CLOVERDALE MINERAL SANDS PROJECT

REFERRAL and SUPPORTING DOCUMENT

ILUKA

August 2006

ILUKA-TR-T14784

Iluka Resources Limited

Cloverdale Mineral Sands Project

Referral Document

August 2006

Prepared by

Level 23, 140 St Georges Terrace

PERTH WA 6000

PART A - PROPONENT AND PROPOSAL INFORMATION

1. PROPONENT DETAILS, PROPOSAL DESCRIPTION AND LOCATION

1.1 Proponent information

- **Proposal title**

  Cloverdale Mineral Sand Project.

- **Name of proponent (Person or entity proposing to implement the proposal)**

  Iluka Resources Limited

- **Address of proponent**

  Level 23, 140 St Georges Terrace

  PERTH WA 6000

- **Key contact for the proposal**

  Shannon Jones, Environmental Adviser

  Phone: 08 9360 4700

  Fax: 08 9360 4777

  shannon.jones@iluka.com

- **Does the proponent own the land on which the proposal is to be established? If not, what other arrangements have been established to access the land?**

  Iluka owns three lots and there are currently nine other landowners with properties lying partly or wholly within the Project Area (Figure 2 of the supporting document). Land access agreements are currently in preparation. Refer to section 1.1 of the supporting document for further information.

- **Is rezoning of any land required before the proposal can be implemented?**

  (please tick) ☐ Yes **If yes**, please provide details.

  ■ No

- **Is approval required from any Commonwealth or State Government agency or Local Authority for any part of the proposal?**

  ■ Yes ☐ No **If yes**, name all Agencies and Local Authorities from which any approval is required.

  Approvals from the Department of Environment (DoE) will include a groundwater abstraction licence, Works Approval and Pollution Prevention Licence. Approval will be required from the Department of Industry and Resources (DoIR) under the Mining Act 1978.

- **If yes above, have you lodged any of the necessary applications or have you discussed the proposal with any person(s) at the Agency or Local Authority?**

  ☐ Yes ■ No **If yes**, name all Agencies and Local Authorities for which applications have been submitted or with whom the proposal has been discussed.

- **What is the current land use on the property, and the extent (area in hectares) of the property?**

  The land is currently used for agriculture. The Project Area covers a total area of 883 ha.

1.2 Proposal Description (Please attach extra pages where necessary)

- **Provide a description of the proposal.**

  Following on from mining at Yoganup West, Iluka proposes to mine the nearby Cloverdale Deposit, located approximately 190 kilometres south of Perth and six km south south east of the township of Capel (Figure 1 of supporting document). The current reserve is approximately 3.5 million tonnes. Mining will take up to two years. Refer to section 1 of the supporting document for further information.

- **What is the proposed ultimate extent (area in hectares) of the activity?**

  It is anticipated that up to 350 ha will be disturbed.

- **Provide the timeframe in which the activity or development is proposed to occur. (Include start and finish dates where applicable)**

  Construction at the Cloverdale site is currently scheduled to start in early 2007, with mining commencing soon after and continuing for approximately two years. An additional three years of ongoing rehabilitation is expected to be required.

- **Provide details of any staging of the proposal.**

  The Cloverdale Deposit will be mined progressively as a single stage project.

- **Indicate whether, and in what way, the proposal is related to other proposals in the region.**

  The Cloverdale Project is located adjacent to the currently operating Yoganup and Yoganup West sites (Figure 3 of supporting document). Currently, ore from the Yoganup West mine site is processed through the Canning concentrator, which is located at the Yoganup site. The Canning concentrator will remain in its current location and be utilised to process ore from the Cloverdale Deposit.

1.3 Location information

- **Please provide proposal location details in one of the following two ways:**

  EITHER

  a) Electronic spatial data (preferred)

  GIS or CAD on CD, depicting the proposal extent, geo-referenced and conforming to the following parameters:

  - datum: GDA94
  - projection: Geographic (latitude/longitude) or Map Grid of Australia (MGA)
  - format: Arcview shapefile, Arcinfo coverages, Microstation or AutoCAD.

  OR

  b) Maps and/or directions (if no electronic spatial data is available)

  Any maps or diagrams of the proposal, together with the following directions:

  - for urban areas: street address, lot number, the suburb and nearest road intersection;
  - for remote localities: the nearest town, together with distance and direction from that town to the proposal site.

  Please also attach the following map/plans, clearly showing the location of the development in its regional and local context.

  Locality plan – Broad Scale

  Provide a locality plan (preferably superimposed on an aerial photograph) to identify:

- proposed development site and any associated infrastructure
- main roads
- urban centres
- wetlands and watercourses
- remnant native vegetation
- adjoining land uses (including recreation)
- sensitive marine areas

❖ **Site Plan – Proposal Details**

Provide a site plan to scale and indicate the location of:

- lot boundaries
- road frontages
- extent of the proposed development area
- extent of the proposed buffer area (if applicable)

❖ **Site Plan – Existing Environment**

Provide a site plan to scale (the same scale as above) and indicate the location of:

- lot boundaries
- road frontages
- any information required to be shown from Section 2.2 of this form
- extent of native vegetation of the site (the extent of overlap between the proposed development area and the area of native vegetation must be highlighted)
- extent of hydrological features on the site (this includes wetlands, watercourses, creek lines, seasonal creeks and artificial drainage lines)
- sensitive marine areas

An electronic version of GIS location details is included on CD.

Figures are also provided in the supporting document.

PART B - ENVIRONMENTAL IMPACTS AND MANAGEMENT COMMITMENTS

2. ENVIRONMENTAL IMPACTS

Describe the impacts of the proposal on the following elements of the environment, through the questions below:

(i) flora and vegetation #;

(ii) fauna #;

(iii) rivers, creeks, wetlands and estuaries;

(iv) significant areas and/ or land features;

(v) coastal zone areas;

(vi) marine areas and biota #;

(vii) water supply and drainage catchments;

(viii) pollution;

(ix) greenhouse gas emissions;

(x) contamination;

(xi) social surroundings; and

(xii) risk.

These features should be shown on the site plan, where appropriate)

For all information, please provide:

(a) the source of the information; and

(b) how recent the information is.

2.1 Flora and Vegetation

- **Do you propose to clear any native flora and vegetation as a part of this proposal?**

  (A proposal to clear native vegetation may require a clearing permit under Part V of the EP Act *(Environmental Protection (Clearing of Native Vegetation) Regulations 2004)*. Please contact the Department of Environment for more information.

  (please tick) ■ Yes ***If yes, complete the rest of this section***

  ☐ No ***If no, go to the next section***

- **How much vegetation are you proposing to clear (in hectares)?**

  Approximately six hectares (ha), including four ha of native vegetation. Refer to section 2.1 of the supporting document for further information.

- **Have you submitted an application to clear native vegetation to the Department of Environment (unless you are exempt from such a requirement)?**

☐ Yes ■No **If yes**, on what date and to which office was the application submitted of the Department of Environment?

- **Are you aware of any recent flora surveys carried out over the area to be disturbed by this proposal?**

■ Yes ☐ No **If yes**, please attach a copy of any related survey reports and provide the date and name of persons / companies involved in the survey/s. (If no, please do not arrange to have any biological surveys conducted prior to consulting with the DoE.)

Hart, Simpson and Associates, 2001.

GHD, 2005, Appendix 1 of supporting document.

Mattiske Consulting, 2006, Appendix 2 of supporting document.

- **Has a search of CALM records for known occurrences of rare or priority flora or threatened ecological communities been conducted for the site? #**

■ Yes ☐ No If you are proposing to clear native vegetation for any part of your proposal, a search of Department of Conservation and Land Management (CALM) records of known occurrences of rare or priority flora and threatened ecological communities will be required. Please contact the Como office of CALM for more information.

Refer to section 2.1 of the supporting document for further information.

- **Are there any known occurrences of rare or priority flora or threatened ecological communities on the site?**

■ Yes ☐ No **If yes**, please indicate which species or communities are involved and provide copies of any correspondence with CALM regarding these matters.

Refer to section 2.1 of the supporting document for further information.

- **If located within the Perth Metropolitan Region, is the proposed development within or adjacent to a listed Bush Forever Site? (You will need to contact the Bush Forever Office, at the Department for Planning and Infrastructure)**

☐ Yes ■ No **If yes**, please indicate which Bush Forever site is affected (site number and name of site where appropriate).

The Project is not within the Perth Metropolitan Region.

- **What is the condition of the vegetation at the site?**

Refer to section 2.1 of the supporting document for further information.

2.2 Fauna

- **Do you expect that any fauna or fauna habitat will be impacted by the proposal?**

(please tick) ■ Yes ***If yes, complete the rest of this section***

☐ No ***If no, go to the next section***

The Project has the potential to impact on fauna habitat through the clearance of vegetation.

- **Describe the nature and extent of the expected impact.**

Refer to section 2.2 of the supporting document for further information.

- **Are you aware of any recent fauna surveys carried out over the area to be disturbed by this proposal?**

  ■Yes ☐ No **If yes**, please attach a copy of any related survey reports and provide the date and name of persons / companies involved in the survey/s. (If no, please do not arrange to have any biological surveys conducted prior to consulting with the DoE.)

  Hart, Simpson and Associates, 2001.

  GHD, 2005, Appendix 1 of supporting document.

  Ninox, 2006, Appendix 3 of supporting document.

- **Has a search of CALM records for known occurrences of Specially Protected (Threatened) fauna been conducted for the site?**

  ■Yes ☐ No (please tick)

  Refer to section 2.2 of the supporting document for further information.

- **Are there any known occurrences of Specially Protected (Threatened) fauna on the site? #**

  ■Yes ☐No **If yes**, please indicate which species or communities are involved and provide copies of any correspondence with CALM regarding these matters.

  Refer to section 2.2 of the supporting document for further information.

2.3 Rivers, Creeks, Wetlands and Estuaries

- **Will the development occur within 200m of a river, creek, wetland or estuary?**

  (please tick) ■Yes ***If yes, complete the rest of this section***

  ☐ No ***If no, go to the next section***

  Refer to section 2.1 of the supporting document for further information.

- **Will the development result in the clearing of vegetation within the 200 m zone?**

  ■Yes ☐ No **If yes**, please describe the extent of the expected impact.

  Refer to section 2.1 of the supporting document for further information.

- **Will the development result in the filling or excavation of a river, creek, wetland or estuary?**

  ■Yes ☐ No **If yes**, please describe the extent of the expected impact.

  The Ludlow River will not be mined, however a crossing will be required.

- **Will the development result in the impoundment of a river, creek, wetland or estuary?**

  ☐ Yes ■ No **If yes**, please describe the extent of the expected impact.

- **Will the development result in draining to a river, creek, wetland or estuary?**

  ■ Yes ☐ No **If yes**, please describe the extent of the expected impact.

  Refer to section 2.3 of the supporting document for further information.

- **Are you aware if the proposal will impact on a river, creek, wetland or estuary (or its buffer) within one of the following categories? (please tick)**

Conservation Category Wetland	☐ Yes	■ No	☐ Unsure
Draft Environmental Protection (Swan Coastal Plain Wetlands) Policy 2004	☐ Yes	■ No	☐ Unsure
Environmental Protection (South West Agricultural Zone Wetlands) Policy 1998	☐ Yes	■ No	☐ Unsure
Perth's Bush Forever site	☐ Yes	■ No	☐ Unsure
Environmental Protection (Swan & Canning Rivers) EPP 1998	☐ Yes	■ No	☐ Unsure
The management area as defined in s4(1) of the Swan River Trust Act 1988	☐ Yes	■ No	☐ Unsure
Which is subject to an international agreement, because of the importance of the wetland for waterbirds and waterbird habitats (e.g. Ramsar, JAMBA, CAMBA) #	☐ Yes	■ No	☐ Unsure

Refer to section 2.3 of the supporting document for further information.

2.4 Significant Areas and/ or Land Features

- **Is the proposed development located within or adjacent to an existing or proposed National Park or Nature Reserve?**

  ☐ Yes ■ No **If yes**, please provide details.

- **Are you aware of any Environmentally Sensitive Areas (as declared by the Minister under section 51B of the EP Act) that will be impacted by the proposed development?**

  ☐ Yes ■ No **If yes**, please provide details.

- **Are you aware of any significant natural land features (e.g. caves, ranges etc) that will be impacted by the proposed development?**

  ☐ Yes ■ No **If yes**, please provide details.

2.5 Coastal Zone Areas (Coastal Dunes and Beaches)

- **Will the development occur within 300m of a coastal area?**

  (please tick) ☐ Yes ***If yes, complete the rest of this section***

  ■ No ***If no, go to the next section***

- **What is the expected setback of the development from the high tide level and from the primary dune?**

- **Will the development impact on coastal areas with significant landforms including beach ridge plain, cuspate headland, coastal dunes or karst?**

  ☐ Yes ☐ No **If yes**, please describe the extent of the expected impact.

- **Is the development likely to impact on mangroves?**

☐ Yes ☐ No **If yes**, please describe the extent of the expected impact.

2.6 Marine Areas and Biota

- **Is the development likely to impact on an area of sensitive benthic communities, such as seagrasses, coral reefs or mangroves?**

  ☐ Yes ■ No **If yes**, please describe the extent of the expected impact.

- **Is the development likely to impact on marine conservation reserves or areas recommended for reservation (as described in A Representative Marine Reserve System for Western Australia, CALM, 1994)?**

  ☐ Yes ■ No **If yes**, please describe the extent of the expected impact.

- **Is the development likely to impact on marine areas used extensively for recreation or for commercial fishing activities?**

  ☐ Yes ■ No **If yes**, please describe the extent of the expected impact, and provide any written advice from relevant agencies (e.g. Fisheries WA).

2.7 Water Supply and Drainage Catchments

- **Are you in a proclaimed or proposed groundwater or surface water protection area?**

  (You may need to contact the Water and Rivers Commission (WRC) for more information on the requirements for your location, including the requirement for licences for water abstraction. Also, refer to the WRC website)

  ■Yes ☐ No **If yes**, please describe what category of area.

  The Project Area lies within the Busselton-Capel Groundwater Area, which is a proclaimed groundwater area. The Project area falls within the Capel River and Capel sub-divisions, which each include 3 aquifers (Superficial, Leederville and Yarragadee). The Cloverdale deposit lies within the superficial aquifers which are category C1 for Capel and C4 for Capel River.

- **Are you in an existing or proposed Underground Water Supply and Pollution Control area?**

  (You may need to contact the WRC for more information on the requirements for your location, including the requirement for licences for water abstraction. Also, refer to the WRC website)

  ☐ Yes ■ No **If yes**, please describe what category of area.

- **Are you in a Public Drinking Water Supply Area (PDWSA)?**

  (You may need to contact the WRC for more information or refer to the WRC website. A proposal to clear vegetation within a PDWSA requires approval from WRC.)

  ☐Yes ■No **If yes**, please describe what category of area.

- **Is there sufficient water available for the proposal?**

  (Please consult with the WRC as to whether approvals are required to source water as you propose. Where necessary, please provide a letter of intent from the WRC)

  ■ Yes ☐ No (please tick)

Refer to section 2.4 of the supporting document for further information.

- **Will the proposal require drainage of the land?**

  ■ Yes ☐ No **If yes**, how is the site to be drained and will the drainage be connected to an existing Local Authority or Water Corporation drainage system? Please provide details.

  Mine pits will be dewatered in order to allow mining where the ore extends below the water table. Refer to section 3.4 of the supporting document for further information.

- **Is there a water requirement for the construction and/ or operation of this proposal?**

  (please tick) ■Yes ***If yes, complete the rest of this section***

  ☐ No ***If no, go to the next section***

- **What is the water requirement for the construction and operation of this proposal, in kl/year?**

  The water requirement for this Project is expected to be approximately 2,500,000 kL/year

- **What is the proposed source of water for the proposal? (eg dam, bore, surface water etc.)**

  Pit dewatering water and existing production bores. Refer to section 2.4 of the supporting document for further information.

2.8 Pollution

- **Is there likely to be any discharge of pollutants from this development, such as noise, vibration, gaseous emissions, dust, liquid effluent, solid waste or other pollutants?**

  (please tick) ■ Yes ***If yes, complete the rest of this section***

  ☐ No ***If no, go to the next section***

- **Is the proposal a prescribed premise, under the Environmental Protection Regulations?**

  (Refer to the EPA *General Guide for Referral of Proposals to the EPA under section 38(1) of the EP Act 1986* for more information)

  ■ Yes ☐ No **If yes**, please describe what category of prescribed premise.

  Category 8: Mineral Sands Mining or Processing: premises on which mineral sands ore is to be mined, screened, separated or otherwise processed

- **Will the proposal result in gaseous emissions to air?**

  ■ Yes ☐ No **If yes**, please briefly describe.

  Refer to section 2.11 of the supporting document for further information.

- **Have you done any modelling or analysis to demonstrate that air quality standards will be met, including consideration of cumulative impacts from other emission sources?**

  ☐ Yes ■No **If yes**, please briefly describe.

- **Will the proposal result in liquid effluent discharge?**

  ■ Yes ☐ No **If yes**, please briefly describe the nature, concentrations and receiving environment.

Refer to section 2.3.4 of the supporting document for further information.

- **If there is likely to be discharges to a watercourse or marine environment, has any analysis been done to demonstrate that the State Water Quality Management Strategy or other appropriate standards will be able to be met?**

  ☐ Yes ■ No **If yes**, please describe.

- **Will the proposal produce or result in solid wastes?**

  ■ Yes ☐ No **If yes**, please briefly describe the nature, concentrations and disposal location/ method.

Refer to section 2.5 of the supporting document for further information.

- **Will the proposal result in significant off-site noise emissions?**

  ■ Yes ☐ No **If yes**, please briefly describe.

Refer to section 2.6 of the supporting document for further information.

- **Will the development be subject to the Environmental Protection (Noise) Regulations?**

  ■Yes ☐ No **If yes**, has any analysis been carried out to demonstrate that the proposal will comply with the Regulations?

