition 7-1 publicly available to the requirements of the Environmental Protection Authority.

8 Identification of Alternative and Additional Sites

8-1 Within the defined project area as documented in schedule 1 of this statement, at a site(s) not previously indicated and following a demonstration to the satisfaction of the Environmental Protection Authority by the proponent that the environmental impacts of mining at the particular site(s) are substantially the same as at those sites previously indicated, the proponent may mine, provided that all other requirements of the proposal are met.

8-2 The proponent shall notify the Department of Environmental Protection of its intention to mine at site(s) referred to in condition 8-1. In support of its notification of intention to mine, the proponent shall submit documentation identifying environmental impacts and proposing measures to manage identified environmental impacts.

8-3 The Chief Executive Officer of the Department of Environmental Protection is responsible for assessing compliance with condition 8-1 and 8-2, and for issuing formal written advice that the condition is satisfied, and that all other requirements of the proposal are met. Documentation prepared by the proponent and the Department of Environmental Protection with regard to satisfying condition 8-1 will be publicly available.

8-4 Where compliance with condition 8-1 is in dispute, the matter will be referred to the Minister for the Environment for determination.

Note

1. The proponent is required to apply for a Works Approval and Licence for this project under the provisions of Part V of the Environmental Protection Act.

The Proposal

The proposal includes gold mining developments within a defined project area on Lake Lefroy a naturally occurring salt lake approximately 7 kilometres southeast of Kambalda. Thirteen sites have already been identified for development of open-cut gold mining pits, some with underground portals and mining. Additional sites may be identified within the defined project area. Waste rock dumps, access infrastructure and mining support facilities such as workshops and contractor's compounds will be associated with the mining developments. Administration, central maintenance and processing of ore will occur at the existing St Ives Gold operations to the south of the lake. The project area and the approximate location of the identified resources are shown on Figure 1 (attached).

Key Characteristics Table

Element	Quantities/Description
Life of project	Approximately 10 years
Mining method	Open pit mining using conventional drilling, blasting, loading and hauling techniques. Underground mining may be conducted at some deposits.
Mining rate	Approximately 21 million tonnes of ore and 414 million tonnes of overburden will be mined during the ten year life of the project. The annual mining rate will vary dependent on the sequence of mining pits.
Mine operation	Continuous operation
Size of ore bodies	Approximately 435 million tonnes of ore and overburden
Strip ratio	Approximately 20:1
Depth of mining	30 - 150 metres
Dewatering volume rate (range)	4000 - 5000 Kilolitres per day for each pit
Approximate area of disturbance within the project area (including access)	805 hectares
List of major components • open pits • overburden dumps • infrastructure (bunds, causeways, roads, settlement ponds, ore pads etc) Total area	 240 hectares 400 hectares 165 hectares 805 hectares