  Please attach the analysis.

Refer to section 2.6 of the supporting document for further information.

- **Does the proposal have the potential to generate off-site, air quality impacts, dust, odour or another pollutant that may affect the amenity of residents and other "sensitive premises" such as schools and hospitals (proposals in this category may include intensive agriculture, aquaculture, marinas, mines and quarries etc.)?**

  ■ Yes ☐ No **If yes**, please describe and provide the distance to residences and other "sensitive premises".

Refer to sections 2.7, 2.8, 2.9 and 2.10 of the supporting document for further information.

- **If the proposal has a residential component or involves "sensitive premises", is it located near a land use that may discharge a pollutant?**

  ☐ Yes ■ No ☐ Not Applicable **If yes**, please describe and provide the distance to the potential pollution source

There is no residential component associated with the Cloverdale mining proposal.

2.9 Greenhouse Gas Emissions

- **Is this proposal likely to result in substantial greenhouse gas emissions (greater than 100 000 tonnes per annum of carbon dioxide equivalent emissions)?**

  ☐ Yes ■No **If yes**, please provide an estimate of the annual gross emissions in absolute and in carbon dioxide equivalent figures.

- **Further, if yes, please describe proposed measures to minimise emissions, and any sink enhancement actions proposed to offset emissions.**

Refer to section 2.11 of the supporting document for further information.

2.10 Contamination

- **Has the property on which the proposal is to be located been used in the past for activities which may have caused soil or groundwater contamination?**

  ☐ Yes ☐ No ■ Unsure **If yes**, please describe.

  The site has previously been used for agricultural purposes.

- **Has any assessment been done for soil or groundwater contamination on the site?**

  ☐ Yes ■ No **If yes**, please describe.

- **Has the site been registered as a contaminated site under the Contaminated Sites Act 2003? (on finalisation of the CS Regulations and proclamation of the CS Act)**

  ☐ Yes ☐ No **If yes**, please describe.

  This Act has not yet been enacted.

2.11 Social Surroundings

- **Is the proposal on a property which contains or is near a site of Aboriginal ethnographic or archaeological significance that may be disturbed?**

  ■ Yes ☐ No Unsure **If yes**, please describe.

  Refer to section 2.12.1 of the supporting document for further information.

- **Is the proposal on a property which contains or is near a site of high public interest (for example, a major recreation area or natural scenic feature)?**

  ☐ Yes ■ No **If yes**, please describe.

- **Will the proposal result in or require substantial transport of goods, which may affect the amenity of the local area?**

  ■ Yes ☐ No **If yes**, please describe.

  Refer to section 1.3 of the supporting document for further information.

2.12 Risk

- **Is the proposal located near a hazardous industrial plant or high-pressure gas pipeline?**

  ☐ Yes ■ No **If yes**, please describe.

- **Does the proposal have the potential to generate off-site risk?**

  ☐ Yes ■ No **If yes**, will the proposal be a major hazardous facility regulated under the *Explosives and Dangerous Goods Act*?

3. MANAGEMENT

3.1 Principles of Environmental Protection

- **Have you considered how your project gives attention to the following Principles, as set out in section 4A of the EP Act? (For information on the Principles of Environmental Protection, please see EPA Position Statement No. 7, available on the EPA web.)**

1.	The precautionary principle.	■ Yes	☐ No
2.	The principle of intergenerational equity.	■ Yes	☐ No
3.	The principle of the conservation of biological diversity and ecological integrity.	■ Yes	☐ No
4.	Principles relating to improved valuation, pricing and incentive mechanisms.	■Yes	☐ No
5.	The principle of waste minimisation.	■Yes	☐ No

- **Is the proposal consistent with the EPA's Position Statements (available on the EPA web)?**

  ■Yes ☐ No

3.2 Management Commitments

- **How has the proposal been developed to avoid, minimise and manage potential impacts?**

  The Project has been designed to avoid, minimise and manage potential impacts where possible. Site plans have been modified and management plans will be developed with the aim of minimising potential environmental impacts identified in environmental assessments.

- **Please describe any specific commitments you make as the proponent to minimising the potential environmental impacts of this development.**

The site layout and mining schedule has been designed to minimise impacts on the surrounding community. Key impacts that can be minimised include vegetation clearance, noise, dust, and light emissions. Outcomes from impact assessments and mine planning studies allowed the following to be taken into consideration when designing the mine plan:

- The concentrator, screen plant, workshops and offices will remain in their current locations at the Yoganup West and Yoganup sites. This area is distant from neighbouring properties.
- Despite the economic value of ore, the area of Ludlow River and vegetation supporting rare flora nearby the river are excluded from mining.
- Noise Bunds 10 m high will be constructed to provide a noise and light barrier.
- Topsoil stockpile bunds will be constructed around the overburden 10 metres bunds. The area (approx. 5 m wide) between these bunds will contain all wash down water and spillages from the overburden bunds and will direct water to the pits.
- Stripping of topsoil and subsoil material scheduled for dry months will involve more watercarts for watering then normally required. This minimises the potential for dust impacts.
- Topsoil, subsoil and overburden stripping to be restricted to daytime hours (7am to 7pm) excluding Sundays and public holidays.
- The existing solar drying dams at the Yoganup minesite will be utilised. No additional solar drying dams are required.
- Ore cartage from the outer pits to the hopper locations in Main Pit will be restricted to daytime hours (7am to 7pm) excluding Sundays and public holidays.
- The earthmoving machinery parking area is located inside the overburden 10m bunds. This minimises the potential for noise impacts.

3.3 Consultation

- **Has public consultation taken place (such as with other government agencies, community groups or neighbours), or is it intended that consultation shall take place?**

  ■Yes ☐ No **If yes**, please list those consulted and attach comments or summarise response on a separate sheet.

  Refer to section 3 of the supporting document.

CHECKLIST and DECLARATION

Before you submit this form, have you:	YES	NO
Completed all the questions on this form?	☒	☐
Have you attached any extra information, such as:		
Site plans?	☒	☐
Detailed explanations?	☒	☐
Comments obtained during consultation?	☒	☐
Have you included any electronic information, such as:		
A CD of the referral and documentation, in PDF format, excluding any confidential information?	☒	☐
A CD of the spatial data?	☒	☐
Any other relevant information?	☒	☐

Following a review of the information presented in this form, please consider the following question. (Your response is Optional)

❑ DO YOU CONSIDER THE PROPOSAL REQUIRES FORMAL ENVIRONMENTAL IMPACT ASSESSMENT?

(Information on the levels of environmental impact assessment is available on the EPA website at www.epa.wa.gov.au)

☒ YES ☐ NO ☐ NOT SURE

IF YES, WHAT LEVEL OF ASSESSMENT?

☒ ASSESSMENT ON REFERRAL INFORMATION

☐ ENVIRONMENTAL PROTECTION STATEMENT

☐ PUBLIC ENVIRONMENTAL REVIEW

☐ ENVIRONMENTAL REVIEW AND MANAGEMENT PROGRAMME

☐ STRATEGIC ENVIRONMENTAL ASSESSMENT

I, Shannon Jones *(full name)* declare that I have completed all of the questions in this form and attached the requested information and declare that the information contained in this form is, to my knowledge, true and not misleading.

Signature Shannon Jones

Name	Shannon Jones
Position	Environmental Adviser
Date	June 2006

Government Agency Contact Details — Attachment 1

Environmental Protection Authority

Westralia Square

Level 8 141 St Georges Tce

PERTH WA 6000

Please mail completed referrals to:

Postal address:

PO Box K822

PERTH WA 6842

Website: www.epa.wa.gov.au

EPA Service Unit

Westralia Square

Levels 8 & 9 141 St Georges Tce

PERTH WA 6000

Telephone: (08) 9222 7000

Facsimile :(08) 9322 1598

Website: www.environment.wa.gov.au

Contact details for the head offices of the primary agencies involved in development proposals follow. You may need to contact your relevant district or regional office (details of all State Government agencies are available on the website of the Department of the Premier and Cabinet, www.dpc.wa.gov.au). You will also need to contact your Local Government Authority in the first instance. For some proposals, consultation with or referral to Commonwealth agencies may be required.

Department of Environment

Westralia Square

Level 8 141 St Georges Tce

Perth WA 6000

For Licensing under Part V -

Telephone: (08) 9222 7000

Website: www.environment.wa.gov.au

Hyatt Centre

3 Plain St

East Perth WA 6004

For Clearing Permit under Part V -

Telephone: (08) 9278 0300

Website: www.environment.wa.gov.au

Water and Rivers Commission

Hyatt Centre

3 Plain St

East Perth WA 6004

Telephone: (08) 9278 0300

Website: www.environment.wa.gov.au

Department of Industry & Resources

The Atrium

168 St George's Terrace

Perth WA 6000

Telephone: (08) 9327 5555

Website: www.doir.wa.gov.au

Mineral House

100 Plain St

East Perth WA 6004

Telephone: (08) 9327 5555

Website: www.doir.wa.gov.au

Department of Fisheries

3rd floor, SGIO Atrium

168 St George's Terrace

Perth WA 6000

Telephone: (08) 9482 7333

Website: www.wa.gov.au/westfish

Department of Conservation and Land Management

Hackett Drive

Crawley WA 6009 Telephone: (08) 9334 0333

Website: www.calm.wa.gov.au

Department for Planning and Infrastructure (including Bush Forever Office)

Albert Facey House

469 Wellington Street Telephone: (08) 9264 7777

Perth WA 6000 Telephone: 1800 626 477 (Bush Forever Office)

Website: www.planning.wa.gov.au

Department of Indigenous Affairs

Level 1, 197 St George's Terrace Telephone: (08) 9235 8000

PERTH WA 6000 Website: www.dia.wa.gov.au

Health Department of Western Australia

189 Royal St Telephone: (08) 9222 4222

EAST PERTH WA 6004 Website

SUPPORTING DOCUMENT

CLOVERDALE MINERAL SANDS PROJECT

SUPPORTING DOCUMENT

August 2006

Prepared by

ILUKA

ACN 008 675 018
Level 23, 140 St Georges Terrace
PERTH WA 6000

SUMMARY

Iluka Resources Limited (Iluka) (the Proponent) proposes to establish a mineral sands mine at the Cloverdale Deposit, approximately 190 kilometres south of Perth and six km south east of the township of Capel, in the Shires of Busselton and Capel (Figure 1). The Cloverdale Project Area is defined by two leases, M70/1107 and M70/1167 (Figure 2) and lies parallel and adjacent to the existing Yoganup West and Yoganup operations (Figure 3). The project is part of Iluka's ongoing South-West Operations, being a continuation of operations as mining and production of heavy mineral concentrate (HMC) at Yoganup West ceases.

The Project Area is extensively cleared and is currently used for agriculture. There are five landowners with properties within the proposed disturbance area. Access agreements are being developed with these landowners.

The Project is currently scheduled to commence pre-production in the first quarter of 2007, with production beginning soon after. This proposed schedule is dependent on internal planning processes and the timely receipt of environmental and other approvals.

The current ore reserve is approximately 3.5 million tonnes with an average grade of 18% heavy mineral.

It is proposed that a maximum of 350 ha will be disturbed. The ore will be mined progressively from several pits using dry mining techniques. Ore will be conveyed to an existing screen plant at Yoganup West to remove oversize material, then slurried and pumped to an existing concentrator at Yoganup, to separate the Heavy Mineral Concentrate (HMC) from the clay and sand. HMC will be transported to the North Capel separation plant for further processing. Dewatering of groundwater inflows into the pit will be required to enable dry mining to occur and process water supply demands will preferentially be met by mine dewatering water. Any additional water will be sourced from existing production bores at Yoganup mine site.

The Ludlow River traverses the Project Area and the Capel River is approximately 200 m north of the proposed area of disturbance. It has been decided not to mine through the Ludlow River.

The mining component of the project is expected to be completed within two years and rehabilitation within a further three years. Most of the decommissioning and landform works will be completed within one year of mining cessation.

The proposal will require approval from a number of State Government authorities, including the Department of Environment and the Department of Industry and Resources.

The Proponent is committed to undertaking a community consultation program from the early stages of the Project development until rehabilitation is complete. Consultation with adjacent landowners has begun and will continue throughout the Project.

A number of environmental and social baseline and impact assessments have been conducted, including vegetation and flora, fauna, groundwater, surface water, aquatic biota, acid sulfate soils (ASS), noise, ethnographic and archaeological. The results of these studies

have been used to complete the referral form and this supporting document. Reports from environmental assessments conducted by consultants are also provided as appendices.

Key environmental issues associated with the proposed mine and addressed in this document are:

- potential impacts of noise on nearby residents;
- management of acid sulfate soils; and
- potential groundwater drawdown from pit dewatering.

This Supporting Document is submitted to the Environmental Protection Authority (EPA) in support of a completed referral form for the project. It describes the proposal, the existing environment and potential environmental and social impacts of the proposal and proposes strategies to mitigate and manage potential impacts.

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1. BACKGROUND INFORMATION

1.1. Location and Land Ownership

The Cloverdale Deposit is located approximately 190 kilometres south of Perth and six kilometres south-south east of the township of Capel, in the Shires of Busselton and Capel (Figure 1). The Project Area is covered by mining leases M70/1107 and M70/1167 (Table 1).

Table 1: Mining Leases covering the Cloverdale Project Area

Mining Lease	Date Granted	Date of Expiry	Holder
M70/1107	4 June 2002	3 June 2023	Iluka Resources Ltd
M70/1167	8 November 2004	7 November 2025	Iluka Resources Ltd

The Project Area covers a total area of 883 hectares and includes two hectares of Vacant Crown Land (VCL) and several road reserves vested in the Shires of Capel and Busselton. The Project Area is extensively cleared and is currently used for agriculture.

Iluka owns three of the lots within the Project Area with nine other landowners occupying the remaining properties, of which only five are within the proposed disturbance area (Figure 2). Land access agreements with these five landowners are currently in preparation (Figure 2).

There are no crown reserves within the Project Area.

1.2. Key Characteristics of the Project

The Cloverdale project is proposed to be established and operated in a similar fashion to other Iluka operations in the south-west. The current reserve is approximately 3.5 million tonnes with an average grade of approximately 18 percent heavy mineral. Mining will take up to two years. The site will operate on a continuous 24 hours per day, 7 days a week basis, however overburden removal will only be conducted between 7 am and 7 pm, Monday to Saturday. This is to reduce night time noise from the operation.

The Cloverdale Project consists of two strands of Heavy Mineral Deposits, 4.5 kilometres long, lying sub-parallel to and approximately 1.5 kilometres northwest of the existing Yoganup West mine site (Figure 3).

Approximately 350 hectares of land will be disturbed in the development of the Cloverdale deposit. This includes disturbance for mine pits, stockpiles, water dam, plant and infrastructure, roads and conveyors. The proposed mine pits and approximate area of disturbance are indicated in Figure 3. An area of no mining has been designated which includes the Ludlow River and nearby Banksia woodland and is also shown in Figure 3. This was excised from the potential mining area following an economic, social and environmental assessment. A crossing will be required over the River.

The key characteristics of the Cloverdale Project are shown in Table 2.

Table 2: Key Characteristics

Characteristic	Description
MINING	
Life of Mine (Mine Production)	2 years
Size of Ore Body	3.5 million tonnes
Total Area of Disturbance	350 ha
Native Vegetation Disturbance	4 ha
Hours of Operation	Overburden removal - 7am – 7pm, Monday to Saturday Ore mining – 24 hour day, 7 day week
PROCESSING	
In-pit Hopper	Cloverdale - operates 24 hour day, 7 day week
Screen Plant	Yoganup West - operates 24 hour day, 7 day week
Concentrator	Yoganup Nominal Processing Rate : 350 tonnes per hour Hours of Operation: 24 hour day, 7 day week
Heavy Mineral Concentrate production	450,000 tonnes per year
OTHER	
Water Supply Sources	Existing Yarragadee bores - licenced for 3100 ML/year Predicted dewatering volume - 1000 ML per year

1.3. Mining Operations and Ore Processing

Cloverdale will come into production as mining at Yoganup West is completed. Topsoil stripping, overburden removal, installation of drainage and noise bunds, preparation of haulroads and construction of infrastructure will commence prior to production. Existing facilities at Yoganup West and Yoganup will be used to process ore from Cloverdale. The Canning Concentrator is currently located at the Yoganup site, processing ore from the Yoganup West Mine Site. This will remain in the same location and be utilised for processing ore from the Cloverdale Deposit. This concentrator has a rated throughput of 350 tonnes per hour.

The mining method will be similar to Yoganup West, with scrapers or truck and shovel excavating the ore and hauling to the in-pit hopper. There are two hopper locations proposed for Cloverdale.

The ore will be conveyed from the hopper to the existing wet screening plant at Yoganup West to remove oversize material (small rocks, plant root material) that must be removed. From the screen plant, ore will be transported via existing pumps and pipeline to the concentrator at Yoganup. The concentrator is a series of pumps and spirals that use the natural physical properties of the mineral (its density) to separate it from the tails to produce Heavy Mineral Concentrate (HMC). HMC will be stockpiled at Yoganup prior to being transported via trucks to Capel for further processing. Transport will be using the same route as is currently used from Yoganup and Yoganup West, on the same basis as existing arrangements, as per Main Roads and Busselton Shire Permits.

Support infrastructure such as offices and workshops will remain in their current position at Yoganup, close to the Concentrator location. An earthmoving contractor's area will be

installed at Cloverdale. The Yoganup West access road will be extended to Cloverdale for equipment movement.

After consideration of options for clay fines management, it was decided to re-use the existing solar drying dams. No new solar drying dams are proposed. Existing water dams (also at Yoganup and Yoganup West) will also be re-used for water management and a new settling dam for stormwater management will be located near the proposed pit.

By leaving existing plant and infrastructure in their current locations and re-using existing facilities, the amount of land required to be disturbed is considerably reduced and environmental and social impacts on local residents are minimised.