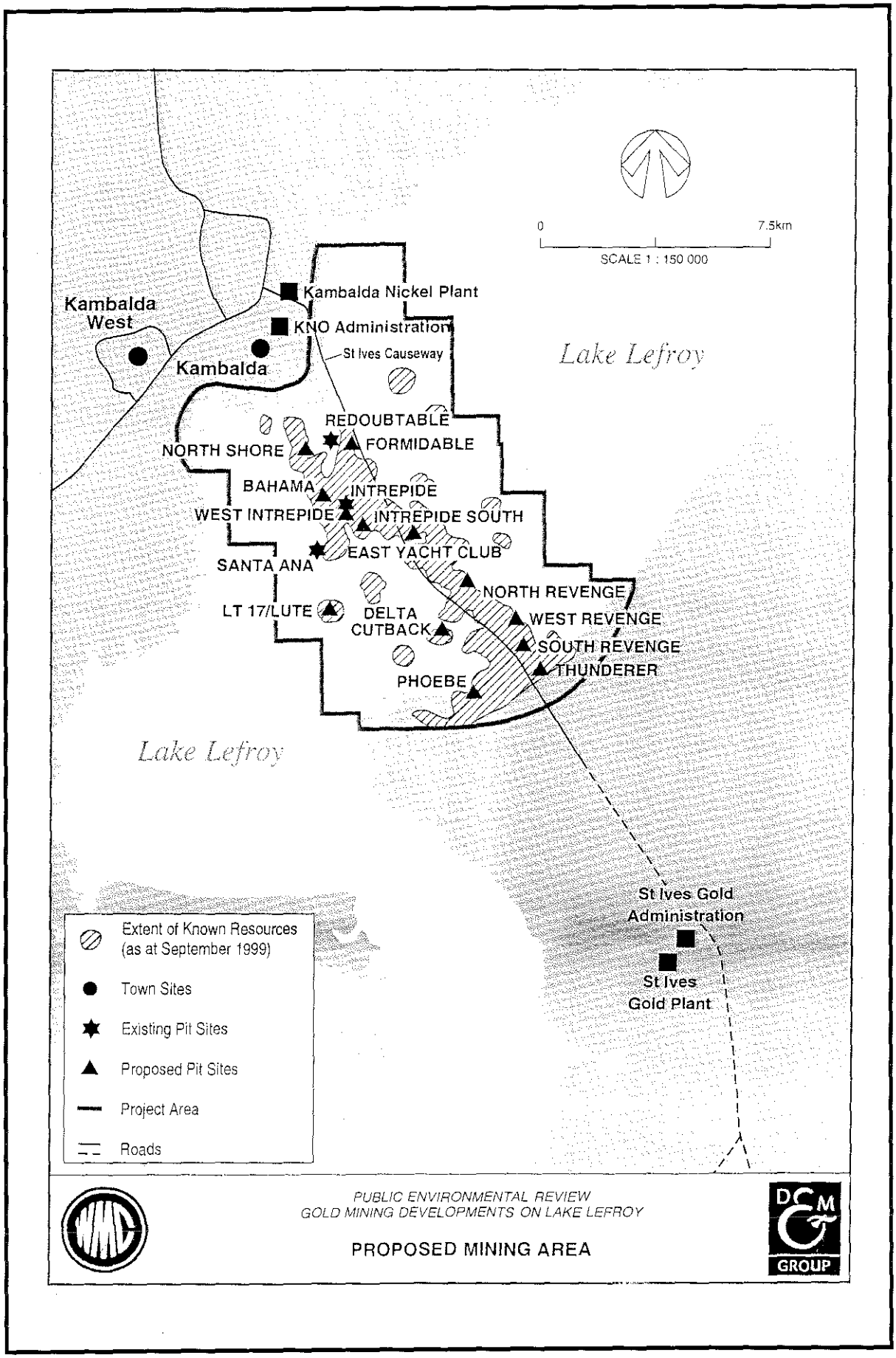

Figure 1. Gold Mining Sites and Project Area

Schedule 2

Proponent's Consolidated Environmental Management Commitments

April 2000

GOLD MINE DEVELOPMENTS ON LAKE LEFROY (1250)

WMC Resources Ltd (St Ives Gold)

Schedule 2: Summary of the Proponent's Environmental Management Commitments

Issue	Objective	Action	Timing	Whose Advice	Evidence of Measurement/Compliance Criteria
1. Groundwater	1. To identify the dewatering requirements of each of the mine pits to be developed as part of this Project and to select the appropriate discharge option.	1.1 For each new pit, undertake an investigation into the quality and volume of groundwater to be abstracted. Evaluate the various discharge options and select the most environmentally appropriate. 1.2 Identify the environmental management measures (including protection of fringing and shoreline areas of the lake) required for selected discharge option. 1.3 Apply for variations to WRC and DEP Licences. 1.4 Provide a summary of actions in the EMP and the reference to monitoring results which will be reported separately under WRC and DEP Licence requirements.	As each new pit is developed.	WRC	The results of these investigations will be reported in the EMP (or separately if timing constraints exist). The Proponent's DEP pollution control licence and WRC Groundwater well licence (GWL) will be modified as appropriate.
2. Surface water	2. To develop a more detailed understanding of the surface hydrology of Lake Lefroy.	2.1 In the EMP provide a map which identifies the surface water monitoring points. 2.2 Provide a legend with the map which identifies the type of monitoring undertaken at each site. 2,3 Provide a summary in the EMP of the objective of the monitoring at each point. 2.4 Provide summary data and discussions on the monitoring in the EMP. 2.5 Provide reference to more detailed reports on the surface water monitoring in the EMP (e.g. WRC report, DEP Licence report, CSIRO study reports). 2.6 Identify changes to the monitoring program and discussion on need for the change.	Within 12 months following ground disturbing activities.	WRC	Reported in the EMP.

Issue	Objective	Action	Timing	Whose Advice	Evidence of Measurement/Compliance Criteria
3. Lake Lefroy	3. To minimise further disturbance of natural islands within the Project Area.	3.1 No additional disturbance of Gamma Island, Oyster Island or Coral Island will occur as a result of the proponent's mining activities.	3.1 Throughout project life.		
4. Lake Lefroy	4. To control erosion and ensure that sediment loads in the lake do not increase significantly as a result of the Project.	4.1 Control erosion by minimising the extent of disturbance of the lakescape and progressively rehabilitating disturbed areas. To demonstrate this, report in the EMP: • a record of areas disturbed for mining and related activities (map and tabular); • a record of areas rehabilitated (map and tabular); and • reconciliation of the areas disturbed and rehabilitated against areas proposed in mining plans presented in previous EMP's. * Note Information will be recorded in GIS format compatible with the GIS of the DEP and the DME.	On an annual basis	DME	Reported in the EMP
5. Rehabilitation	5. To obtain a better understanding of the long term stability of the lake sediments (when partially submerged in lake water) to facilitate the development of appropriate management and closure strategies as required.	5.1 Provide in the EMP an overview of investigations/research undertaken and to be undertaken with respect to geotechnical pit wall stability post mining in the EMP. 5.2 Provide an update of findings in the EMP. 5.3 Identify and discuss any additional geotechnical investigations undertaken or to be undertaken in the EMP. 5.4 Report on the findings of the additional investigations in the EMP. 5.5 Detail in the EMP actions that are intended to be taken as a result of investigations.	5.1 Within 12 months of ground disturbing activities. 5.2 On an annual basis. 5.3 On an annual basis. 5.4 At the completion of research investigations.	DME and WRC	Reported in the EMP.