Dewatering of groundwater inflow into the pit will be required to enable dry mining to occur. Groundwater investigations have been conducted to predict water inflow and potential drawdown impacts. Process water supply demands will preferentially be met by surface water run-off and mine dewatering water. Additional water requirements will be sourced from existing bores currently supplying water for operations at Yoganup West and Yoganup.

Following backfill of mining voids, the area will be rehabilitated to a landform and landuse similar to the surroundings.

Figure 4 gives an overview of the processes followed in mining of mineral sands.

1.4. Dangerous Goods and Hazardous Substances

The screening and concentration process proposed for mining the Cloverdale Deposit does not involve the use of any toxic chemicals with the exception of flocculant which is not toxic in the concentrations discharged. Therefore, the use of potentially dangerous or hazardous substances will be limited. Material Safety Data Sheets for all products will be kept on site by Iluka.

Radiation will be managed according to the Iluka Southwest Radiation Management Plan. See section 2.9 for further details.

1.5. Workforce

The proposed Cloverdale minesite will be staffed by the same crew currently operating at the nearby Yoganup West operation. This is approximately 25 on-site Iluka personnel and 50 earthmoving contractors. Administration, mine planning, surveying, and metallurgical staff will all be based out of the existing offices at Yoganup, while mine geology, environmental and laboratory requirements will be supported by the existing Capel offices. A number of contractors will also be employed from time to time to carry out specialised tasks including maintenance, engineering construction, fencing and rehabilitation.

1.6. Resource Requirements

1.6.1. Power

The existing power supply to the Yoganup West minesite will be extended to the Cloverdale minesite.

Electrical power requirements for the entire site are expected to be approximately 6.0 megavoltamperes (MVA) at 22 kilovolts (kV). Initial consultation with Western Power has identified that the current infrastructure supplying power to the concentrator at Yoganup is rated to carry this demand, but will require some upgrades.

1.6.2. Fuel

Diesel fuel for machinery, vehicles and plant will be trucked by road to the site. Fuel will be stored in approved containment vessels and appropriately bunded.

1.6.3. Water

Water requirements for the process will be sourced from mine dewatering abstractions and existing Yarragadee Formation groundwater supplies at the Yoganup Mine.

2. EXISTING ENVIRONMENT, IMPACT ASSESSMENT AND MANAGEMENT

2.1. Vegetation and Flora

2.1.1. Existing Environment

Three flora and vegetation surveys have been conducted in the Cloverdale Project Area. An Ecological Review covering part of the Project Area was conducted by Hart, Simpson and Associates in September 2001 (HSA, 2001). Two flora and vegetation surveys were conducted within the Project Area and surrounds during 2005. The first was conducted in autumn (GHD, 2005) and the second in spring (Mattiske Consulting, 2005). A survey of the adjacent Yoganup West site was conducted in 2002 (Mattiske Consulting, 2003) and information from this survey was considered in the 2005 surveys. The reports from the 2005 surveys are included as Appendix 1 and Appendix 2.

The area surveyed in 2005 is primarily on private land consisting of mainly cultivated paddocks and plantations. The native vegetation remaining consists of small areas, often in road reserves, drainage lines or partially grazed paddocks (Mattiske Consulting, 2005). Remaining vegetation types as mapped during the spring 2005 survey are described in Table 3 and shown in Figure 5. Both 2005 surveys used the Bush Forever Condition Rating Scale (Government of WA, 2000, cited in Mattiske Consulting, 2006) to classify the condition of remaining vegetation from 1 (pristine or nearly so) to 6 (the structure of the vegetation is no longer intact and the area is completely or almost without native species). The condition of the remaining vegetation has been modified by grazing, weed invasion and dieback and the majority is rated condition 5. The condition rating is described in Table 3 and shown in Figure 6.

CALM's database was searched for records of Declared Rare Flora (DRF), Priority Flora (PF) and Threatened Ecological Communities (TECs). There are no records of TECs or rare flora within 1 km of the proposed disturbance area. There are records of two TECs but no rare or priority flora between one and two kilometres from the proposed disturbance area (Figure 7). In addition, CALM and DEH databases were searched for potential occurrences of rare and priority flora within the region. Searches of the CALM database indicate that 11 rare and 32 priority flora may potentially occur in the Cloverdale survey area (Mattiske Consulting, 2005). The results of these searches were used for guidance during surveys.

Two areas of vegetation within the survey area were noted as having local and regional significance. The first area is the less disturbed areas of Banksia Woodland (type B1) on Warns Road and adjacent sections on lot 2015 (ranging from condition 3 to condition 5) which support the rare orchid *Caladenia huegelii*. The second area is Lot 3096 containing E1 and M1 vegetation types rated at condition 2 to condition 4 (GHD, 2005; Mattiske Consulting, 2005).

The spring survey noted the presence of a vegetation community equivalent to community 3a '*Corymbia calophylla – Kingia australis* woodlands on heavy soils', This community is listed at the State level as critically endangered and at the Federal level under the EPBC Act (1999) as a TEC. This community is shown as vegetation type C2 on Figure 5. There were three occurrences of vegetation type C2 within the survey area.

On lot 4221 and Warns Road, the C2 vegetation is degraded, rated at condition 5, with only remnant trees of Marri and Kingia persisting in paddocks (Plate 1; Figure 8). There is little value in maintaining these values (Mattiske Consulting, 2005). As a result of the degree of degradation in this area the vegetation is not considered to be a TEC (E. Mattiske, pers comm., 23 June 2006). A small area of vegetation type C2 in the Road reserve along Downes Road was rated at condition 4, and supports a larger range of understorey species, however due to the size of the road reserve the longer term prospects for protecting this area from weed invasion are limited (Mattiske Consulting, 2005). A third occurrence of this vegetation type is just 0.4 ha in size and is rated at condition 4 (Figure 9). Both of these occurrences are in slightly better condition however are considered to be borderline as to whether they will persist in the longer term (E. Mattiske, pers comm., 23 June 2006).

Plate 1: Vegetation Type C2, lot 4221

Plate 2: Vegetation Type C2, Warns Road

The surveys located one rare and three priority species within the survey area (Figure 7). One individual of the orchid species *Caladenia huegelii*, a declared rare flora (DRF) under the Wildlife Conservation Act (1950) and Endangered under the Environmental Protection and Biodiversity Conservation Act (1999) was located in the 2001 Ecological Review (Hart, Simpson and Associates, 2001). The exact location of the *Caladenia huegelii* found in this survey is unknown; however it was within the Banksia woodland near the corner of Warns Road and Downes Road (vegetation type B1). Small numbers of the priority 3 species *Acacia semitrullata* were also found during this survey.

This orchid was targeted during the spring 2005 surveys, with several searches of potential habitat conducted during its flowering period. Five individuals were identified in the Banksia woodland (vegetation type B1) on lot 2015 and the Warns Road Reserve (Figure 7). These individuals are outside of the disturbance area within an “area of no mining”. This is an area which contains mineral, however also holds environmental and social value. An economic, environmental and social assessment was conducted on this area, and it was subsequently removed from the area of mining. This species is dependent on rainfall so will not be impacted by potential drawdown (E. Mattiske, pers comm., 3 May 2006). This species is therefore not expected to be impacted by the proposed mine.

The March 2005 survey (GHD, 2005) found five individuals of *Acacia semitrullata* (P3) and the spring 2005 survey (Mattiske Consulting, 2005) found three priority taxa, *Franklandia triaristata* (P4), *Pultenaea skinneri* (P3) and *Acacia semitrullata* (P3).

Table 3: Vegetation types and conditions within survey area, spring 2005.

Vegetation Type	Site	Approx. Area (Ha)	Condition
A1 – Woodland of *Agonis flexuosa* over pasture on sandy soils	Lot 976 (Cloverdale Rd)	12.4	5
	Downes Rd	5.6	5
	Lot 3229 (Ludlow River)	0.4	5
B1 – Open Woodland of *Banksia attenuata – Banksia ilicifolia* over *Kunzea ericifolia*, *Podocarpus drouynianus* and *Dasypogon bromeliifolius* with emergent *Eucalyptus marginate* subsp. *Marginata* on sandy soils.	Lot 3782/Warns Rd north	6.0	5
	Lot 3782/Warns Rd centre	10.8	5
	Lot 2015/Warns Rd south	24.7	3-5
	Lot 3229 (Ludlow River)	6.0	5
C1 – Open Forest to Woodland of *Corymbia calophylla – Eucalyptus rudis* over *Melaleuca preissiana*, *Melaleuca rhaphiophylla* and *Agonis flexuosa* over *Astartea scoparia*, *Taxandria linearifolia* and *Cyathochaeta avenacea* on major water-courses.	Ludlow R. – east Warns Rd	8.5	5
	Ludlow R. – west Warns Rd	15.5	4
	Ludlow River - downstream	13.2	5/4
	Capel River	32.1	4
C2 – Open forest to Woodland of *Corymbia calophylla* over *Banksia grandis*, *Kingia australis* and *Xanthorrhoea preissii* on loam soils.	Lot 4221/Warns Road	32.9	5
	Lot 2015	0.4	4
	Downes Road	1.0	4
C3 – Woodland of *Corymbia calophylla* over pasture on loam soils.	Cloverdale Road	1.6	5
	Warns Road	3.2	5
	Lot 3229 (Ludlow River)	3.6	5
E1 – Open Woodland of *Eucalyptus marginata* subsp. *marginata – Banksia attenuata – Banksia grandis – Xylomelum occidentale* over *Stirlingia latifolia* and *Dasypogon bromeliifolius* on sandy soils.	Lot 3096	3.1	2/4
	Warns Road	0.6	4
	Downes Road	0.8	4
E2 – Open Forest of *Eucalyptus marginata* subsp. *marginata – Corymbia calophylla* over low shrubs and herbs on sandy-loam soils.	R2850	4.6	4
M1 – Woodland of *Melaleuca preissiana* over *Hypocalymma angustifolium* and mixed sedges.	Lot 3096	0.4	3
	Warns Road	0.3	4
	Downes Road east	0.6	4
	Downes Road west	0.3	5
	Lot 3229 (Ludlow River)	0.6	5

2.1.2. Impacts and Management

The EPA Position Statement No. 2 (EPA, 2000) refers to the clearing of vegetation. In section 4.3, the statement includes eight elements for consideration during the assessment of impacts. Applicable elements have been incorporated into this assessment.

Element one of EPA Position Statement No. 2 requires clearing to be minimised. An area of Banksia Woodland has been excised from the mine plan as outlined in section 1.2. This area contains the rare *Caladenia huegelii*. As outlined in section 1.3, existing solar drying dams will be utilised and the concentrator and screen plant will remain in their current positions. This significantly reduces the need for disturbance. Where possible, facilities have been located on cleared pasture areas, avoiding areas of vegetation.

The total proposed disturbance area is approximately 350 ha. The majority of this area is cleared (condition 6). A total of four ha of native vegetation is proposed for clearing, and two ha of planted vegetation (plantation and stock shelters). All native vegetation within the area to be disturbed is rated at condition 5 (degraded) (Table 4 and Figure 10).

Table 4: Native vegetation to be cleared

Vegetation Type	Approx. Total Area (Ha)	Approximate area to be cleared (Ha)	Condition of area to be cleared
A1 – Woodland of *Agonis flexuosa* over pasture on sandy soils	18.4	2	5
C1 – Open Forest to Woodland of *Corymbia calophylla – Eucalyptus rudis* over *Melaleuca preissiana*, *Melaleuca rhaphiophylla* and *Agonis flexuosa* over *Astartea scoparia*, *Taxandria linearifolia* and *Cyathochaeta avenacea* on major water-courses.	77.8	2	5

Element 4 relates to the threshold level of 30% of the pre-clearing extent of the vegetation type. The Project Area occurs on three vegetation complexes as defined in 1:250,000 mapping by Heddle *et al* (1980a), namely the Abba, Swan and Southern River Complexes. These vegetation complexes are all below 30% of the pre-clearing extent of the vegetation type and the Abba and Swan complexes are below 10% of the original extent.

While it is recognised that the vegetation complexes on the Swan Coastal Plain are largely cleared, the four ha of native vegetation proposed for clearing in this project are degraded, with either colonising species occurring after disturbance or stressed overstorey species. Clearing of this degraded vegetation is not considered to represent a significant impact.

In accordance with elements 2 and 3 of section 4.3 of the Position Statement, no rare or priority flora, or TEC communities located in either 2005 survey are within the proposed disturbance area. Two of the three areas of vegetation noted as having local and regional significance are entirely outside of the proposed disturbance area. The third, the Ludlow River, has been significantly modified by past grazing activities. However, while it does not provide a link between areas of significant vegetation, it has value as a corridor for fauna movement (Ninox 2006; Mattiske, 2005). Less than two ha of vegetation along the Ludlow River is within the proposed disturbance area. This vegetation is rated at condition 5 (GHD 2005; Mattiske Consulting, 2005).

The potential for groundwater drawdown impacts on vegetation is covered in section 2.4.

The disturbance area will be rehabilitated to productive agricultural lands. It is intended that riparian vegetation along the river be bolstered in order to protect the channel, while maintaining necessary crossings. Replanting along the Ludlow River will be subject to Landholder approval. Alternatively, farm shelter belts will be installed on nearby properties owned by Iluka, using a native species mix. Rehabilitation will take into consideration linking fragmented vegetation. Following rehabilitation, there will be more areas of native vegetation across the Project Area providing better links for fragmented vegetation. This will provide alternative mechanisms to protect biodiversity as required by element 5.

Impacts to vegetation have been identified and can be managed to meet the EPA objective for vegetation as required by element 8. The project has been designed to ensure impacts to vegetation and flora are minimal with only four ha of native vegetation in poor condition (condition 5) being disturbed by the project. No DRF, PF or TEC will be cleared by the proposal.

2.2. Fauna

2.2.1. Terrestrial fauna

Fauna surveys were conducted in March 2005 (GHD, 2005) and in October 2005 (Ninox, 2006). The area covered by these studies (the Study Area) included the Project Area and surrounds. Reports from these surveys are included as Appendix 1 and Appendix 3.

A survey of the adjacent Yoganup West site was conducted in 2003 (Ninox, 2003) and information from this survey was considered in the 2005 surveys.

Both the GHD and Ninox survey reports contain full lists of specially protected (threatened) species identified through literature searches as known to occur in the region. Searches were conducted of the EPBC Act Protected Matters Search Tool to identify Significant Fauna and of the CALM rare fauna database to identify Rare and Priority species which may occur in the general Capel area. Bird species listed under international agreements were also considered.

A total of 46 species of bird were observed in the survey area during the two 2005 surveys, including one introduced species (Laughing Kookaburra). All species recorded are typical of farmland with fragmented remnants of degraded native vegetation. One bird species listed as vulnerable under State legislation (*Wildlife Conservation Act*, 1950) and as endangered under Commonwealth legislation (*Environmental Protection and Biodiversity Conservation (EPBC) Act*, 1999), Carnaby's Cockatoo (*Calyptorhynchus latirostris*) was observed feeding on a small group of pine trees outside of the proposed disturbance area. The Forest Red-tailed Black Cockatoo (*Calyptorhynchus banksii naso*) was also observed flying overhead. This species is listed as vulnerable under State legislation.

Baudin's Cockatoo (*Calyptorhynchus baudinii)* is also listed as Endangered under the EPBC Act and Vulnerable under the Wildlife Conservation Act. This species has not been observed in the survey area, however it may occur. No trees with the potential to contain suitable cockatoo nesting hollows were noted within the areas containing mineral resources (Ninox, 2006).

A cockatoo survey was also conducted in March 2006 (Johnstone and Kirkby, 2006) (Appendix 4). The purpose of this survey was to assess the value of remnant vegetation in the proposed disturbance area to provide nesting and feeding sites for Carnaby's Cockatoo, Baudin's Cockatoo and Forest Red-tailed Black Cockatoo. The survey found very little evidence of cockatoos feeding or breeding on the site (Johnstone and Kirkby, 2006). Therefore it is unlikely that the proposal will have an impact on these cockatoos.

Four birds listed on the China/Australia Migratory Bird Agreement (CAMBA) and two birds listed on the Japan/Australia Migratory Bird Agreement (JAMBA), including one bird listed on both agreements, could occasionally be present in the survey area. They are the Great Egret, Cattle Egret, Glossy Ibis, Rainbow Bee-eater and Fork-tailed Swift. The fork-tailed Swift rarely lands in Australia, the Egrets and Ibis are unlikely to be affected by the proposal and the Rainbow Bee-eater, while known to breed in the south-west, is unlikely to nest in cleared paddocks. It is therefore unlikely that there will be any impact on these birds (Ninox, 2006).

The Peregrine Falcon, listed as Other Specially Protected Fauna under the Wildlife Conservation Act (1950), could occur in the Survey Area (Ninox, 2006), however is unlikely to be impacted by the proposal.

One species of native mammal, the Western Grey Kangaroo and two introduced mammals, the Red Fox and European Rabbit, was observed in both 2005 surveys. Evidence of a further two species, the Common Brushtail Possum and the Western Ringtail Possum (*Pseudocheirus occidentalis*) were also found, both outside of the proposed disturbance area. The Western Ringtail Possum is listed under State and Commonwealth legislation as vulnerable. The only evidence of this species was dreys (nests) and scats in cultivated gardens. A specific search within remnant vegetation proposed to be disturbed found no further evidence of the species. Where the Western Ringtail Possum and the Common Brushtail Possum occur together and the Ringtail is outnumbered by the Brushtail, the Ringtails are actively excluded (B. Jones Pers. Comm, cited in Ninox, 2006).

Six other mammals of conservation significance could occur in the survey area. These include the Chuditch and the Quokka, both listed as Vulnerable under both the *EPBC Act* (1999) and *Wildlife Conservation Act* (1950). The degree of clearing in the Survey Area may preclude the Chuditch from occurring and the lack of dense thickets used by the Quokka make that species unlikely to be present (Ninox, 2006).

The Wambenger (Phascogale) is a Priority 3 species on CALM's Priority Fauna list. This species may occur where trees with suitable shelter hollows are present, for example, along the Capel and Ludlow Rivers. The Priority 5 Southern Brown Bandicoot (Quenda) may occur within riverine vegetation, the Priority 4 Western False Pipistrelle may occur and the Water Rat may occur in riparian zones, however the degraded condition of riparian area within the survey area limits the possibility.

Five frog species were recorded and five others may occur, none of which are of conservation significance. Six species of reptile were recorded, none of which are of conservation significance. One reptile of conservation significance, the Carpet Python, may occur however is considered unlikely given the high level of past vegetation clearance (Ninox, 2006).

Due to the substantial clearing in the Greater Bunbury Region, the value of remaining vegetation as refuge for fauna, especially birds and reptiles, is likely to be high. However,

none of the fauna habitats that are in good condition will be directly impacted by the development of the proposal and little vegetation is proposed to be cleared. Therefore there is likely to be minimal impact on the vertebrate fauna species that are known or predicted to occur (Ninox, 2006).

2.2.2. Aquatic Fauna

A survey was conducted of the aquatic ecosystem at eight sites along the Ludlow River in early November 2005 and one site on the Capel River in January 2006 (Wetland Research and Management (WRM), 2006). The survey sites are shown on Figure 11 and the report from this survey is included as Appendix 5. The Ludlow River survey found a total of 111 macroinvertebrate taxa, four fish including one introduced species, three crayfish, no adult frogs, one tadpole species and seven waterbirds. All species observed were common. The Capel River survey found 59 macroinvertebrate taxa, three fish, two crayfish, no frogs or tadpoles, and no waterbirds. There was also anecdotal evidence from local landowners of other species occurring.

One CALM priority 4 macroinvertebrate species, the freshwater mussel *Westralunio carteri*, was recorded in the Capel River (WRM, 2006). This species prefers shallow water habitats with stable, sandy or muddy bottoms and inhabits both permanent and seasonal rivers. It can survive prolonged periods of drought by burrowing into bottom muds and sealing the bivalve. It may thus survive potential drawdown of river pools associated with mine dewatering.

Impacts on aquatic fauna as a result of the project are considered to be negligible. The construction of a stream crossing will be conducted in a manner that minimises impacts to surface water flows and therefore aquatic fauna. Appropriate licences will be sought from the Department of Water (DoW) for the stream crossing.

2.3. Surface Water

The Cloverdale Project Area lies within the Vasse-Wonnerup Estuary catchment area and surface waters originate from the Whicher Scarp. There is one river channel running through the Project Area (the Ludlow River) and one running 200 m to the north (the Capel River). There are also several agricultural drains which traverse the Project Area, and enter the Ludlow River downstream (Figure 11). The Ludlow River enters the Vasse Estuary more than 11.5 km west of the Project Area. The Capel River passes through Capel Township approximately 6.5 km from the resource then discharges into the ocean, approximately 13 km downstream of the Project Area.

There has been extensive alteration of the upstream catchment, mainly as a result of agricultural activities which have substantially affected catchment hydrology, increasing runoff and recharge to the water table (URS, 2003). The increased flow, combined with clearing of fringing riparian vegetation, has lead to erosion problems (GeoCatch, 2002). The majority of the Ludlow River is severely degraded with minimal vegetation cover and extensive erosion.

Plate 3: Ludlow River passing through the proposed mine, November 2005. Photo courtesy WRM.

Upstream of the Project Area, the Ludlow River and its tributary Tiger Gully traverse the Yoganup West Minesite and are being diverted to allow mining of the Yoganup West deposit. Historically, the Tiger Gully joined the Ludlow River in the middle of the Cloverdale resource, though stream restoration works at Yoganup West will result in the confluence being upstream of the Cloverdale Project Area. The final stream alignment is shown in Figure 11 and considered as the current environment in this document.

Mineral exists under the Ludlow River where it passes through the Project Area. An economic, social and environmental assessment of this area was conducted, concluding that it was not viable to mine this portion of the resource given the environmental and social costs. The river has subsequently been removed from the mining area as shown in Figure 11 as an 'area of no mining'. A crossing will be required, to provide access to mineral south of the river. This crossing may be permanent to provide ongoing stream crossing for the landowner. Appropriate beds and banks licences will be sought for the crossing and will include details of the design, location and permanency of the crossing.

2.3.1. Water Quantity

Runoff from rainfall is the major component of streamflow in the Ludlow River, Tiger Gully and other drains in the catchment. The Ludlow River and agricultural drains are seasonal, with most runoff occurring between June and September. There is a dam on the Ludlow River, upstream of the Cloverdale Deposit, however this dam has been known to dry out in summer. Surface water was monitored at five locations around the Project Area in 2005, including three agricultural drains entering the Project area and one drain and the Ludlow River downstream of the Project Area. The maximum flow coming onto the Project Area recorded to date through each of these drains was 129 l/s (approximately 11,146 m^3 in a day), 53.5 l/s (approximately 4,622 m^3 in a day) and 20 l/s (approximately 1,728 m^3 in a

day). Monitoring station TGD, which measures combined flows in the Ludlow River downstream of Yoganup West and upstream of the Cloverdale site recorded a flow of 355,945 m^3 on the 18th August 2005. This is the maximum flow that has been recorded to date.

2.3.2. Water Quality

Water quality has been adversely affected as a result of erosion, high nutrient loading from fertilisers and stock access to water courses (URS, 2003). Data from the Yoganup and Yoganup West monitoring stations, from the sites around the Cloverdale Project Area and from the aquatic ecosystems survey have shown a range in pH of 5.8 to 8.1, Conductivity ranging from 77 µS/cm to 1,300 µS/cm and TSS from <1 mg/L to 250 mg/L.

The aquatic ecosystem survey concluded that most *in situ* physico-chemical variables tested indicated a 'slightly to moderately disturbed ecosystem', based on ANZECC/ARMCANZ 2000a (WRM, 2006).

The Capel Land Conservation District Committee (LCDC) has provided pH and EC data collected from the Capel River near to the Cloverdale Project Area. Data has been collected from this site approximately every three months since 2002 and showed a pH range of 6.6 to 7.6 and an EC range of 524 µS/cm to 1,230 µS/cm.

2.3.3. Aquatic Ecosystem Assessment

A survey was conducted of the aquatic ecosystem at eight sites along the Ludlow River in early November 2005 and one site on the Capel River in January 2006 (WRM, 2006; Appendix 5).

The riverine condition of all sites was considered degraded due to historic pastoral practices and unrestricted livestock access to waterbodies. Typical of rural regions in the south west, channels were characterised by poor bank stability with extensive erosion, as evidenced by bank slumping, channel widening, bed down-cutting and extensive sedimentation. Filamentous algae covered up to 30% of bed substrates. Only isolated clumps of submerged macrophytes and emergent sedges were present. The terrestrial understorey was sparse and the overstorey ranged from open to moderately dense mixed woodlands. There was little evidence of recruitment outside of the Conservation Category Wetland area and, to a lesser degree, the Capel River site.

The riverine ecosystems of the Ludlow River were determined to be of limited regional conservation value due to past disturbances, including drain construction, disturbance of the riparian zones (livestock, weed infested and erosion prone) and loss of in-stream habitat. Given the extensive historic clearing in the region, the regional ecological value of the remaining riparian vegetation was considered to be high (WRM, 2006).

All sites were assessed for foreshore condition (ranging from A1 (pristine) to D3 (drain weed dominated) and given an environmental health rating (excellent to very poor), based on the WRC foreshore assessment techniques (WRC, 1999). While an environmental rating of 'moderate' was assigned to the Capel River site and the Ludlow sites downstream of the proposed disturbance area, all other sites were rated as 'poor' to very poor (Table 5). See Figure 11 for site locations.

Table 5: Foreshore condition and environmental health ratings (WRM, 2006)

Site No.	Foreshore condition	Environmental health
1	C1 - erosion prone; understorey weeds only	Very poor
2	C1 - erosion prone; understorey weeds only	Poor
3	C1 - erosion prone; understorey weeds only	Poor
4	C2-C3 - eroding (but streamlining commenced)	Poor - Very poor (but streamlining commenced)
5	C3 - eroding	Very poor
6	B3-C1 – good overstorey but channel erosion prone generally with localised areas of undercutting & bank slumping	Moderate
7	B3-C1 – good overstorey but channel erosion prone generally but with localised areas of undercutting & bank slumping	Moderate
8	B3-C1 – good overstorey but channel erosion prone generally but with localised areas of undercutting & bank slumping	Moderate
9	C1 – good overstorey but channel generally erosion prone with localised areas of undercutting & bank slumping	Moderate

2.3.4. Management of Surface Water

Agricultural paddock drains which traverse the proposed mining area and drain into the Ludlow River are proposed to be mined. Drain flow and overland surface flow will either be directed around the mine path and into the Ludlow River or will be directed into the mine pit, where water will be recovered into the process water system. Runoff and erosion from disturbed areas has the potential to increase turbidity and suspended solids in surface water flows. Fine particles could travel some distance in surface water flows, whereas heavier particles are likely to settle close to the source of the erosion. Disturbed areas will be bunded to capture rainfall and runoff, with water directed to the process water system.

Potential contaminants to surface waters include hydrocarbons and flocculants. Potential contamination sources include the concentrator area, mine workshop, vehicle washdown bay, fuel bays and refuelling areas. Where possible, the Cloverdale Project will make use of existing facilities. The only new facilities required at Cloverdale are an area for contractors, a settling dam and in-pit facilities. Any potential contaminants will be contained and managed to prevent contamination to the environment.

Water from pit dewatering and stormwater will preferentially be used for process water supply, reducing the need for disposal of water from the site. However in the event that site water discharge is required, this will be conducted at a licensed discharge point, with monitoring in place to ensure that the water released meets discharge requirements. Yoganup and Yoganup West have licensed discharge points with monitoring stations in place. A licence change will be sought should there be any requirement for an additional discharge point from Cloverdale.

Water quality and quantity will be monitored on a regular basis in accordance with the site licence. Discharge water will be of a quality that will not adversely affect the beneficial use

of the receiving waterbody, not cause or contribute to soil erosion and not have a detrimental effect on flora and fauna downstream of the discharge point.

A surface water monitoring schedule including quality and quantity measurements on the Ludlow River is already in place. This monitoring will continue throughout operations.

Conservative worst-case groundwater impact assessments suggest that drawdown impacts on the Ludlow and Capel Rivers will be negligible and short-lived (URS, 2006). Drawdown is discussed further in section 2.4.

The management strategies outlined above ensure that surface water values, including ecosystem maintenance, are protected. Surface water discharges will meet statutory requirements and there will be no adverse environmental impacts.

2.3.5. Wetlands

Wetlands not only include lakes with open water but areas of seasonally, intermittently or permanently waterlogged soil. Approximately 25% of the Swan Coastal Plan between Moore River and Mandurah is classified as wetland (WRC, 2001). The classification system developed by the Semeniuk Research Group is employed for wetland classification on the Swan Coastal Plain (Hill et al, 1996). This system classifies wetlands based on landform and water permanence and includes dampland (seasonally waterlogged basin), sumpland (seasonally inundated basin), lake (permanent inundated basin), artificial basins (dam), floodplain (seasonally inundated flat) and plausplain (seasonally waterlogged flat).

Wetlands of international significance are listed under the Ramsar Convention which is an international treaty that covers the conservation of wetlands of international importance. Within Western Australia twelve of these wetland systems exist. The closest to the Cloverdale Project Area is the Vasse-Wonnerup Estuary system, located more than 11.5 km west of the Project Area.

Wetlands of national significance requiring protection are listed under the Directory of Important Wetlands and/or under the Australian Heritage Commissions Register of the National Estate. There are no wetlands within the Project Area nor within a 5 km radius that are considered to be of national significance.

Wetlands of regional significance within the Swan Coastal Plain are protected under the Environmental Protection (Swan Coastal Plain Lakes) Policy (EPP) 1992. There are no EPP wetlands within the Project Area, however there are four gazetted EPP wetlands within a 4 km radius of the Project Area. Gazetted EPP Wetlands 970, 974, 975 and 969 are located between 2 and 4 km to the northwest of the mineral reserve (Figure 11).

Hill et al (1996) undertook an evaluation of the Wetlands within the Swan Coastal Plain. As part of this evaluation three broad management categories have been defined for wetlands. These include Resource Enhancement, Conservation and Multiple Use wetlands. The Project Area and its surrounds is generally flat, low-lying cleared land, most of which has been classified as multiple use wetland.

There are no Conservation Category or Resource Enhancement Category Wetlands within the proposed disturbance area. There is a Conservation Category wetland on the Ludlow River, downstream of the disturbance area. This wetland extends for 2.5km. There is one Conservation Category Wetland 1.5km upstream of the proposed disturbance area on Tiger

Gully adjacent to the Yoganup minesite. There are also two Resource Enhancement Category wetlands immediately north of this Conservation Category Wetland (Figure 11).

There are no impacts anticipated on any of the described wetlands as a result of the proposal.

2.4. Groundwater

Mining of the Cloverdale Deposit will require dewatering of mine pits in order to allow mining where the ore extends below the water table. Water removed from the pit by dewatering will be preferentially used for process water. Where water from dewatering is insufficient to meet process requirements, bores will be used to supplement the demand.

Iluka currently has Yarragadee bores which supplement process water requirements for the current operations. These bores will continue to be used.

2.4.1. Groundwater modelling

Dewatering has the potential to cause drawdown of groundwater outside of the mine pit. Detailed groundwater studies have been completed (URS, 2006) and the report from this study is included as Appendix 6. The report provides a baseline assessment of the local groundwater environments and the potential for drawdown based on knowledge of the local geology and groundwater systems and experience at the adjacent Yoganup West deposit (URS, 2006). It must be stressed that the assumptions employed in groundwater modelling are conservative to ensure that a worst case impact level is determined.

Monitoring results from nearby Yoganup West piezometers have enabled a comparison of observed drawdown to the drawdown predicted prior to mining. Results have shown drawdown in the deeper piezometers screened within the Yoganup and Leederville Formations, and little to no drawdown in the shallow and medium piezometers screened within the Guildford Formation. Additionally, monitoring piezometers near the southern end of the pit which experienced drawdown are already showing significant recovery. No nearby landowners have reported impacts to their water supplies from mining operations at Yoganup West.

The findings from Yoganup West were considered in development of the Cloverdale model which predicts different groundwater responses in the Guildford Formation to the Yoganup and Leederville Formations.

At the commencement of groundwater studies for Cloverdale, a series of 36 standpipe piezometers were installed at 12 sites in and around the deposit, in order to characterise the aquifers present (Figure 12). Typically, the surface, shallow and medium depth piezometers intersect the Bassendean Sand, Guildford Formation and Yoganup Formation. The deep piezometers intersect either the Yoganup Formation or the Leederville Formation.

Information from those piezometers and the geological model suggest that the Cloverdale environment is very similar to the Yoganup West environment, again with a heavy clay layer over the sandier Yoganup and Leederville Formations.

The superficial formations are recharged by rainfall on the site, while the Yoganup and Leederville Formations are recharged from the Blackwood Plateau.

Groundwater samples taken for quality analysis indicated that the local groundwaters are of a sodium-chloride type, are moderately to slightly acidic (pH 4.0-7.0) and are typically fresh to brackish, ranging from 150-4600 mg/L TDS).

Iluka conducted a groundwater resource census of landowners within approximately two kilometres of the deposit, collecting information on bores and dams. This information was used in groundwater assessments to predict the potential changes in groundwater environments being used for water supply. A total of 55 dams were recorded, including 18 that were interpreted as either intersecting the water table, being seasonally recharged by groundwater and/or have uncertain water sources. A total of 91 bores were recorded in the census and are used for stock watering, irrigation and household purposes. A small number of the bores are currently unused.

Groundwater modelling is designed to present the upper-bound potential drawdown of groundwater, representing the worst case. It is expected that the Cloverdale model overestimates drawdown and groundwater abstraction, due to a number of factors, including:

- The simulated hydraulic conductivities of the Guildford, Yoganup and Leederville formations are overestimated, so that the model overestimates dewatering abstraction and the drawdown within the these formations;
- The model provides discrete flow paths, rather than potential multiple layer responses typical of the Leederville Formation, and consequently further overestimates dewatering abstraction and drawdown; and
- The model does not simulate recharge to the water table whereas experience at Yoganup West shows that the water table is recharged seasonally. (URS, 2006)

2.4.2. Potential Impacts

Dams and bores

Of the 18 dams interpreted as either intersecting the water table, being seasonally recharged by groundwater and/or having uncertain water sources, only five dams are located in areas that may experience groundwater drawdown. The worst case drawdown predictions on these dams range from < 0.1 m to 0.5 m. These predicted drawdowns are not expected to represent significant impacts (URS, 2006).

Of the 91 bores identified in the census, 73 were interpreted to source water from the superficial formations and 15 were interpreted to source water from the Leederville Formation. The remaining three are high yielding bores ranging from 150 m to 300 m in depth, screened in the lower Leederville Formation and/or the Yarragadee Formation (URS, 2006).

Modelling predicted that 19 of the 73 superficial bores may experience drawdown of less than 0.5 m. There is not expected to be a significant impact on water supply from these bores. One superficial bore is expected to experience drawdown of up to 1.0 m, however the landowner has indicated that this bore has previously collapsed and is not currently used. There is no drawdown predicted in the remainder of the superficial bores (URS, 2006).

The 15 Leederville bores identified in the census are all within the area of predicted drawdown. Predicted drawdown ranges from 0.4 m to 7.2 m. Many of these bores are deep with access to a large depth of water and drawdown is not expected to impact water supply.

Landowners with modelled drawdown in the vicinity of their bore were re-visited to discuss the model outputs and potential drawdown on their bore. Iluka has committed to monitoring the groundwater drawdown through the installed piezometer network and in the case where water supplies are impacted, Iluka will provide alternative water supplies.