Issue	Objective	Action	Timing	Whose Advice	Evidence of Measurement/Compliance Criteria
			5.5 At the completion of research investigations.		
6. Rehabilitation	6. To minimise disturbance to the biota of the Project Area.	In conjunction with Commitment 4 and 11 6.1 Areas of the Lake shoreline which will be disturbed in the next 12 months by the project will be specifically identified on a plan in the EMP. 6.2 Detail will be provided on how impacts from disturbance will be managed. * Note Information will be recorded in GIS format compatible with the GIS of the DEP and the DME.	6.1 On an annual basis. 6.2 On an annual basis.	DME and CALM	Reported in the EMP.
7. Rehabilitation	7. To minimise the generation of dust during the construction and operation of the Project.	7.1 Prepare a management procedure detailing measures to minimise dust during the construction and operation of the project. The management procedure shall address: • the use of saline water for dust suppression on haul roads and other exposed surfaces; and • measures to control over-spraying by water trucks such as bunding to prevent the egress of saline water to the surrounds with run-off directed to catch pits.	7.1 Prior to ground disturbing activities.	DEP and DME	The management procedure will be included in the EMP. The effectiveness of the measures will be monitored by the DEP licence.
8. Surface water	8. To prevent flooding of fringing vegetation with hypersaline water from dewatering discharges and to minimise disturbance	8.1 Any new mine dewatering discharge points required as a result of implementing this project will be identified on a map in the EMP. 8.2 The map will identify the relative elevations between the lake bed at the discharge point and shoreline vegetation when a discharge point is	1 As new discharge points are proposed.	WRC and CALM	Reported in the EMP

Issue	Objective	Action	Timing	Whose Advice	Evidence of Measurement/Compliance Criteria
	to the *Schizothrix spp* mats, aquatic flora and invertebrate fauna inhabiting the playas.	located within 100 m of the shoreline. 8.3 Additional protection measures such as sumps and bunds will also be identified when appropriate. 8.4 Photographic monitoring points will be established at discharge points when the discharge is within 100 m of the shoreline and photographs will be taken annually until the discharge point is no longer used. 8.5 Relative lake water levels will be noted when they are greater than the elevation of the lake bed at the discharge point. 8.6 Discussion will be provided in the EMP on any likely impacts of elevated lake water levels and on the impacts of dewatering on the shoreline and flora. 8.6 Measures to manage impacts on shoreline areas will be proposed. * Note Information will be recorded in GIS format compatible with the GIS of the DEP and the DME.			
9. Fauna	9. To develop a better understanding of the vertebrate fauna of the Project Area and facilitate the development of appropriate management programs as required.	9.1 The existing vertebrate fauna monitoring program will be reviewed within 12 months of the project commencing. 9.2 The findings of the review and any proposal to revise program will be reported in the EMP. 9.3 Feral cat eradication will be conducted on an as needed basis. 9.4 Results of any feral cat eradication program will be reported in the EMP.	9.1 Within 12 months following ground disturbing activities. 9.2 On an annual basis. 9.3 On an annual basis 9.4 On an annual	DEP and CALM	Reported in the EMP.

Issue	Objective	Action	Timing	Whose Advice	Evidence of Measurement/Compliance Criteria
			basis.		
10. Rehabilitation	10. To identify those lake muds that are suitable for use as plant growth media in rehabilitation programs.	10.1 A research and investigation program on the use of lake muds as a rehabilitation media will be established with the University of Western Australia. 10.2 The objectives of the study will be reported in the EMP. 10.3 Results and recommendations will be reported in the EMP.	10.1 Within 12 months of ground disturbing activities. 10.2 At the completion of the research investigations.	DME and CALM	The results of these investigations will be reported in the AEMP.
11. Rehabilitation	11. To determine the feasibility of using overburden in dune reconstruction.	11.1 When the feasibility studies for Pheobe and/or Thunderer pits are undertaken, the possibility of reconstructing dunes previously mined for sand will also be considered. 11.2 Any conceptual designs developed will be reported in the EMP. 11.3 If dune reconstruction adjacent to these pits is feasible designs and progress toward achieving these designs will be reported in the EMP.	11.1 When the feasibility studies for Phoebe and Thunderer pits are undertaken. 11.2 At the completion of the investigations. 11.3 At the completion of the investigations	DME and CALM	Reported in the EMP

Notes:
Department of Conservation and Land Management (CALM)
Department of Environmental Protection (DEP)
Department of Minerals and Energy (DME)
Water and Rivers Commission (WRC)
Environmental Management Program (EMP)
Geographic Information System (GIS)

Appendix 6

Summary of Submissions and

Proponent's Response to Submissions

10 January 2000

Department of Environmental Protection
9th Floor, Westralia Square
141 St George's Terrace
PERTH WA 6000

Attention: Mr Mark Jefferies

Dear Sir,

PROPONENT'S RESPONSE TO SUBMISSIONS
GOLD MINING DEVELOPMENTS ON LAKE LEFROY
PUBLIC ENVIRONMENTAL REVIEW
(ASSESSMENT NO. 1250)

This letter presents the response by WMC Resources Ltd (St Ives Gold) to the issues raised in public and government agency submissions on the Public Environmental Review (PER) for gold mining developments on Lake Lefroy prepared by Dames & Moore (1999).

The submissions were summarised by the Department of Environmental Protection (DEP) and included issues associated with:

- nature conservation values;
- aquatic flora;
- terrestrial flora and fauna;
- landform considerations;
- rehabilitation;
- groundwater quality; and
- Aboriginal culture and heritage.

These issues (in italics), and St Ives Gold's response, are presented below.

1. General comments

1.1 *Support is expressed for the work already* ***conducted*** *by St Ives Gold in terms of flora, fauna and habitat inventories and the likely effects on these by the project.*

A further report on the aquatic ecology studies conducted for the Project has been prepared by Curtin University (Chaplin and John, 1999) and submitted to St Ives Gold. A copy of this report will be provided upon request to the DEP, Department of Conservation and Land Management (CALM) and Department of Minerals & Energy (DME).

The findings of any additional survey work, and any modifications made to the environmental management of the Project as a consequence of these studies, will be reported in the Annual Environmental Management Plan (AEMP) that will be provided to the regulatory authorities each year (see Section 1.11 of the PER for further information on the AEMP process).

1.2 *The commitment of St Ives Gold not to develop new infrastructure on Coral, Gamma and Oyster islands is supported.*

As indicated in Section 5.10 of the PER, CALM has advised that the natural islands on Lake Lefroy may be locally significant as they may provide breeding sites for birds, particularly waterfowl.

St Ives Gold's commitment not to construct any new facilities or infrastructure on Gamma, Oyster and Coral island (Commitment 5) was made in recognition of the importance of avoiding disturbance of natural islands as much as possible.

2. Nature conservation values

2.1 Salt lakes and their fringing vegetation are poorly represented in the conservation reserve system in the Coolgardie Biogeographic Region. There is minor representation in the Mt Manning Range Nature Reserve as well as in CALM-managed land (Jaurdi, Mt Elvire and Goongarrie). CALM continues to investigate opportunities to include representative areas of all land types and landforms within each biogeographic region into a system of management that has nature conservation as a primary objective (including conservation reserves and management agreements). Within the Coolgardie Biogeographic Region (and in all rangeland bioregions), lake systems and their fringing vegetation continue to be a high priority for securing conservation management arrangements. This is particularly the case as these systems continue to have imposed pressures upon them from development and grazing land uses. Lake Lefroy and its surrounds appear to have significant, specific conservation values. This is supported in this document by data statements including:

- *"the vegetation of this land system is highly preferred for grazing by native and introduced fauna but the survey by Payne et al. (1998) found the vegetation in the survey was generally in good condition..." (Section 3.6).*

- *23 species of waterfowl have been recorded utilising the lake system (Section 3.10.2). It is difficult to compare this figure with other observations from similar lakes in the region as different search efforts would yield different results. However, 52 species of waterfowl, in total, have been previously recorded from the southeast interior (Storr, 1986), from 7 types of wetlands*

(B8, B12, B6, B10, B13, B14 and C2). Given that this lake represents one wetland type, 23 species could be considered as significant.

- *10 significant fauna species may occur in the project area (Section 3.10.4).*
- *"nearly all saline wetlands in Western Australia's Goldfields Region occur either within pastoral leases or as unallocated Crown land, so there are few statutory mechanisms for their protection..." (Section 3.14).*
- *Declared Rare Flora (DRF) (Pityrodia scabra) is known to occur on the lake margins (see comments above re Section 3.8).*

Other lakes in the Coolgardie Biogeographic Region may have equal or higher specific conservation values but comparisons have only been made with different wetland types (Rowles Lagoon - B6, B13 and B14) within the same bioregion or the same wetland types (B8) outside of the bioregion (Lakes Marmion and Ballard [Murchison bioregion] and Lake Barlee [Murchison & Yalgoo]).

It is recommended that St Ives Gold undertake further investigations to compare the nature conservation values of Lake Lefroy with similar wetland types in the Coolgardie Biogeographic Region.

Based on the above comments that identify Lake Lefroy as containing high conservation values, is St Ives Gold intending to enter into discussions with CALM regarding improving the conservation status and management of this wetland type and its surrounds in the Coolgardie Biogeographic Region? In particular, has St Ives Gold discussed with CALM, the management of Lake Lefroy and any possible opportunities to secure other areas with similar values?

The following comments are offered to clarify the above statements:

- Section 3.6 of the PER states that Payne et al. (1998) found that the vegetation of the Lefroy land system within the survey area (i.e. the area surveyed by Agriculture Western Australia) was generally in good condition (except where disturbed by previous or current sand, gold or other mining activities). The area proposed for development for the Phoebe and Thunderer pits has been extensively disturbed by sand mining and does not hold any particular conservation value.
- Table 3.12 of the PER provides a list of waterbirds known to occur or which may occur at a range of wetlands in the Goldfields region. A review of the data collated by Ninox Wildlife Consulting (1995, 1999) which are presented in Appendix E of the PER indicates that whilst 23 species may occur at the lake, none of these have actually been recorded there during previous baseline or monitoring surveys. Lake Lefroy is not known to be an important breeding site for waterbirds and is unlikely to provide this function as it does not experience the freshwater phase and increased invertebrate activity that occurs as other lakes such as Lake Ballard, Lake Barlee and Lake Marmion.
- Of the 10 significant fauna species that may occur in the Project Area listed in Table 3.13 of the PER, only the Peregrine Falcon (*Falco peregrinus*) has been previously recorded in the area. This species is regarded as a rare visitor, mostly in autumn and winter (Storr, 1986). Suitable habitat for these species is present in the Project Area and its surrounds, but it is unlikely that permanent populations of these species will occur in the area or be affected by the proposed mining developments.

- Only Lake Walton, part of Lake Goongarrie and the southern portion of Lake Marmion occur within lands managed for conservation purposes. Both Lake Lefroy and Lake Walton are classified as intermittent saline lakes (B8) by ANCA (1996) though these lakes are somewhat different in size and location.

- The DRF species, *Pityrodia scabra*, has not been recorded in the Project Area though suitable habitat is present (see the response to Issue 4 – Terrestrial Flora, below).

Some areas of the lake (such as the natural islands that have not been disturbed by mining activity) may be considered to have some conservation value but the Project Area itself, which comprises the biologically inactive saline lakebed and a small area of previously disturbed shoreline, has little conservation value. The management of current and proposed mining operations will not detract from the conservation values of other areas at Lake Lefroy.

St Ives Gold's proposal for gold mining developments on Lake Lefroy was described in the PER in both a local and regional context. The regional assessment did not focus on the biogeographic region but took a broader view of the Goldfields region. Given the detailed nature of the studies conducted for the Project, and the small area of disturbance associated with the proposed mining developments, further regional studies are not warranted at this stage.