Surface waters

Any impacts to the Ludlow and Capel Rivers are likely to be short-lived during the period of mining.

In both rivers, there may be an increase in seasonal seepage from the river to the water table, however for both rivers, the potential impact on stream flow is expected to be negligible (URS, 2006).

Vegetation

The potential for groundwater drawdown impacts on vegetation is understood to be dependent on soil types, vegetation rooting depths, existing groundwater levels and predicted drawdown levels. Soil studies undertaken at Cloverdale, involving trench excavation at points within the Project Area, have identified soil types and the distribution of plant roots through the soil profile (SWC, 2006c, Appendix 7).

The Ludlow River and Warns Road vegetation is shown on Figure 13 in relation to the proposed mine pits. The Main Pit is approximately 95 m from the River at its closest point, where it is 20 m deep. The time from the commencement of overburden removal to the end of overburden backfill in the southern portion of this pit is up to eight months. South Pit 1 is a small pit between the Ludlow River and Warns Road. This pit is approximately 40 m from the River and 16 m deep at its deepest point. The time from commencement of overburden removal to the end of overburden backfill is up to three months. With the exception of the crossing location, there will be no disturbance within 15 m of the Ludlow River.

The condition five vegetation east of Warns Road is approximately 5 m from South Pit 1. This pit is over 90 m from the condition 3 vegetation on the Warns Road reserve. The distance from South Pit 2 to the Downes Road reserve is over 75 m. This pit is up to 18 m in depth (Figure 13).

The distance to vegetation, depth of mining voids and period of mining have all been taken into account in developing the groundwater model and assessing the potential for impacts on vegetation from mining.

The majority of vegetation areas are in areas with less than 0.2 m predicted maximum drawdown. Vegetation areas M1 on Downes Road east, E1 on Downes Road, C2 (equivalent to TEC 3a) on Lot 2015, A1 on Lot 976 and B1 on Lot 2015/1180 Warns Road South are within areas of 0.5 m predicted maximum drawdown. C2 on Downes Road is a small, thin area of roadside vegetation, equivalent to TEC 3a, which has predicted drawdown just exceeding 0.5 m. C1 on Ludlow River east of Warns Road has a maximum predicted

drawdown ranging from less than 0.1 m furthest from the mine pits to over 1 m between the pits.

With the exception of one soil type, all soils had a very low plant available moisture content (<5%), so that vegetation is required to explore a large volume of soil to acquire sufficient water. With the exception of the type B1 vegetation on lots 2015 and 1180, the vegetation within the survey area had roots that exceeded the depth of the trenches (approximately 9 m). It is expected that these roots extend down 12-15m to the water table (SWC, 2006c). Based on the rooting depth and the depth to groundwater much of the vegetation within the Project Area is classified as a category 3 phreatophyte or as a non–phreatophyte (Froend and Zencich, 2001, cited in SWC, 2006c). Non–phreatophytic vegetation obtain all of their moisture requirements from the soil profile and category 3 phreatophytic vegetation acquire the majority of water requirements from the soil profile with minimal extraction from the water table.

The predicted maximum drawdown of the water table is minimal and coupled with the low or minimal dependence on groundwater, no impact on any vegetation is likely to occur in response to mining and groundwater drawdown (SWC, 2006c).

The B1 vegetation on lots 2015 and 1180 had a relatively shallow root system (<3m) compared to other vegetation within the Project area. This was due to the presence of a permanent surficial aquifer perched on the Guildford clay underlying this area (SWC, 2006c). This, coupled with the sandy texture of the soil here indicated that the vegetation is reliant upon water from the perched aquifer (SWC, 2006c). This perched aquifer originates at the intersection of the Bunbury Basalt and Guildford formation and is the result of water being forced up onto the Guilford Clay by the Bunbury Basalt (SWC 2006c). Mining will not impact on this shallow basalt and consequently not impact this shallow aquifer or the vegetation that relies upon it (SWC, 2006c).

2.4.3. Management and Monitoring

There is an existing network of 36 groundwater monitoring piezometers around the Cloverdale deposit and a second, outer set of piezometers is currently being installed (Figure 12). While some of the existing piezometers will be lost once operations commence, the remaining piezometers will be used throughout mining to monitor changes in water levels.

The monitoring will also provide an indication if drawdown is reaching landowner bores or vegetation areas. In addition, soil moisture probes will be utilised to monitor soil moisture beneath the Warns Road vegetation. This will identify if unexpected impacts have occurred to the surficial aquifer supporting this vegetation. Appropriate trigger levels will be defined after collection of baseline data prior to mining and will be based on levels less than the permanent wilting point. If the trigger is exceeded, an irrigation system will be installed. This type of system has been used successfully at the adjacent Yoganup West mine.

A groundwater management plan will be developed prior to the commencement of operations. The plan will include a monitoring program and management responses.

2.5. Waste

Wastes will be managed in a manner that will not result in long-term impacts on groundwater, surface water or other aspects of the natural environment. Iluka encourages the use of landfill alternatives with the priorities for waste management being:

- Waste avoidance/reduction
- Reuse/recycle
- Waste treatment
- Waste disposal

Various waste products will be produced by the proposed Cloverdale operations. These include:

- **Green Waste:** Where viable, timber will be salvaged for use. Timber that cannot be mulched, chipped or milled (due to excessive sand, rock or other impediment), will be stacked, burnt or stored for habitat creation in rehabilitation of remnant vegetation.

- **Hydrocarbon Products:** Waste oils will be collected in a sump. All hydrocarbon-contaminated waste will be removed from site and disposed of according to waste regulations.

- **Structural Waste:** Some structural waste will be generated from maintenance activities. This waste will be recycled through a scrap metal merchant.

- **Domestic Waste:** Rubbish generated on the site such as food scraps, food wrappings and waste paper will be collected and disposed at the local Shire disposal site or an approved alternative.

2.6. Noise

The project will generate noise from mining, processing and transport activities. The main source of noise will be earth-moving equipment. The project has been designed and modified to minimise the risk of off-site noise emissions.

Noise levels from the operations are required to comply with the *Environmental Protection (Noise) Regulations (1997)*. The regulations stipulate the following noise levels at receiving locations:

Table 6: Noise limits at receiving locations

Time	Residential
0700 – 1900 hours Monday to Saturday	45 dB(A)
0900 – 1900 hours Sundays and Public Holidays	40 dB(A)
1900 – 2200 hours Monday to Saturday	40 dB(A)
2200 – 0700 hours Monday to Saturday and to 0900 hours Sundays and Public Holidays	35 dB(A)

To predict the noise that may be created by the proposed mining operation, a simulated model was developed. Noise levels emitted from the mining equipment (fixed and mobile) have been calculated from existing mine sites and data from manufacturers. This data

represents the noise levels from machinery that has not been modified to reduce noise, in order to predict the maximum potential impact. This data, together with local weather data, ground topographical data and receiver locations, was used to predict noise levels at nearby residences. In total, 34 resident locations were considered (see Figure 2). Many of the residences modelled are on properties for which landowner permission is required for mining to occur. The results of noise modelling will be provided to these landowners and incorporated into access agreements.

The full report from noise modelling is included as Appendix 8 and is summarised briefly below.

Noise levels were predicted based on worst case scenarios for day and night conditions. Noise levels vary depending on the weather conditions and the operating locations of mobile equipment, therefore the model incorporated meteorological conditions likely to generate the highest noise levels (ie the worst case scenario), including temperature, humidity, inversion and wind speed. Wind speeds of 4m/s during day-time operations and 3m/s for night–time operations were modelled. Worst case noise levels were modelled for nine different stages throughout the mine life, which represented the main changes to mining activities. Noise levels were then modelled for the eight cardinal wind directions, retaining all other worst case meteorological conditions. The model therefore predicts the expected worst case noise levels for each resident under each wind direction throughout the mine life.

The model was run with no noise bunds, 5 m noise bunds and 10 m noise bunds to reduce noise impacts. This showed that 10 m noise bunds are beneficial and these have subsequently been incorporated into the mine plan.

2.6.1. Day time noise

Between 7am and 7pm Monday to Saturday the noise limit is 45dB(A). During the day, both mining and processing equipment will be operating. With 10 m bunds in place, up to 11 resident locations (not owned by Iluka) were predicted to receive noise in exceedance of the day time noise regulations under certain weather conditions at some stages during mining. Due to the long, thin nature of the deposit most residents are only affected for a short duration when mining is closest to the residence. Maximum noise exceedences during day time operations are shown in Table 7.

The highest noise level predicted was approximately 54 dB under south-easterly winds at residence R1 immediately adjacent to the proposed mine. The key source of noise emissions during day time operations is mobile earthmoving equipment.

Table 7: Maximum noise exceedences during day time operations

RESIDENT	Mining Phase and Duration								
	Stage 1 (1 mth)	Stage 2 (1 mth)	Stage 3 (2 mths)	Stage 4 (1 mth)	Stage 5 (1 mth)	Stage 6 (3 mths)	Stage 7 (4 mths)	Stage 8 (1 mth)	Stage 9 (3 mths)
R1	S – W 47.6	-	-	-	-	S – W 46.8	All 54.3	E – W 48.8	N – SW 49.3
R9	-	-	-	-	-	-	SE – SW 47.2	-	SE – SW 45.9
R10	-	-	-	-	-	-	SE – SW 47.3	-	SE – SW 45.6
R11	-	-	-	-	-	-	SE – W 46.9	-	-
R12	-	-	-	-	-	-	SE – SW 46.1	-	-
R15	-	-	-	-	-	-	S – N 48.6	-	W – NE 48.5
R16	S – NW 50.6	W 45.2	SW - NW 46.0	-	-	S - NW 48.4	SW - E 49.3	NW 45.3	NW - NE 46.0
R17	SW – N 49.2	-	SW - NW 45.4	-	-	SW - NW 46.3	NW 45.7	-	-
R18	SW – NE 52.5	SW – N 51.5	SW - NW 51.0	NW 46.3	SW – N 47.4	SW – NE 51.0	SW – NE 50.1	-	-
R32	-	-	-	-	NE – E 45.1	-	-	-	-
R34	N – SE 46.6	N – SE 45.9	-	E – SE 45.8	E – S 47.7	NE – S 48.3	-	-	-

2.6.2. Evening & night time noise

Between 7pm and 10pm every day and from 9am to 7pm on Sundays and Public Holidays, the noise limit is 40 dB(A). Between 10pm and 7am everyday and from 10pm to 9am on Sundays and Public Holidays the noise limit is 35 dB(A). During these times the concentrator, conveyors, screenplant and a scraper will be operating. Modelling data indicates that the noise levels may exceed 35 dB(A) at the residences nearest the Yoganup and Yoganup West operations where the stationary equipment is located. Two of these residences, R18 and R19 are predicted to be impacted under north-westerly to south-easterly winds and the third residence R20 is predicted to be impacted under easterly to westerly winds. Iluka leases this property. A maximum noise level of approximately 39 dB(A) is predicted in northerly to easterly winds.

2.6.3. Tonality

Previous assessments of Iluka's operations have not considered tonality to be an issue and it is not expected to be an issue at Cloverdale. Noise monitoring around existing south west mine sites in the past has detected some tonality. However readings have been intermittent and it has not been possible to determine whether the mining operations were the source. Iluka has never received a complaint regarding tonality from a mine site.

2.6.4. Monitoring and Management

Landowner access agreements are being developed for several landowners that will incorporate clauses regarding noise emissions. Landowner agreements are currently being developed to access properties containing 7 of the 11 residences affected by day time noise and all night-time affected residences are leased by Iluka or will have landowner access agreements.

Several of these residences have been previously noise attenuated. Maintaining noise levels below 45 dB(A) during day time will be required at residences R11, R12, R15 and R34. The maximum exceedence currently predicted for these residences is 3.6 dB(A) (Table 7). Iluka is committed to minimising noise levels from the operation on all surrounding residences.

10 metre bunds will be placed in key locations around the mining perimeter to minimise noise emissions. A number of options to further reduce noise levels are currently being assessed including utilising minimal noise emitting reversing beepers and minimising numbers of machinery operating at once.

Construction work will be done in accordance with Regulation 13 (Construction Sites) of the Environmental Protection (Noise) Regulations 1997. Noise levels during construction of the noise bunds and initial mining areas are likely to exceed noise limits as no bunding will be in place. This is allowed for under Regulation 13.

Noise will be monitored during the construction and initial mining phases. The results of this noise monitoring will be used to refine the noise model. Noise levels will be monitored at the site boundary as required by the operational licence.

Any complaints received relating to noise will be investigated using the complaints management procedure. Nearby residents will be provided with contact details for the site manager and shift coordinator.

Monitoring of noise and regular consultation with landowners will ensure that any noise issues are identified and appropriately managed. A noise management plan will be prepared prior to the commencement of operations. This plan will include details of modelling, monitoring, the complaints procedure and management.

2.7. Dust

Dry mining operations typically generate dust associated with mining, processing and transport activities. Dust suppressant techniques employed on existing Iluka mine sites will be implemented at the Cloverdale Project as appropriate to minimise the generation of dust. The existing dust management procedures for Yoganup West will be implemented at Cloverdale.

Dust control measures may include:

- minimising clearing and open area;
- not disturbing topsoil until required;
- regular watering and grading of roads;
- using biodegradable chemical suppressants;
- stabilising bund and stockpiles from wind erosion
- growing of temporary crops to bind soil & lift wind from surface;
- re-establishment of pasture as soon as possible after mining has been completed; and
- using sprinkler systems and oversize material where appropriate.

Dust monitoring will be conducted during operations in accordance with DoE licence requirements. Regular communications will be held with adjacent landowners and a complaints management system, including investigation, action and feedback, will be implemented at Cloverdale as at existing Iluka sites. With the above mitigation techniques in place, there will be no adverse impacts from dust on environmental values or the health, welfare and amenity of people and land uses.

2.8. Light

During night time operations, light overspill and glow has the potential to impact on nearby residents. To minimise the impacts of this the in-pit hoppers will be located below the natural ground surface level or behind constructed bunds so that nuisance light overspill does not extend beyond the boundary of the Project Area. The noise bunds around the site will also help contain light.

While ore mining will be on a continuous basis it is proposed that overburden stripping be carried out on day shift only (7am-7pm, Monday – Saturday). This will limit the requirement for, and impact of, light from the equipment on site.

As the screen plant and concentrator will remain in their current locations at Yoganup West and Yoganup there will be no additional light emissions from these sources.

Should any complaints be received regarding light spill, these will be followed up using Iluka's complaint management procedure.

2.9. Radiation

All naturally occurring soils, rocks and minerals contain small amounts of the radioactive materials (radionuclides) Thorium and Uranium. The background gamma radiation level of the earth's surface is largely due to the presence of these elements. These radionuclides are not soluble and do not break free from the sand. The reason they are still present is due to their decay half life (time taken to lose their radioactivity) being millions of years.

Natural background levels within the South West region of WA are typically in the order of 0.2 micrograys per hour (µGy/h), however background levels vary from location to location based on the soils and minerals present in the area.

Mineral sands naturally contain more radionuclides than clays and 'yellow sands'. Throughout the mineral sands mining process, controls are in place to prevent any potential alteration to the natural background radiation of mining areas. "Pre mining" and "post mining" radiation surveys are conducted. This ensures that the natural background radiation levels remain unchanged as a result of the mining process.

The Cloverdale Project contains a low concentration of the mineral monazite. Monazite contains the naturally occurring radioactive elements thorium and uranium, which are associated with all heavy minerals mined by Iluka. Monazite is typically confined to the Cloverdale orebody at concentrations of about 0.1%. It increases through the concentration process to approximately 1-2% in the HMC. The concentration of thorium and uranium in the heavy mineral concentrate produced is variable but typically in the order of 800 ppm thorium and 100 ppm uranium and is significantly dependent on the concentration of the mineral monazite.

A pre-mine background radiation survey has been conducted over the proposed disturbance area at Cloverdale. Background radiation levels ranged between 0.01 and 0.08 with an average of 0.025 µGy/h.

As required under regulation 16.7 of the Mines Safety and Inspection Regulations, the Cloverdale project will follow the Iluka Southwest Radiation Management Plan which has been prepared in accordance with the Department of Consumer and Employment Protection (DOCEP) guidelines and other associated relevant legislation. As detailed in this plan, measures taken to minimise exposure to radiation include the provision and use of appropriate facilities and equipment, monitoring programs, individual dose assessments, reporting, training and inductions, and a waste management plan.

The handling, storage and transport of ore and HMC is able to be conducted safely in accordance with the approved Radiation Management Plan.

A post-mining radiation survey will be conducted to ensure levels are similar to pre-mining levels and thus demonstrate the negligible impact of radiation to the public and the environment as a result of the mining process.

2.10. Acid Sulfate Soils

Actual Acid Sulfate Soils (AASS) and Potential Acid Sulfate Soils (PASS) are collectively known as Acid Sulfate Soils (ASS). AASS are ASS which have previously been oxidised. PASS are ASS which have not been oxidised but which testing has shown have the potential to oxidise. ASS are present and currently being managed at the adjacent Yoganup West mine. They were therefore identified as potentially occurring at Cloverdale.

An extensive ASS drilling and analysis program was undertaken in 2005 to identify the occurrence of Actual Acid Sulfate Soils (AASS) and Potential Acid Sulfate Soils (PASS) across the site and through the soil profile, and its extent to be predicted by modelling. A very small amount of AASS was detected in the Yoganup Formation. Modelling predicts approximately 1% PASS in the overburden (SWC, 2006a). Approximately 20% of the ore and a large proportion of material outside of the pit is PASS affected. The report from this study is included as Appendix 9.

There is the potential for ASS to occur in the areas immediately surrounding the mine pits due to the diffusion of oxygen into the sediments as the cone of depression of groundwater extends. To consider the potential impact on PASS from dewatering activities, a theoretical assessment was conducted (SWC, 2006a). This assessment identified that oxygen diffusion into the sediments is limited by high moisture contents. High moisture contents are expected to remain in the sediments following dewatering hence restricting the influx of oxygen to within 10 m of the pit edge (SWC 2006a, 2006b). This restricted oxygen influx will retard oxidation of PASS materials outside of the ore zone. The report from this assessment is included as Appendix 10.

The identification of significant ASS affected areas through modelling has highlighted the areas where management should be focussed. The ASS management practices currently proposed for Cloverdale are based on the management practices currently employed at Yoganup West, and recommendations from the ASS report for Cloverdale (SWC, 2006a). A detailed ASS Management Plan has been developed for Cloverdale and is included as Appendix 11. This management plan outlines the ASS management practices that will be

applied at Cloverdale in order to minimise any potential impacts related to ASS arising from mining this deposit.

2.11. Greenhouse Gas

The only gaseous emissions generated at the Cloverdale Project will be from standard diesel and petrol combustion engines. The emissions from the combustion engines contain some particulate matter, carbon monoxide and other gases including carbon dioxide (CO_2).

A greenhouse gas estimation has been conducted based on emissions from existing sites. The total annual emissions from the operation of the minesite and transportation of HMC are estimated at approximately 72,000 tonnes CO_2-e. This is a slight increase from existing emissions, due to the increased material movement requirements however it is less than 100,000 tonnes per annum of carbon dioxide equivalent emissions. Therefore the proposed mine is not likely to result in substantial greenhouse gas emissions.

2.12. Heritage

2.12.1. Aboriginal Heritage

A search of the register of Aboriginal sites, maintained by the Department of Indigenous Affairs, indicated one registered site that reportedly contains scattered artefacts. This site (ID 5147) covers a large area of the Capel region and is rated as unreliable. Ethnographic and Archaeological surveys of the Project area were conducted in 2005 to determine whether any sites of Aboriginal significance may be disturbed.

The ethnographic survey was conducted by anthropologist RE O'Connor (O'Connor, 2005) with representatives of the South West Boojarrah Native Title claimant group. The report from this survey is included as Appendix 12 of the supporting document. No ethnographic sites were identified, however the representatives did request that the Ludlow River be protected from disturbance. After economic, environmental and social assessment the Ludlow River was excluded from the mineral reserve, however a crossing will be required to access mineral south of the River. The ethnographic survey concluded Aboriginal heritage considerations were not deemed to be an impediment to development within the Project Area (O'Connor, 2005).

An archaeological survey of the Project Area was conducted (Glendenning, 2006). The report from this survey is included as Appendix 13 of the supporting document. Two scar trees were identified, as shown on Figure 14. Mine related infrastructure, including a drain diversion had been planned in the vicinity of the scar trees. The layout of infrastructure is now being modified in an attempt to avoid the trees. The final position of infrastructure is yet to be determined. Should it not be possible to avoid the trees completely, permission to move the trees will be sought from the Minister of Indigenous Affairs, under section 18 of the Aboriginal Heritage Act 1972.

If during the course of the development of the mine, artefact or skeletal material is uncovered Iluka will report these discoveries under Section 15 of the Aboriginal Heritage Act (1972-80) to the appropriate department. The implementation of the Cloverdale Project will not adversely affect historical and cultural associations and will comply with relevant heritage legislation.

2.12.2. European Heritage

A search of the Heritage Council of WA, Australian Heritage Council and National Trust of Australia (WA) website databases was conducted. Municipal Inventories of heritage places for the Shires of Capel and Busselton were also searched. No heritage sites were located within the proposed disturbance area.

2.13. Rehabilitation

The proposed Cloverdale mine will be rehabilitated using similar methods to other operations in the south-west. Where practical, rehabilitation will be undertaken progressively during operations. Rehabilitation aims to achieve a stable and functioning landform which is consistent with the surrounding landscape and is acceptable to the community and other stakeholders.

As Yoganup, Yoganup West and Cloverdale are adjacent to each other and materials moved, handled and stored across all three sites, an overall materials management strategy will be developed, incorporating all three sites. This will enable the most effective use of materials across all three sites to construct the soil profile.

Rehabilitation will aim to fill the final mine void and achieve a final landform similar to the pre-mining contours. The overall profile of the pit will be blended into the undisturbed level outside the proposed mining limits.

Land throughout the Project Area has been extensively cleared and is currently used for grazing cattle. Iluka proposes to rehabilitate the mining area to enable a final land use of agriculture.

The in-pit hopper, contractor area, internal roads, powerlines and water pipelines will be removed at the completion of mining.

Some infrastructure (including dams, roads and other services) may be retained on site if requested by the landowner and if this does not adversely affect the overall aims of the rehabilitation program. Remaining infrastructure at the Yoganup and Yoganup West Mine sites will be rehabilitated following completion of mining at Cloverdale.

Mining voids will be progressively backfilled, stockpiled subsoils and topsoils will be returned, the landform will be reshaped to the design profile and pasture will be established.

A total of four hectares of native vegetation is proposed to be cleared. All vegetation to be cleared is rated at condition 5 with little or no understorey (see section 2.1). Due to the degraded nature of the vegetation, the loss of seed banks in topsoil and invasion of weed and pasture crops, it is not proposed to return these areas to native vegetation.

It is intended that riparian vegetation along the river be bolstered in order to protect the channel, while maintaining crossings. Replanting along the Ludlow River will be subject to Landholder approval. Alternatively, farm shelter belts will be installed on nearby properties owned by Iluka, using a native species mix. Where possible, rehabilitation will take into consideration linking fragmented vegetation.

It is anticipated that up to three years (post mining) will be required for Iluka to complete backfilling and returning the land to its design profile. The land will then be managed under

a typical agricultural regime, but will be subject to productivity monitoring and land capability investigation. The land will only be returned to the owner when a post-mining agricultural report by an independent agricultural consultant is completed which verifies that pre-mining productivity levels have been met and are sustainable.

3. COMMUNITY CONSULTATION

3.1. Consultation Program

On commencement of the feasibility studies for the Cloverdale project a community consultation program was implemented by Iluka to ensure that an open dialogue between the company and residents was developed and maintained, and to engage the local community in aspects of the mine approval process and ongoing management of the operation. The plan satisfies the requirements of the Interim Industry Guide to Community Involvement developed by the Department of Environment (DoE).

The consultation program comprises the following phases:

- Identification of stakeholders
- Dissemination of information and identification of stakeholder issues
- Collection of feedback from stakeholders
- Response to the stakeholder issues
- Communication of the Proponent's response.

3.1.1. Identification of Stakeholders

Interested stakeholders in the project have been identified as community members in the immediate surrounds of the project, people within the local shire, special interest groups and decision making authorities. These stakeholders are listed in Table 8. Stakeholders were identified during the consultation process and consulted accordingly.

Table 8: Stakeholders Identified

Stakeholder Group	Specific Stakeholders
Community Members	Landowners and Residents within the proposed mine area
	Landowners and Residents within 2km of the proposed mine area
Community and Industry Organisations and Groups	Southwest Boojarah Native Title Group
	Dr Steve Thomas (MLA)
	Capel Land Conservation District Committee
	GeoCatch
	Busselton – Dunsborough Environment Centre
	South West Environment Centre
	Capel Equestrian Centre
	Conservation Council
Government Agencies	Environmental Protection Authority (EPA)
	Department of Environment (DoE)
	Shire of Capel
	Shire of Busselton

3.1.2. Dissemination of Information & Identification of Issues

Methods used to disseminate information to the community and identify key issues regarding the Cloverdale Project involved the following consultation mechanisms:

All Stakeholders

Community Updates were distributed to all residents within the Cloverdale area and to other non-local stakeholders in November 2005 and April 2006. Community Updates will continue to be developed to provide an update of mine planning, approvals processes and Iluka's operations.

Landowners in Project Area

There are currently nine landowners other than Iluka with properties within the Project Area and five landowners with property within the proposed disturbance area. Land access agreements are being developed with these five landowners. Landowner agreements will be in place prior to the commencement of mining.

These landowners have also provided access for environmental and other surveys conducted as part of baseline studies and mine development studies. Summaries of key findings of flora, fauna and aquatic studies have been provided to the landowners involved.

Landowners adjacent to the Project Area

Several meetings and ongoing discussions on key issues such as dust, noise and groundwater have been held with individual landowners.

Landowners within approximately 2 km of the proposed mining area were contacted for an initial introduction to the project and to provide information as part of a bore census. This initial meeting provided an opportunity to record any concerns from landowners and to provide them with contact details should they have any concerns which they wished to raise in the future.

Where potential noise or changes to groundwater have been predicted by studies, landowners within 2 km were revisited to present the findings of reports and discuss possible impacts and mitigation.

Capel Community

In addition to the community update, Iluka provides input to community newsletters and publications. Through its community sponsorship program Iluka has provided sponsorship for community events and developments. Iluka is the major sponsor of the Capel Fest. At the Capel Fest Iluka provides an information marquee and tours of the Capel operations.

Capel Land Conservation District Committee

Iluka has had several discussions with members of the Capel LCDC specifically regarding the Cloverdale Project.

In September 2005, thirteen members of the LCDC toured Yoganup West mine site (the mine site closest to the Cloverdale Project Area) and were shown the Cloverdale Project

Area. The Cloverdale project was discussed with the group. The group were also shown post-mining rehabilitation at Stratham West and North Capel. Iluka received positive feedback from the group during the tour. Members and staff from GeoCatch also participated in this tour.

Government Agencies

Preliminary discussions have been held with the Capel and Busselton Shires, DoIR and several departments within the DoE. Discussions will continue with these agencies as required throughout the life of the Project. Annual reporting is conducted by Iluka for its Southwest operations and regular inspections conducted of operations. Cloverdale has been discussed in these forums.

Invitations to meet to discuss the Project were extended to the South West Environment Centre, GeoCatch and the Busselton Dunsborough Environment Centre. Representatives from Iluka met with representatives of the Busselton Dunsborough Environment Centre on 3 May 2005. Their primary concern was that the Ludlow River not be mined through and realigned. A meeting is held with the Conservation Council each year to update them on upcoming projects and the Cloverdale Project is included in this update.

Table 9 : Summary of Stakeholder Issues

Issues Raised	Response
Community Members	
Will the mining operate for 24 hours a day and on weekends?	Yes. Iluka must comply with all relevant regulations relating to noise. Lower limits apply at night time and over some parts of weekends. Mining activities may need to be modified to ensure that any noise from the site is under the applicable limit at all times. Refer to section 2.6.
Concerns about impacts on water supply when mining commences	Iluka has undertaken studies in regards to water impacts and conducted a bore census of nearby landholders. A groundwater model has been prepared to identify any impacts on private water resources. The model provides an indication of the worst case potential change in water levels at landowner water resources. Discussions have been held with these landholders to help determine the potential for impact and negotiate mitigation strategies. Refer to section 2.4.

Issues Raised	Response
Concerns regarding noise.	The company must adhere to noise regulations set by the DoE. Noise modelling predicts noise levels exceeding regulations at several resident locations under certain conditions. Noise mitigation methods that have already been investigated include constructing noise bunds at strategic locations around the site and investigating the use of different types of machinery. Other methods being investigated are installing devices to suppress noise on fixed and mobile equipment. Refer to section 2.6.
Concerns regarding dust from the mining operation.	Explained standard activities that are undertaken at Iluka sites to manage dust, including minimising open area, using water trucks and bund walls being covered in grass or other substance to form a crust. Refer to section 2.7.
Which haulage route would the mine use?	The route to be used is Tutunup Road and Ludlow-Hithergreen Road, then Bussell Highway to the Capel processing facilities. This is the same haulage route that has been used for a number of years for the Yoganup and Yoganup West mine sites, and is endorsed by the Shire of Busselton. Refer to section 1.3.
Will you be mining through the Ludlow River?	No, it has been decided that the Ludlow River will be excluded from the mine plan, however a crossing will be required to access mineral south of the river.
How was the land going to be put back?	The land will be rehabilitated to agricultural land. The landowners have input into the rehabilitation including farm layout, fencing plans, pastures and tree belts to suit their operations. Iluka has had excellent results rehabilitating agricultural land at other mine sites, with increases in agricultural productivity from pre-mining levels. Refer to section 2.13.
Community and Industry Groups	
Request that the native vegetation be retained or salvaged where possible	Iluka will minimise its impact on native vegetation on the site and, where viable, will salvage timber.

Issues Raised	Response
Are there Acid Sulfate Soils at this site?	As there are Acid Sulfate Soils (ASS) at the neighbouring Yoganup West mine site, an extensive testing program was undertaken at Cloverdale. This program found that ASS are present and a management plan was subsequently developed. Refer to section 2.10.
Interested when mining of deposits in this area would cease and when Iluka would stop using the current haulage route.	Cloverdale is the only deposit in the area that Iluka is currently planning to develop, and which will require haulage along the existing route. Any future projects will be subject to further community consultation and associated environmental approvals. At this time, none are planned for this area.

3.1.3. Ongoing Consultation

The proponent will continue to liaise closely with local authorities and the local community during the construction of the Project and will implement a consultation program which includes regular meetings with landowners in proximity to the mine, and community consultation as issues arise.

The ongoing consultation program will involve:

- Ongoing liaison with relevant government and community representative groups;
- Conducting open days for the local public;
- Providing contact details should residents or local authorities have any issues to raise with Iluka.
- Discussions with the Shires of Capel and Busselton regarding traffic management;
- Meetings with councillors and staff of local authorities;
- Dissemination of information through community newspapers and Iluka's Community Updates; and
- Providing information on the Project to the Iluka workforce.

4. CONCLUSIONS

The Cloverdale Project can be conducted without causing significant environmental impacts. No Threatened Ecological Communities, regionally significant vegetation, Declared Rare Flora or Priority Flora will be impacted by the proposal. Native vegetation to be cleared is in poor condition and totals 4 ha. No significant fauna are likely to be impacted.

The Ludlow River which runs through the deposit will not be mined, however a crossing will be required. Should discharge of water be required from site, discharge waters will comply with licence conditions. Changes to groundwater resulting from dewatering of mine pits is not expected to significantly impact the environment or water supplies.

Noise modelling indicates that day time noise limits may be exceeded at four residences with whom landowner access agreements are not being established. Noise emissions will be reduced by minimising the number of machinery operating in adverse weather conditions and implementing a noise management plan including monitoring and consultation with neighbours.

Waste, dust and light will all be managed using standard practices to ensure that there will be no adverse impacts on the environment or community.

Extensive ASS investigations have identified the extent of ASS and determined that with appropriate management, there will be no significant impacts resulting from mining. A management plan has been developed to ensure that operations are conducted to minimise potential impacts.

No ethnographic sites were located within the proposed disturbance area. Two archaeological sites were located. These sites, both scar trees, will be avoided where possible. No other known sites of heritage significance are present within the proposed disturbance area.

Based upon the impact assessments discussed above, Iluka believes the Cloverdale Mineral Sands Project can be designed and managed to ensure acceptable social and environmental outcomes and that an ARI level of assessment is appropriate.

5. REFERENCES

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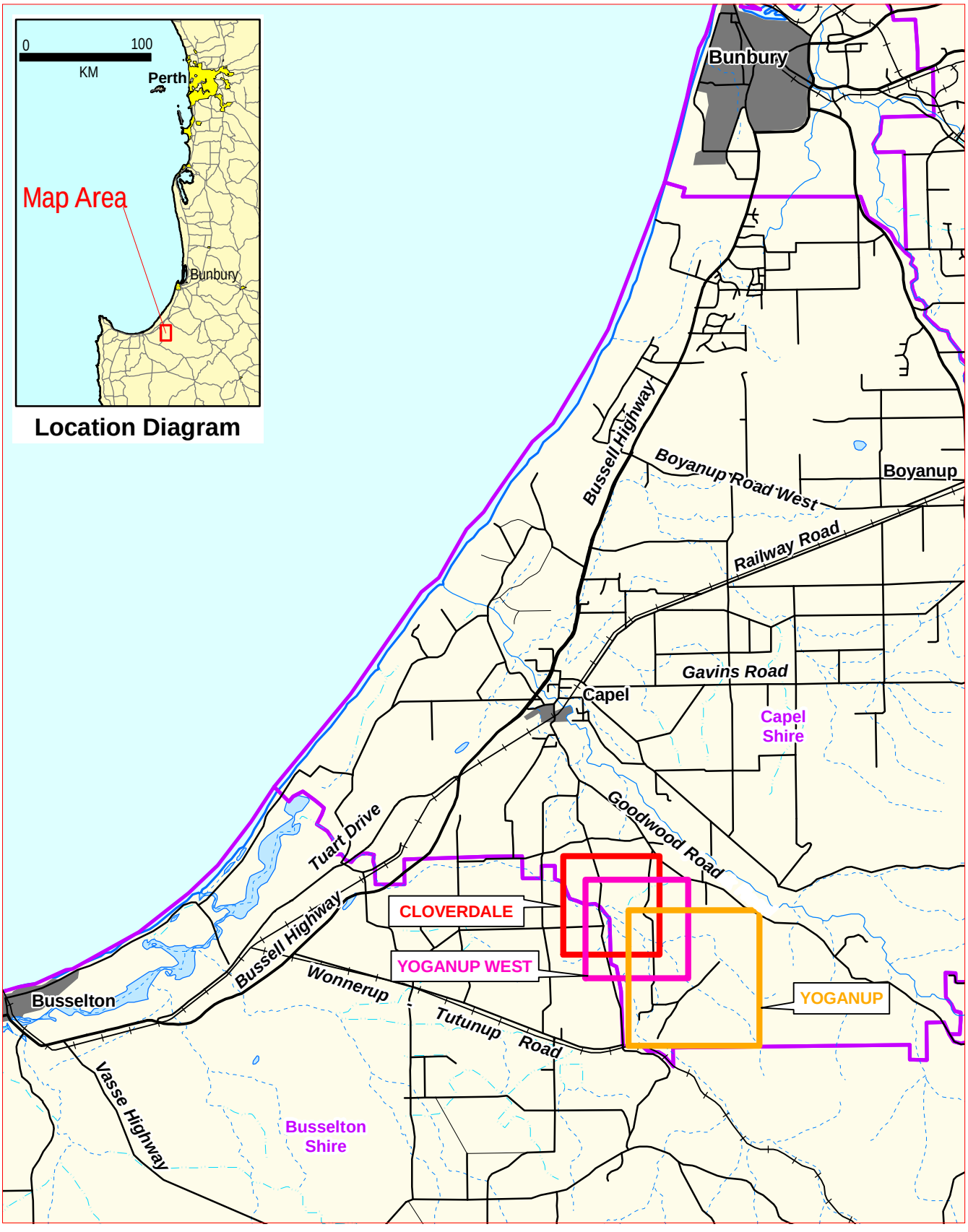
FIGURES