The environmental studies conducted at Lake Lefroy has been used as a model for other operations in the region. In addition, WMC has instigated some baseline work on Lake Cowan and Lake Dundas through WMC's Central Norseman Operations which will contribute to an improved understanding of the environmental values of salt lakes in the region.

3. Aquatic flora

3.1 *It is noted that the playas support algal mats (Schizothrix). The 2.4 ha of algal mats affected by the proposal may be considered by some to be a minor figure when compared to the total area of available habitat. However, the PER does not confirm if other projects on Lake Lefroy are likely to also have an impact on other areas the algal mats. It is difficult to consider the impacts from this proposal on the algal mats without knowing what the cumulative impacts from other operations are likely to be. Can St Ives Gold confirm the cumulative areas of algal mats that are likely to be affected by their gold mine developments and other known developments on the lake?*

As described in Section 3.9 of the PER, the salt-encrusted region of Lake Lefroy is generally devoid of aquatic flora. These species (which include the filamentous cyanobacterium *Schizothrix* sp.) are more likely to occur in the ephemeral pools and samphire zones present along the lake's shoreline.

St Ives Gold is not aware of any other active exploration or mining activities on Lake Lefroy other than its own operations and those of WMC subsidiary Kambalda Nickel Operations. Those gold and nickel operations based on the lake are located away from any areas that might support algal mats.

The only impact on the algal mats due to this Project will be associated with the development of the Phoebe and Thunderer pits and associated infrastructure on the eastern shoreline of Lake Lefroy. The development of these pits will result in the disturbance of approximately 2.4 ha of playas and claypans that could support *Schizothrix* mats. This represents an insignificant portion of the total area of suitable habitat in the Lake Lefroy area. Consequently, this disturbance is not considered to be of local or regional significance.

The work conducted by St Ives Gold in the assessment of this Project has resulted in the identification of key factors in Lake Lefroy's hydrology and ecology which could be utilised in any subsequent environmental impact assessment by other potential developer(s), hopefully resulting in improved environmental outcomes.

4. Terrestrial flora

4.1 The PER infers that floristic and vegetation data have been extrapolated from monitoring plots that are removed from the proposed areas of disturbance. It is not clear whether those areas requiring vegetation removal (Thunderer and Phoebe pits) have been specifically searched for rare flora.

The PER goes on to state (Executive Summary) that "the vegetation in these areas has been disturbed previously through sand mining and is not known or likely to support DRF or Priority Flora". This statement is speculative.

In regard to this statement, a number of considerations are relevant:

- *Pityrodia scabra (DRF) is known to occur elsewhere along the lake margin of Lake Lefroy. All known populations of Pityrodia scabra in the Goldfields occur in disturbed areas (tracks, roadways, pipeline and powerline corridors, sand mining operations and rehabilitation) among an open woodland of eucalypts and spinifex (Triodia scariosa) in light brown gypsiferous sands, generally preferring sandy slopes adjacent to salt lakes and claypans (from Technical Report: EVR 156, "Management Plan for Declared Rare Flora: Pityrodia scabra"- WMC May 1998).*

- *A number of associated species recorded in rare flora report forms are common to the extrapolated vegetation type included within proposed pit areas (particularly vegetation type S3). These include Triodia scariosa, Eucalyptus platycorys, Acacia ligulata, Alyxia buxifolia, Westringia rigiola and Scaevola spinescens.*

Were these areas specifically searched for rare flora? If not, it is recommended that St Ives Gold specifically search the areas proposed for disturbance by the Thunderer and Phoebe pits for the presence of DRF and Priority Flora.

A baseline flora and vegetation survey of the Lake Lefroy area (including the Project Area) was conducted by Mattiske Consulting in April and August 1993. Opportunistic collection of flora species was conducted in addition to the establishment of monitoring plots. Time was also allocated during this survey to searching for rare, threatened and geographically restricted species (Mattiske Consulting, 1996).

In addition, a number of surveys specifically searching for *Pityrodia scabra* have also been conducted in the Lake Lefroy area. As a result of these surveys, populations of this species are known to occur near Lake Fore (a small salt lake located between Lake Lefroy and Lake Zot), to the east of Lake Lefroy and to the south of Lake Lefroy. As most of these populations occur in areas where WMC has infrastructure, a Management Plan has been

developed to manage potential impacts on this species as a result of activities by St Ives Gold and Kambalda Nickel Operations (WMC Resources Ltd, 1998). This Plan includes a commitment for further surveys aimed at locating populations of rare flora that may occur in areas controlled or impacted by WMC activities.

Searches for DRF and Priority Flora were also conducted in and around the Thunderer-Phoebe area in June 1998, January 1999 and September/December 1999. No DRF or Priority Flora species were recorded in the Phoebe or Thunderer areas during these surveys. As *Pityrodia scabra* is known to colonise disturbed areas, another search of the proposed mining areas will be conducted prior to the commencement of construction to determine if this (or other rare or priority species) have become established since the previous survey. The results of this survey will be reported through the AEMP process (as described in Section 1.11 of the PER).

In the event that DRF is identified within the area proposed for development, discussions will be held with CALM regarding appropriate management strategies and approvals for clearing if required.

5. Terrestrial fauna

5.1 *The information regarding non-avian fauna appears sound and conclusions acceptable provided the clearing does not extend further than indicated in this document. Impact on fauna would have to be reconsidered should there be any proposals for further extension to disturbance. Can St Ives Gold confirm what approvals would be required for any proposal to expand the area of disturbance?*

As discussed in Section 2 of the PER, the Project Description provided in the PER is indicative and it is likely that changes will be made to the layout and timing of the proposed mining developments. These modifications may result in changes to the area of disturbance. Factors that will influence these modifications include the results of further exploration and resource delineation, and the results of environmental monitoring and research programs, and market conditions. For example, the dimensions of the proposed mine pits will vary according to factors such as the gold price, the gold content (grade) of the ore, the ratio of ore to overburden and geotechnical considerations. The area of disturbance that exists at any given time will also vary according to the progress of the rehabilitation program.

Changes to the Project will be addressed through the AEMP process described in Section 1.11 of the PER. It is envisaged that the AEMP will:

- review the development of the Project in the previous 12 months;
- provide a detailed description of the mining developments proposed for the next 12 months (including the environmental management measures incorporated into the design of the mines and associated infrastructure located on Lake Lefroy); and
- provide a summary of projected activities for the next three years.

However, it is accepted that the EPA reserves the right to subject any future proposals to formal environmental impact assessment should it consider this necessary (as discussed in Section 1.2 of the PER).

5.2 *Many of the wetland types specified in Table 3.12 are incorrect and could be misleading. This appears to be due to typographical errors. An amended table, based on the paper by Chapman and Lane (1997), is attached. Please revise the Table 3.12.*

The correct version is attached.

Waterfowl Occurrence on Wetlands in the Eastern Goldfields

Bird Species	Wetland Name and Type(s)[1]																							
	Lake Lefroy	Fitzgerald Lagoon	Lake Wannaway	Lake Cowan	Lake Arrow	Lake Douglas	Lake Hannans	Canegrass Swamp	Lake Miranda	Rowles Lagoon	King of the West	Lignum Swamp	Brown Lagoon	Lake Carnage[2]	Malcolm Dam	Black Flag Lake	Lake Barlee	Galah Rock Lake	Lake Ballard	Lake Raeside	Lake Noondie	Pinnacles Stn/n Lake	Lake Wallon	Lake Mason
	B8	B10	B8	B12	B8	C2	B8	B10	B8	B6,13,14	B8	B13	B6	B6,14	C2	B8	B8	B8	B8	B8	B8	B8	B8	B8
Blue-billed Duck										✓			✓	✓										
Musk Duck										✓			✓	✓										
Freckled Duck										✓		✓	✓	✓										
Black Swan	✓		✓		✓		✓		✓	✓	✓		✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓
Aust. Shelduck	✓	✓	✓	✓	✓		✓		✓	✓	✓		✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓
Aust. Wood Duck	✓		✓	✓				✓		✓				✓		✓	✓					✓		
Pacific Black Duck	✓	✓	✓	✓	✓	✓	✓	✓		✓			✓	✓		✓	✓		✓					
Australasian Shoveler	✓		✓	✓	✓			✓	✓			✓												
Grey Teal	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓
Chestnut Teal		✓		✓			✓																	

Pink-eared Duck	✓		✓	✓						✓		✓	✓	✓		✓	✓							
Hardhead			✓					✓	✓	✓			✓	✓										
Australasian Grebe										✓														
Hoary-headed Grebe	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓					✓
Little Pied Cormorant										✓														
Little Black Cormorant	✓									✓														
White-faced Heron	✓		✓	✓	✓	✓	✓			✓			✓	✓		✓	✓	✓	✓	✓	✓		✓	
White-necked Heron	✓			✓	✓	✓	✓	✓							✓	✓				✓				
Great Egret					✓																			
Straw-necked Ibis					✓		✓												✓	✓				
Yellow Billed Spoonbill	✓					✓				✓														
Aust. Spotted Crake								✓				✓												
Black-tailed Native Hen	✓		✓	✓		✓		✓		✓		✓		✓	✓	✓	✓							✓
Erasian Coot	✓	✓	✓	✓		✓	✓	✓	✓	✓			✓	✓		✓						✓		
Black-tailed Godwit	✓			✓						✓														
Common Greenshank	✓		✓	✓			✓							✓										
Black-winged Stilt	✓				✓		✓		✓		✓		✓	✓	✓	✓								✓
Banded Stilt	✓				✓					✓						✓	✓		✓	✓				
Red-necked Avocet	✓				✓		✓		✓	✓					✓	✓	✓				✓			✓
Red-capped Plover	✓				✓		✓		✓					✓	✓	✓	✓							✓
Black-fronted Dotterel			✓							✓			✓	✓										
Hooded Plover	✓				✓												✓		✓					
Red-kneed Dotterel					✓		✓			✓														
Gull-billed Tern	✓								✓															✓
Whiskered Tern	✓								✓	✓			✓	✓	✓	✓								

Source: Ninox (1995, 1999) for Lake Lefroy data, Chapman and Lane (1997) for the remainder of the data.

Notes:

1. *B8 – Intermittent saline lake; B12 – seasonal saline marsh; B6 – seasonal freshwater lake; B10 – intermittent freshwater marsh; B13 – shrub-dominated freshwater marsh; B14 – seasonally-flooded freshwater wooded swamp; C2 – man-made dams of less than 8 ha in area (as defined by ANCA, 1996).*

2. Includes data from Clear Lake and Muddy Lake.

5.3 *Appendix K, fauna habitat assessment criteria, is a useful concept. Whilst it could be argued that the criteria are subjective, environmental impact assessment decisions could benefit from this type of approach. However, in this context, a number of changes to the criteria are recommended:*

- *exclusion of criterion 3 - this criterion does not seem to be particularly relevant; and*
- *a criterion that includes cumulative impacts on similar habitat types by all land uses in the bioregion should be included.*

What is St Ives Gold view on these suggested alterations?