Legend

Shire Boundary

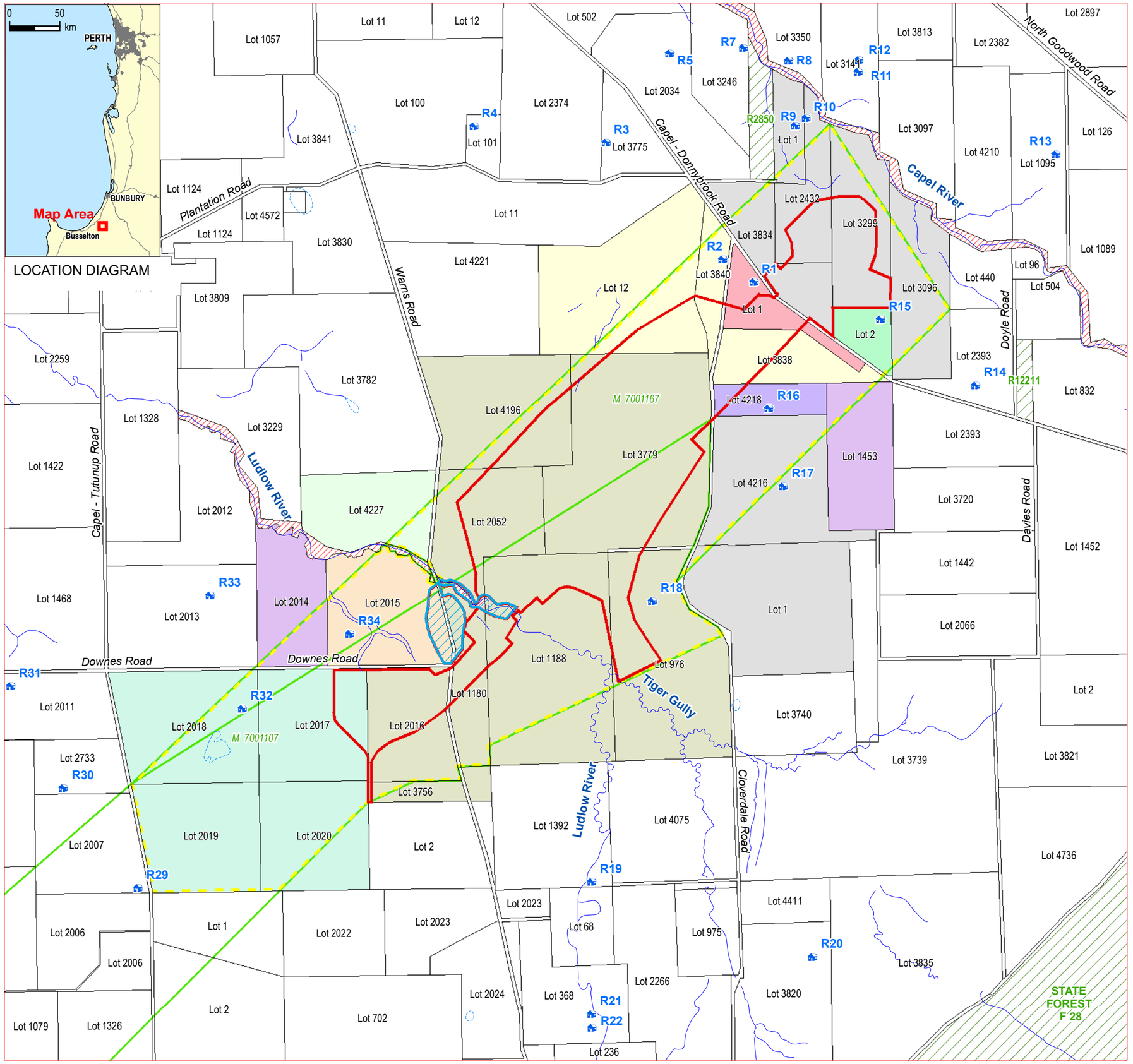
0 5 10km

ILUKA

CLOVERDALE

REGIONAL LOCATION PLAN

ORIG:	S.Jones		
DRAWN:	S.P.		
SCALE:	1:200 000		
DATE:	13 April 2005	DWG No: 150243 ver.00	FIGURE: 1



REVISIONS

Ver.	ORIG	DESIGN	DATE	COMMENTS

Legend

- Area of no mining
- Area of disturbance
- Project Area
- Iluka Tenements (within project area)
- Vacant Crown Land
- Reserves
- Cloverdale Residences
- Watercourse Perennial

Landowners

- Iluka Owned Properties
- Bibby G P & McKechnie J P
- Brown G F & L D
- Carribean Investments Pty Ltd
- Doyle E J & P T
- Doyle M C & C A
- Fremantle Trading Co Pty Ltd
- Hutton
- Norton
- Weir J G & Weir - Gibson V W

N

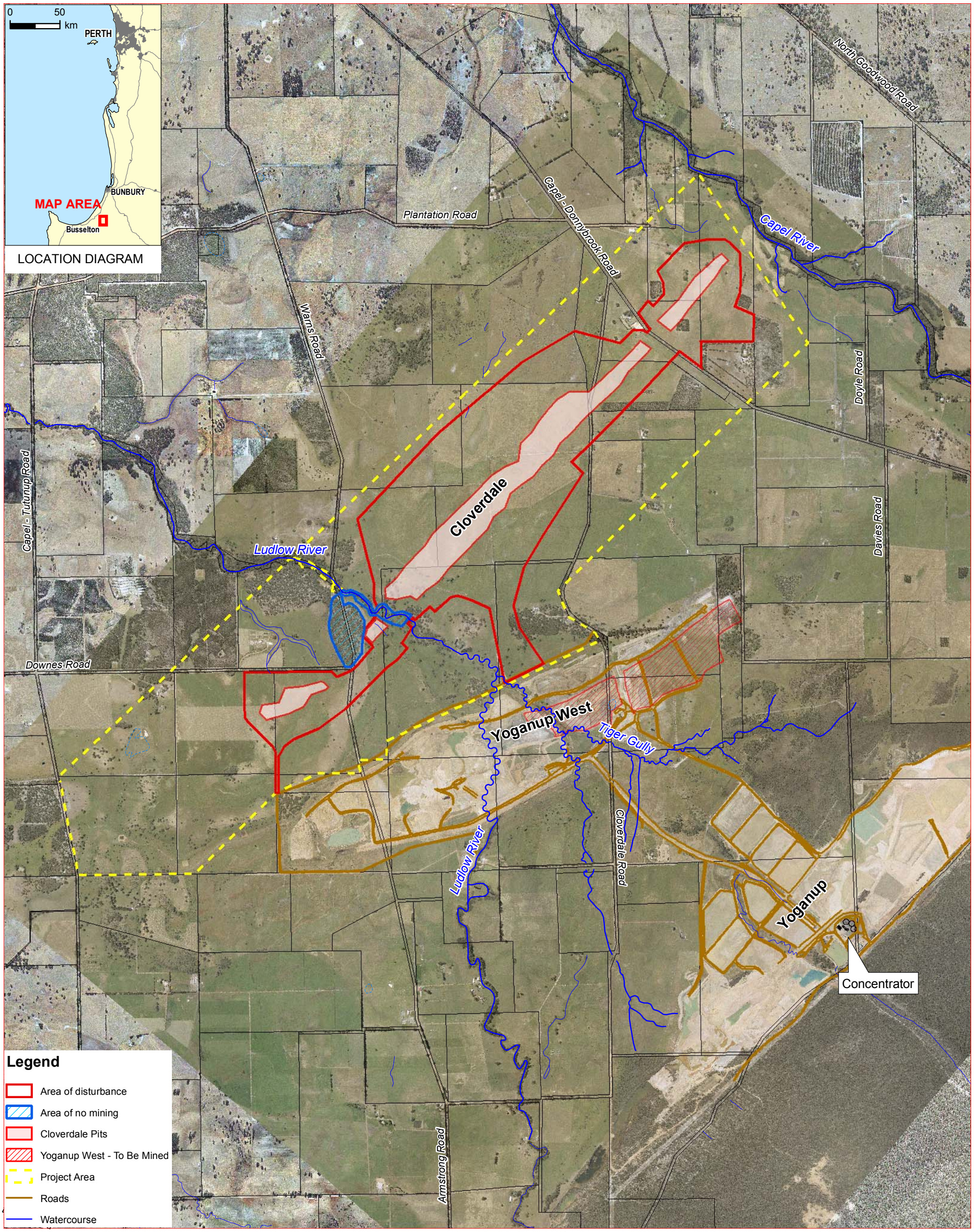
0 500 1,000 1,500 Meters

ILUKA

CLOVERDALE

LANDOWNERS AND RESIDENCES

ORIG:	T.Flavel		
DRAWN:	T.L.G		
SCALE:	1:25,000		
DATE:	22 May 06	DWG No: 163249 ver.00	A3 FIGURE: 2



Aerial Photo : 19 Nov 2005

N

0 500 1,000 1,500 Metres

Ver.	ORIG	DESIGN	DATE	COMMENTS

REVISIONS

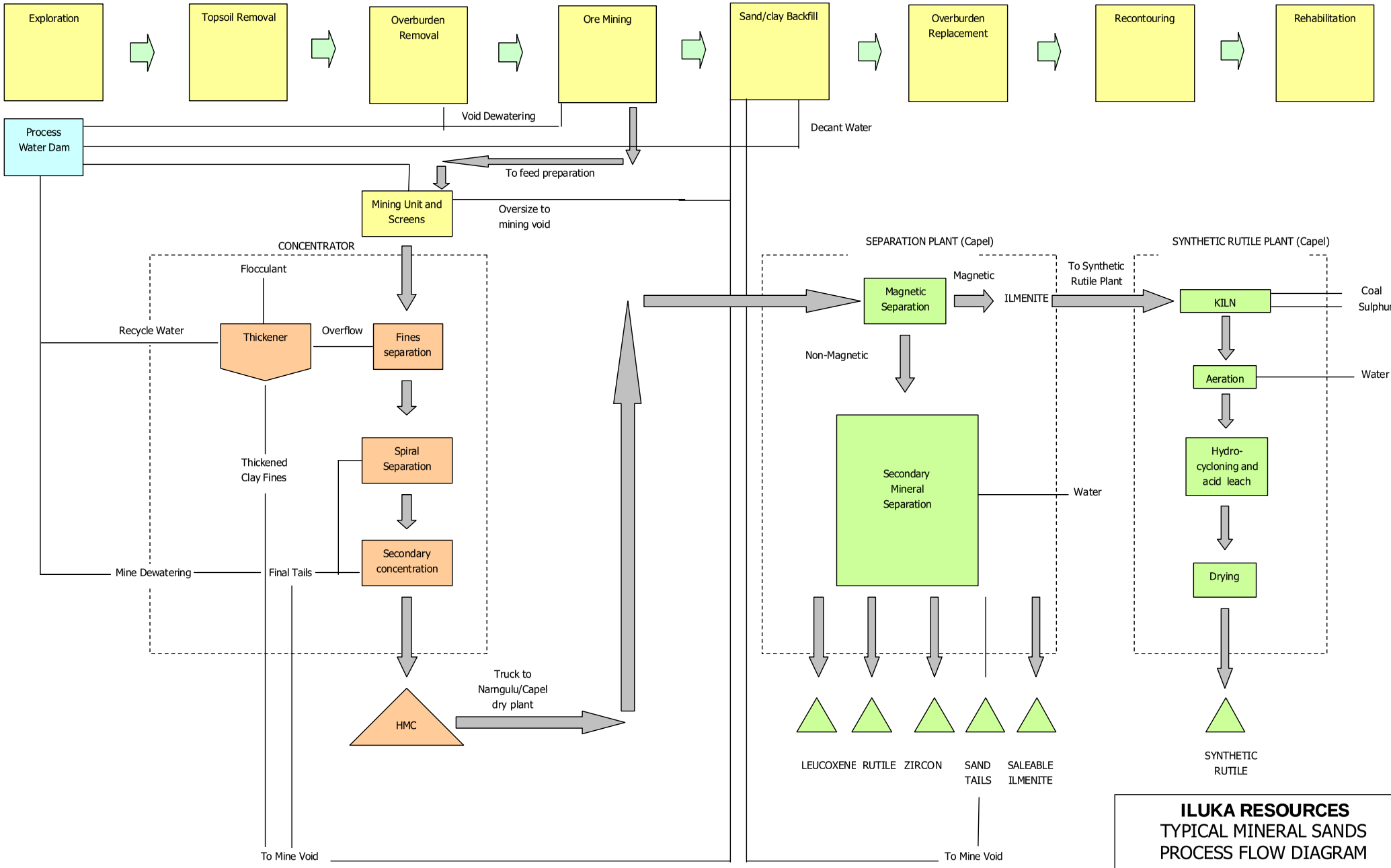
ILUKA

ORIG:	T. Flavell
DRAWN:	T.L.G
SCALE:	1:25,000
DATE:	22 May 06

CLOVERDALE

LOCALITY PLAN

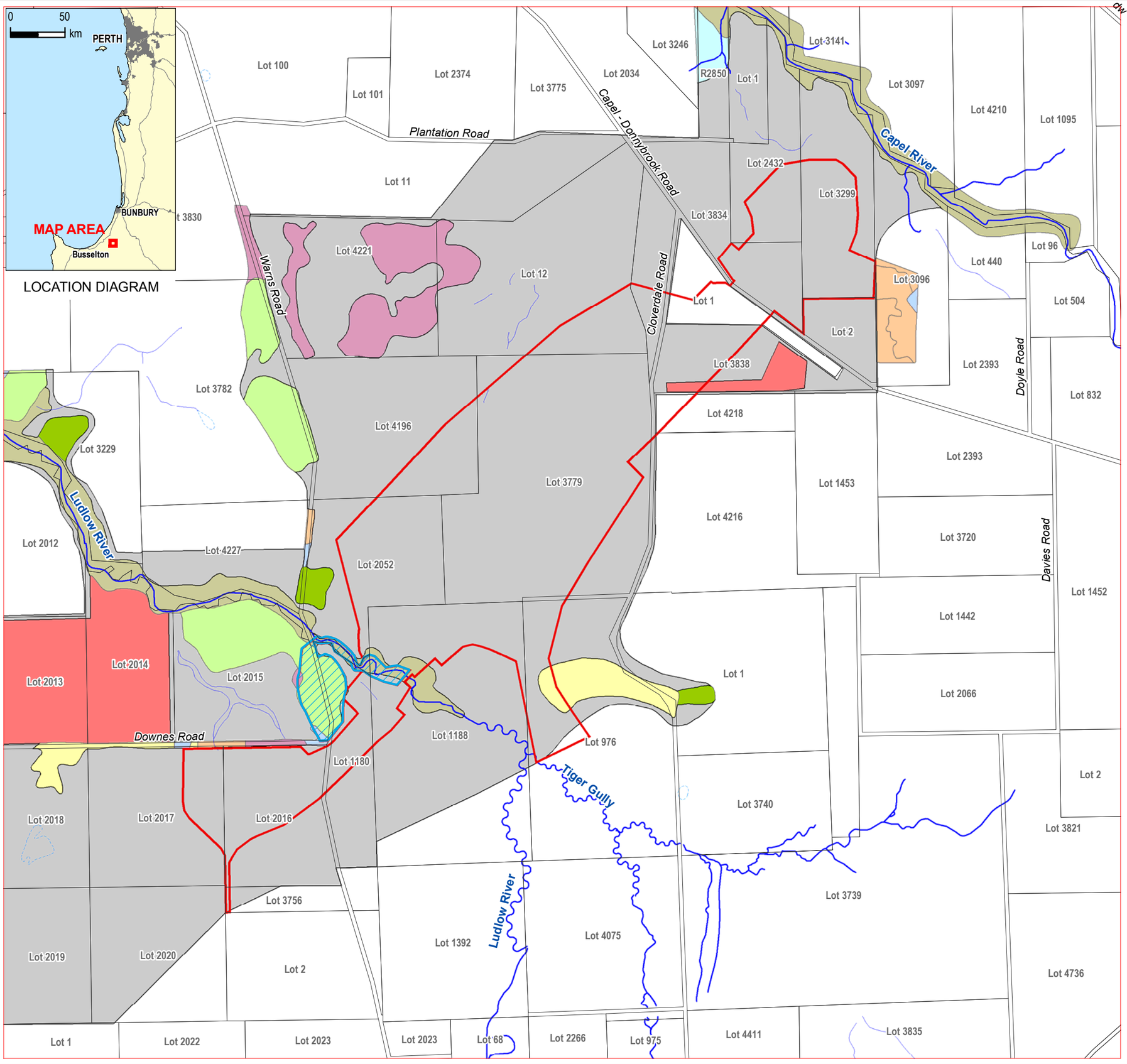
DWG No: 163247 ver.00 | A3 | **FIGURE: 3**