Section 5.10.2 of the PER notes that these criteria represent a consolidation of similar attempts to create habitat impact, or habitat significance, indices and should be regarded as preliminary only. The above comments will be considered if further work is conducted in refining these criteria.

6. Landform – mine voids

6.1 *The proposal to leave open voids on the lakebed is of concern. Open voids may affect the form and structure of the lakebed. It is noted that research is being undertaken by the proponent with regard to pit stability and it is considered that this research should be completed before any decisions on whether to leave voids permanently open are taken. The CSIRO study referred to in the PER may provide some information to clarify this matter. Management approaches of the proponent must be flexible enough to incorporate the research findings. Can St Ives Gold confirm why they consider it is appropriate to make decisions on the final resting state of the final voids (that is to leave them open) before the appropriate research has been completed?*

The project layout maps provided as Figures 2.2-2.4 and 2.6-2.8 in the PER provide an indication of where open voids may be located during the life of the Project. It is important to note that these maps are indicative only and that the final decision on whether to leave individual pits as open voids or implement some other closure option has not yet been made. Mine scheduling will be conducted so as to maximise opportunities for backfilling mined-out pits within economic constraints, but it is recognised that open voids will remain in some areas.

The closure option for each pit will be selected according to the process outlined in the decision tree presented in the PER as Figure 2.9. Under this process, the decision on the preferred closure option for each pit will be subject to a cost benefit analysis which will consider of a range of factors including:

- environmental issues (eg. water balance, salinity, biota and acid generating potential);
- surrounding land use;
- geological/geotechnical issues (including pit wall stability);
- availability of suitable material for backfilling;
- stakeholder issues;

- regulatory acceptance;
- economic considerations; and
- engineering issues.

The decision on the preferred option will also take into consideration the findings of research programs such as those currently being conducted by CSIRO into the hydrology of post-mining voids and the geotechnical investigations into the stability of the pit walls proposed by St Ives Gold under Commitment 7.

A closure and rehabilitation plan will be prepared for each pit and will describe:

- the closure option selected for the pit (and the rationale behind its selection);
- how the closure and decommissioning will be implemented;
- the rehabilitation objectives and completion criteria relevant to the closure option; and
- the monitoring program that will be implemented to determine progress made in achieving the rehabilitation objectives.

The closure and rehabilitation plans will be included in the AEMP to be submitted to the regulatory authorities on an annual basis for review and comment.

In addition, two years prior to the completion of the life of the Project, St Ives Gold will review its closure and rehabilitation planning to ensure that a "walk away"[1] solution is developed for any mine voids remaining in the Project Area. The findings of this review will also be reported through the AEMP process.

7. landform – flood protection

7.1 *Section 2.4 refers to flood protection. What is the life expectancy of flood protection bunds around pits that will not be backfilled?*

Bunds will be constructed in accordance with the DME's guidelines for safety bund walls around abandoned open pit mines, which address the long term post-mining stability of these structures. If the design criteria used by St Ives Gold meet the DME's requirements then it is reasonable to assume that the bunds will remain stable in the long term. However, it is recognised that the DME's guidelines do not address all factors concerning bund design and may not be totally suited to the specific requirements of each mine. Therefore, St Ives Gold has conducted a number of studies into pit wall stability and used these findings in bund design.

The main factor affecting the life expectancy of bunds around mine voids is geotechnical stability. Studies conducted for St Ives Gold (as described in Section 5.6 of the PER) have demonstrated that, in sediments 5-15 m thick, the potential failure surfaces for open voids

[1] A 'walk away' solution means that the site shall either no longer require management at the time the Proponent ceases operation or, if further management is deemed necessary, the Proponent shall make adequate provision so that the required management is undertaken with no liability to the State.

would not extend to more than 30 m behind the pit crest. Bunds are generally placed 50-100 m from the crest of the pits to ensure their integrity is not undermined by any slumping or failures that may occur. Voids are currently present on Lake Lefroy at the Revenge, South Delta and Redoubtable mines. No instability of pit walls or bunds has been experienced in these voids.

Bunds that are to be retained in the long term will be landscaped and rehabilitated to minimise the risk of surface erosion and slumping. Consideration will be given to removing the bunds from around a pit if it can be demonstrated that public safety will not be compromised by doing so.

In addition it is anticipated that any voids left on the lake will fill to within 5 meters of the surface (as described in Section 5.5 of the PER)

7.2 *How long is St Ives Gold committed to checking and maintaining flood protection bunds?*

St Ives Gold will monitor the integrity of the bunds during the life of the Project and whilst it retains the Mineral Leases on which the proposed gold mining developments will be located.

7.3 *In the longer term, who would be responsible for maintenance of flood protection bunds?*

The responsibility for environmental management of mine sites reverts to the State when a mining company relinquishes its mining or mineral lease(s). However, St Ives Gold is committed to ensuring that the Project Area is left in a safe and stable condition such that the tenements can be relinquished without any future liability for the company or the State.

St Ives Gold will not relinquish its leases until the completion criteria for this Project (which will be developed in consultation with the regulatory authorities) have been fulfilled.

7.4 *Will St Ives Gold include a commitment to maintain flood protection bunds?*

As stated in Section 2.4 of the PER and in Response 7.2 and 7.3 above, the integrity of the bunds will be checked by St Ives Gold on a regular basis and remedial work conducted if required.

7.5 *The decision tree appears to be a useful tool. Can St Ives Gold provide further explanation of the criteria that will be used to arrange closure options in order of preference?*

The ranking of possible closure options and selection of one option for more detailed consideration will be dependent on the outcome of the cost-benefit analysis. This will involve an assessment of all of the relevant factors including:

- environmental issues (eg. water balance, salinity, biota and acid generating potential);
- surrounding land use;
- geological/geotechnical issues (including pit wall stability);

- availability of suitable material for backfilling;
- stakeholder issues;
- regulatory acceptance;
- economic considerations; and
- engineering issues.

Subject to the outcome of the Cost-Befit Analysis preliminary discussions with the relevant regulatory authorities may also be held to determine their requirements and the acceptability of the ranked alternatives.

8. Rehabilitation

8.1 *The commitment of St Ives Gold to rehabilitate on a progressive basis is supported. It is noted that St Ives Gold intends to prepare plans for the rehabilitation and final closure of the project two years prior to the project's completion. Will St Ives Gold make the final plan available for a public consultation period?*

St Ives Gold will seek public input into the preparation of the final closure and rehabilitation plan.

8.2 *St Ives Gold's intention to develop waste dumps into islands is supported in principle. Is it St Ives Gold intention to model all waste dumps into islands?*

All overburden dumps located on Lake Lefroy will be designed to complement the geomorphological features of the lake's natural islands and will be rehabilitated. The design process is described in Section 2.3 of the PER.

8.3 *It is noted that St Ives Gold has committed to using existing infrastructure on the lakebed wherever possible and to remove it as it becomes unnecessary. Has the proponent considered the effect this type of infrastructure may have on the lake bed? In particular the effects on the geological form and structure of the lake bed. For example, the possible effect that structures, such as bunds and waste dumps, could have on creating mud waves around the structures and the possibility that they may force groundwater to the surface. If these impacts have not been considered, is any research into these effects proposed?*

The construction of mine infrastructure may result in the localised displacement of sediments in the immediate vicinity of these features. However, this development is unlikely to have a significant impact on the lake's structure or groundwater regime. Similar loading elsewhere within the Project Area has not resulted in visible mobilisation of lake sediments.

St Ives Gold's commitments to removing causeways and other infrastructure when no longer required for the Project and to rehabilitating disturbed areas on a progressive basis will minimise the long term impact of the Project on the lakescape.

9. Groundwater quality

9.1 *The proposed gold mining developments are located within the Goldfields Groundwater Area. The proposed mining developments will require pit dewatering using in pit sumps and/or bores. It is acknowledged that both the surface water and groundwater resources are hypersaline. The Waters and Rivers Commission (WRC) advises that St Ives Gold will require a groundwater abstraction licence. The WRC is prepared to issue an exploration licence to facilitate testing of the local hydrology. The WRC will require the preparation of an operating strategy prior to issuing the groundwater licence. Is St Ives Gold aware of the WRC requirements to prepare an operating strategy prior to the WRC issuing the groundwater licence?*

St Ives Gold currently holds a groundwater licence from WRC for its existing operations. The company is aware of WRC's requirements to prepare an operating strategy and will address these requirements in consultation with this agency.

9.2 *The dewatering process is an area that requires careful scrutiny. Given the potential for properties of the water to vary at different sites, it is essential that water returned to the lake is carefully monitored. The proponent's commitment to continue its water monitoring program is supported.*

As stated in Section 2.5.1 of the PER, the water abstracted from the pits will be hypersaline and will have physical and chemical properties similar to those of the natural lake waters. However, some variation may occur as groundwater quality is primarily a function of aquifer geology.

The discharge of mine water to Lake Lefroy is licenced by the DEP. Water quality monitoring is conducted on a three or six monthly basis (depending on the parameter being measured) using St Ives Gold's water monitoring procedures (as described in Appendix J of the PER), and the results are submitted to the DEP.

9.3 *The potential, however minor, for acid generation is of concern. It is noted that St Ives Gold generally considers that pits will not be deep enough to encounter sulfides and that there are some difficulties in determining the presence of sulfides at these greater depths. St Ives Gold estimates depths of between 30 - 150 meters for pits. As the depth of pits is unknown, does the expectation of not coming into contact with sulfide bearing bedrock extend across this range or, if not, at what point might it be expected that the pits come into contact with sulfides?*

If the pits come into contact with sulfides, has St Ives Gold developed a sampling program and management procedures that will come into effect should this material be encountered?

Data collected by St Ives Gold to date indicate that the overburden has little or no sulfide content and a low potential for acid generation. Any sulfide minerals such as pyrite that do occur are generally associated with zones of mineralisation (i.e. associated with the ore) and are volumetrically very small. These zones also often contain relatively high levels of acid-consuming carbonate minerals.

It is recognised however that the distribution of sulfide and carbonate minerals within fresh Archaean bedrock can be quite variable. Therefore, acid generation testwork is conducted as part of St Ives Gold's routine metallurgical testwork and the results are used to develop strategies to monitor and isolate any high sulfide material as part of day-to-day mining operations.

10.Aboriginal culture and heritage

10.1 It is noted that archaeological surveys and ethnographic consultations have not identified any sites of significance. If no sites are impacted by the proposed gold mine developments then St Ives Gold has no obligations to fulfill under the provisions of the Aboriginal Heritage Act 1972.

Copies of the heritage reports referred to in the PER document have yet to be lodged with the Aboriginal Affairs Department (AAD). Does St Ives Gold intend to lodge the documents referred to in the PER with the AAD and if so by when?

A summary of the Aboriginal heritage studies conducted to date by St Ives Gold has been submitted to the AAD.

11.references

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Yours sincerely
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