ILUKA RESOURCES

TYPICAL MINERAL SANDS PROCESS FLOW DIAGRAM

FIGURE 4



REVISIONS

Ver.	ORIG	DESIGN	DATE	COMMENTS

Legend

- Area of no mining
- Area of disturbance

Drainage

- Watercourse Perennial

Existing Vegetation

Vegetation Code

- **A1** Woodland of Agonis flexuosa over pasture on sandy soils.
- **B1** Open Woodland of Banksia attenuata - Banksia ilicifolia over Kunzea ericifolia, Podocarpus drouynianus and Dasypogon bromeliifolius with emergent Eucalyptus marginata subsp. marginata on sandy soils.
- **C1** Open Forest to Woodland of Corymbia calophylla - Eucalyptus rudis over Melaleuca preissiana, Melaleuca rhaphiophylla and Agonis flexuosa over Astartea scoparia, Taxandria linearifolia and Cyathochaeta avenacea on major watercourses.
- **C2** Open Forest to Woodland of Corymbia calophylla over Banksia grandis, Kingia australis and Xanthorrhoea preissii on loam soils.
- **C3** Woodland of Corymbia calophylla over pasture on loam soils.
- **CL** Mostly cleared cultivated paddocks with occasional Corymbia calophylla, Eucalyptus marginata subsp. marginata and Melaleuca preissiana
- **E1** Open Woodland of Eucalyptus marginata subsp. marginata - Banksia attenuata - Banksia grandis - Xylomelum occidentale over Stirlingia latifolia and Dasypogon bromeliifolius on sandy soils.
- **E2** Open Forest of Eucalyptus marginata subsp. marginata - Corymbia calophylla over low shrubs and herbs on sandy-loam soils.
- **M1** Woodland of Melaleuca preissiana over Hypocalymma angustifolium and mixed sedges.
- **PL** Plantations

Vegetation data supplied by Mattiske Consulting Pty Ltd : January 2006

N

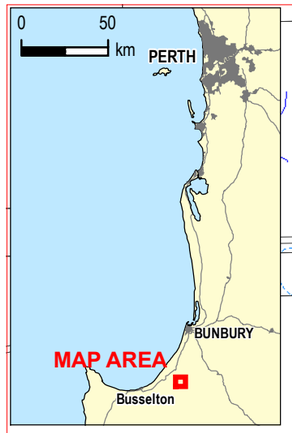
0 250 500 750 1,000 1,250 Meters

ILUKA

CLOVERDALE

EXISTING VEGETATION

ORIG:	T.Flavel		
DRAWN:	T.L.G		
SCALE:	1:20,000		
DATE:	22 May 06	DWG No: 163248 ver.00	A3 FIGURE: 5



LOCATION DIAGRAM

REVISIONS

Ver.	ORIG	DESIGN	DATE	COMMENTS

Legend

- Area of disturbance
- Area of no mining
- Watercourse Perennial

Vegetation Condition

Rating , Description

- 2, Excellent
- 3, Very Good
- 4, Good
- 5, Degraded
- 6, Completley Degraded
- N/A, Plantation

Vegetation Condition data supplied by
Mattiske Consulting Pty Ltd : January 2006

N

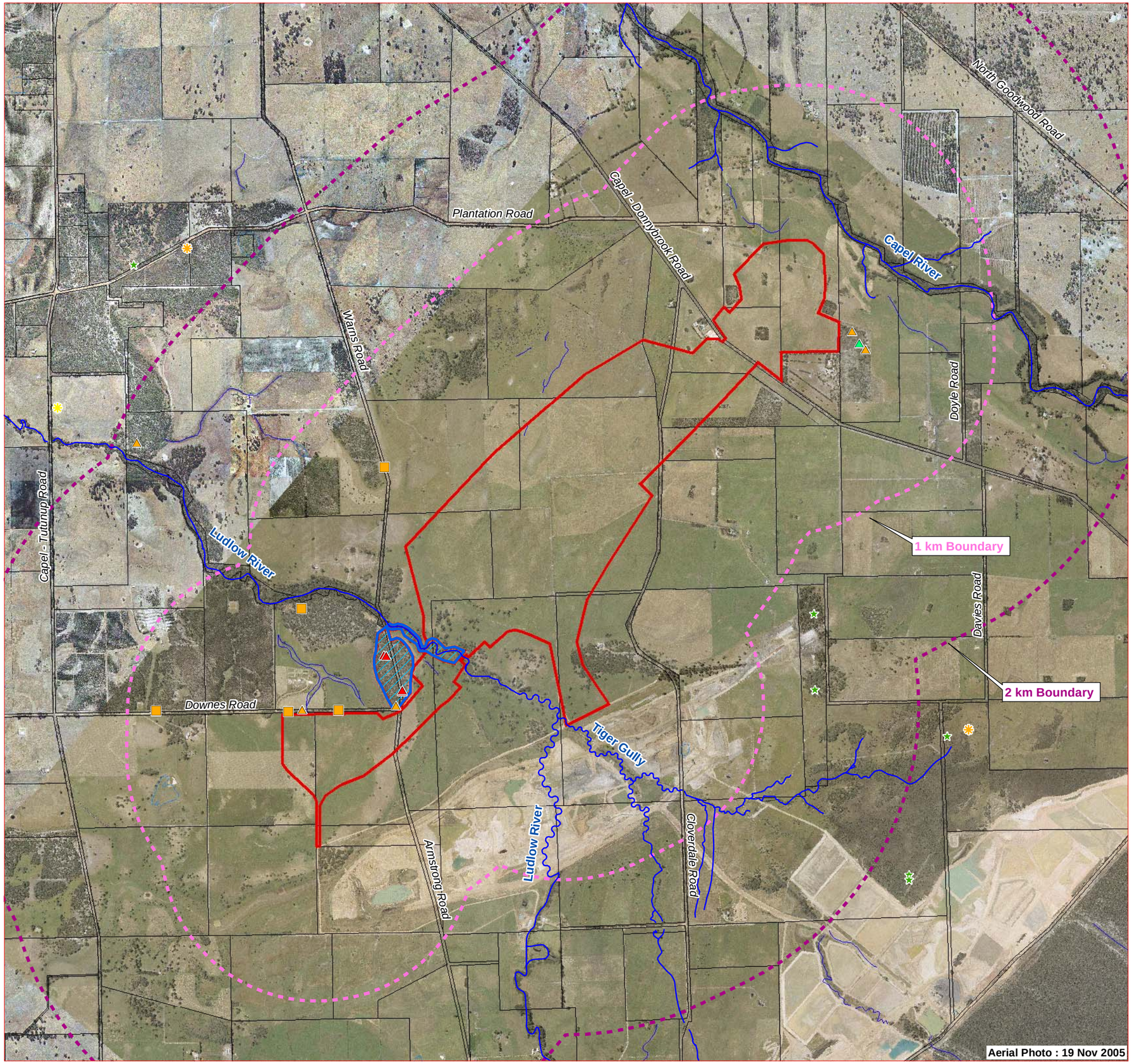
0 250 500 750 1,000 1,250
Meters

ILUKA

CLOVERDALE

EXISTING VEGETATION CONDITION

ORIG:	T.Flavel		
DRAWN:	T.L.G		
SCALE:	1:20,000		
DATE:	22 May 06	DWG No: 163250 ver.00	A3 FIGURE: 6



REVISIONS

Ver.	ORIG	DESIGN	DATE	COMMENTS
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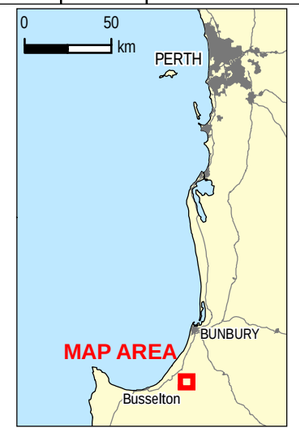


LOCATION DIAGRAM

Legend

- Area of disturbance
- Area of no mining
- 1 km Buffer
- 2 km Buffer

Rare Flora (CALM)

Classification

- Rare
- Priority 1
- Priority 2
- Priority 3
- Priority 4

GHD Survey - March 2005

Classification

- Priority 3

Mattiske Survey - Oct 2005

Classification

- Rare
- Priority 3
- Priority 4

Threatened Ecological Communities

- TEC Sites
- Watercourse Perennial

N

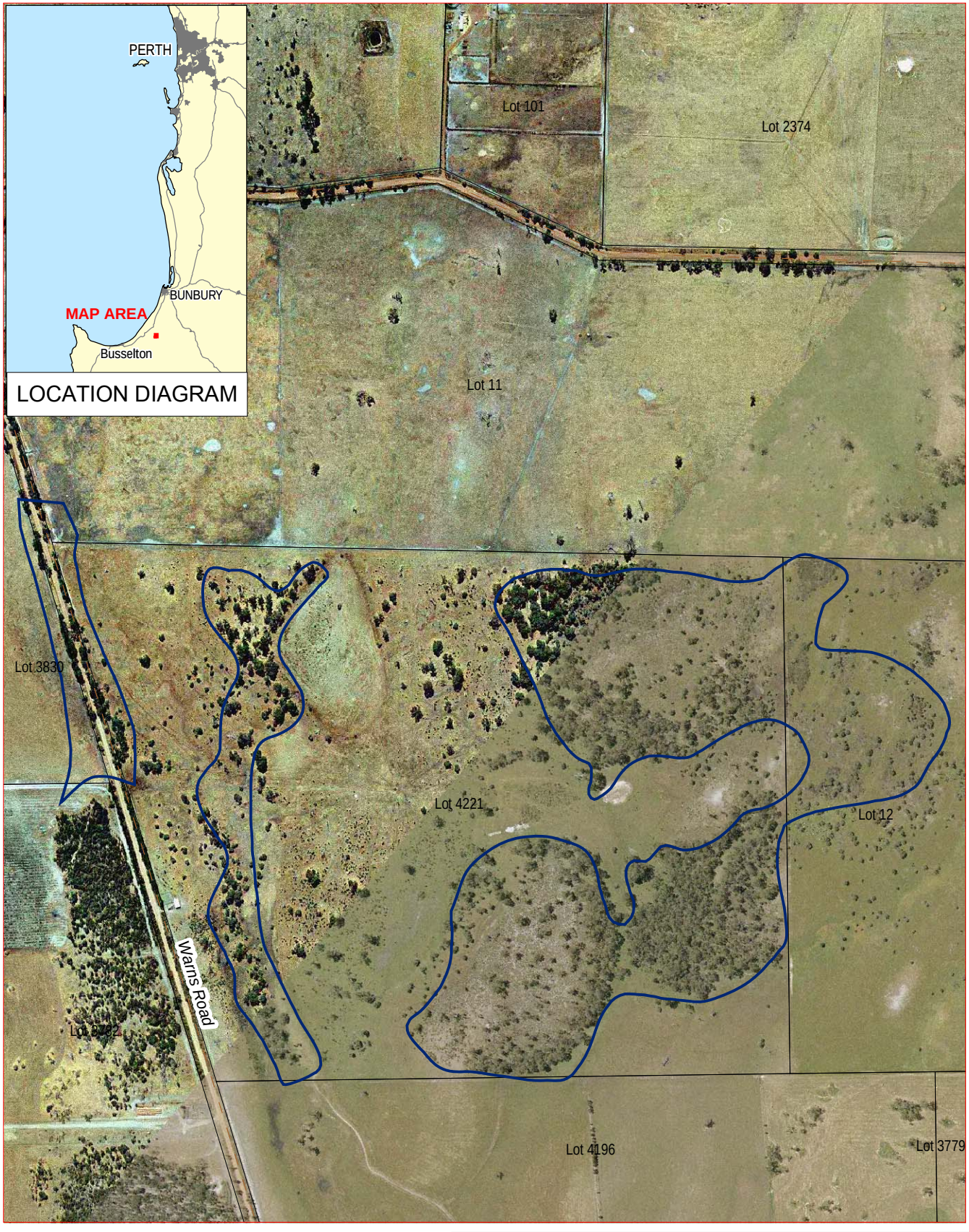
0 500 1,000 1,500 Meters

ILUKA

CLOVERDALE

PRIORITY SPECIES & TEC's

ORIG:	T.Flavel		
DRAWN:	T.L.G		
SCALE:	1:25,000		
DATE:	22 May 06	DWG No: 163251 ver.01	A3 FIGURE: 7



Legend

- Vegetation Type C2
- Cadastre

Aerial Photo : 19 Nov 2005
Skyview :

N

0 130 260 520 Meters

ILUKA

ORIG:	SJones
DRAWN:	SJones
SCALE:	1:7,500
DATE:	23 June 2006

CLOVERDALE
VEGETATION TYPE C2
Lot 4221 & Warns Road

DWG No: APJCV_VegC2A_060623 | A4 | FIGURE: 8

Legend

- Vegetation Type C2
- Cadastre

Aerial Photo : 19 Nov 2005

N

0 50 100 200 300 Meters

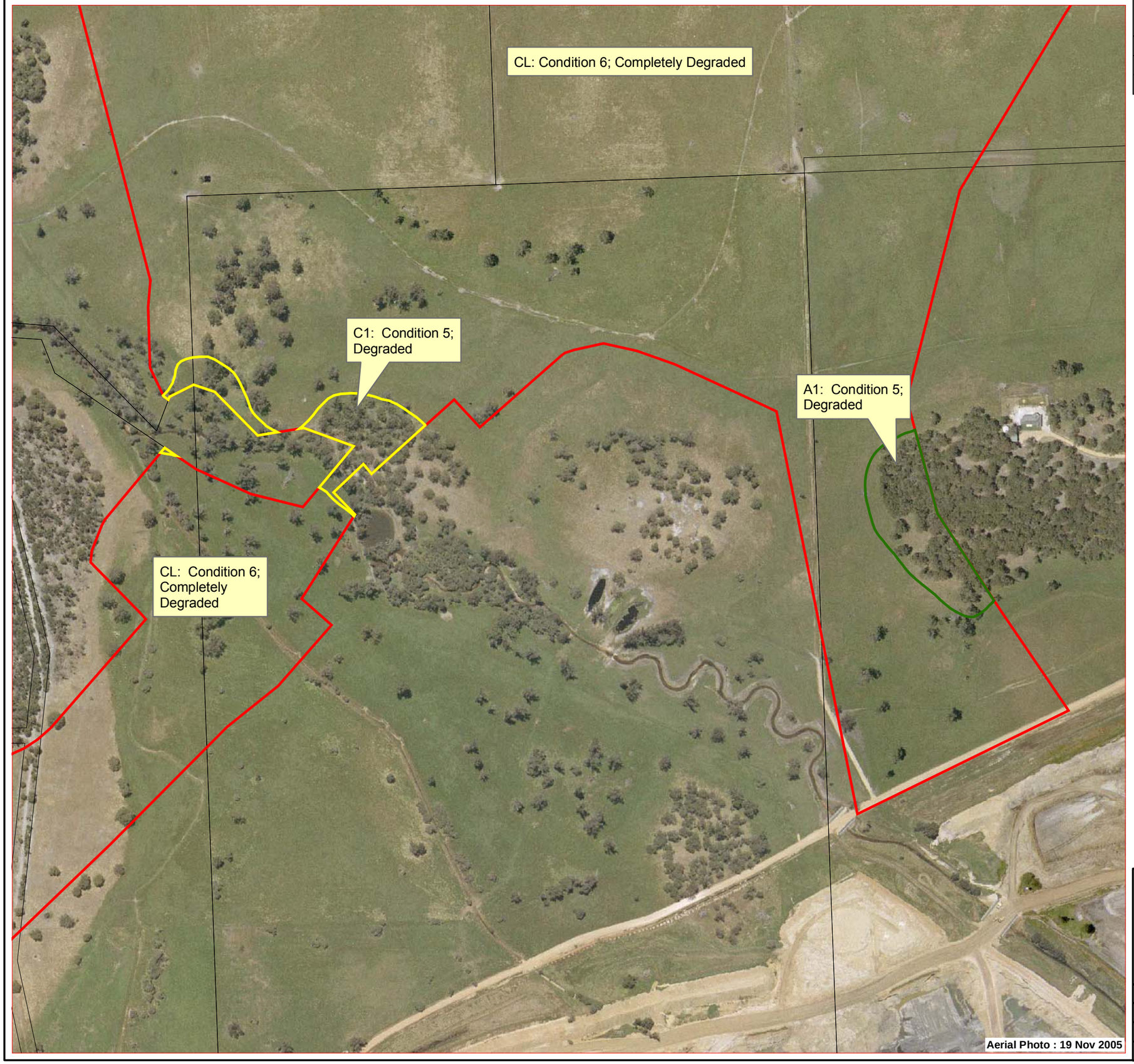
ILUKA

ORIG:	SJones
DRAWN:	SJones
SCALE:	1:5,000
DATE:	23 June 2006

CLOVERDALE

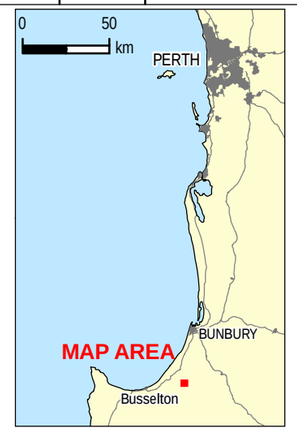
VEGETATION TYPE C2 Lot 2015 & Downes Road

DWG No: APJCV_VegC2B_060623 | A4 | FIGURE: 9



REVISIONS

Ver.	ORIG	DESIGN	DATE	COMMENTS



LOCATION DIAGRAM

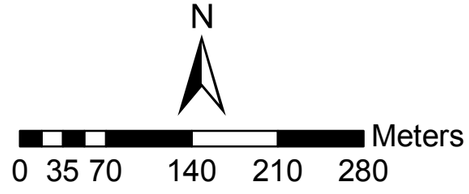
Legend

Proposed disturbance area

Native vegetation to be cleared

A1: Woodland of *Agonis flexuosa* over pasture on sandy soils

C1: Open Forest to Woodland of *Corymbia calophylla* - *Eucalyptus rudis* over *Melaleuca preissiana*, *Melaleuca rhaphiophylla* and *Agonis flexuosa* over *Astartea scoparia*, *Taxandria linearifolia* and *Cyathocaeta avenacea* on major water-courses

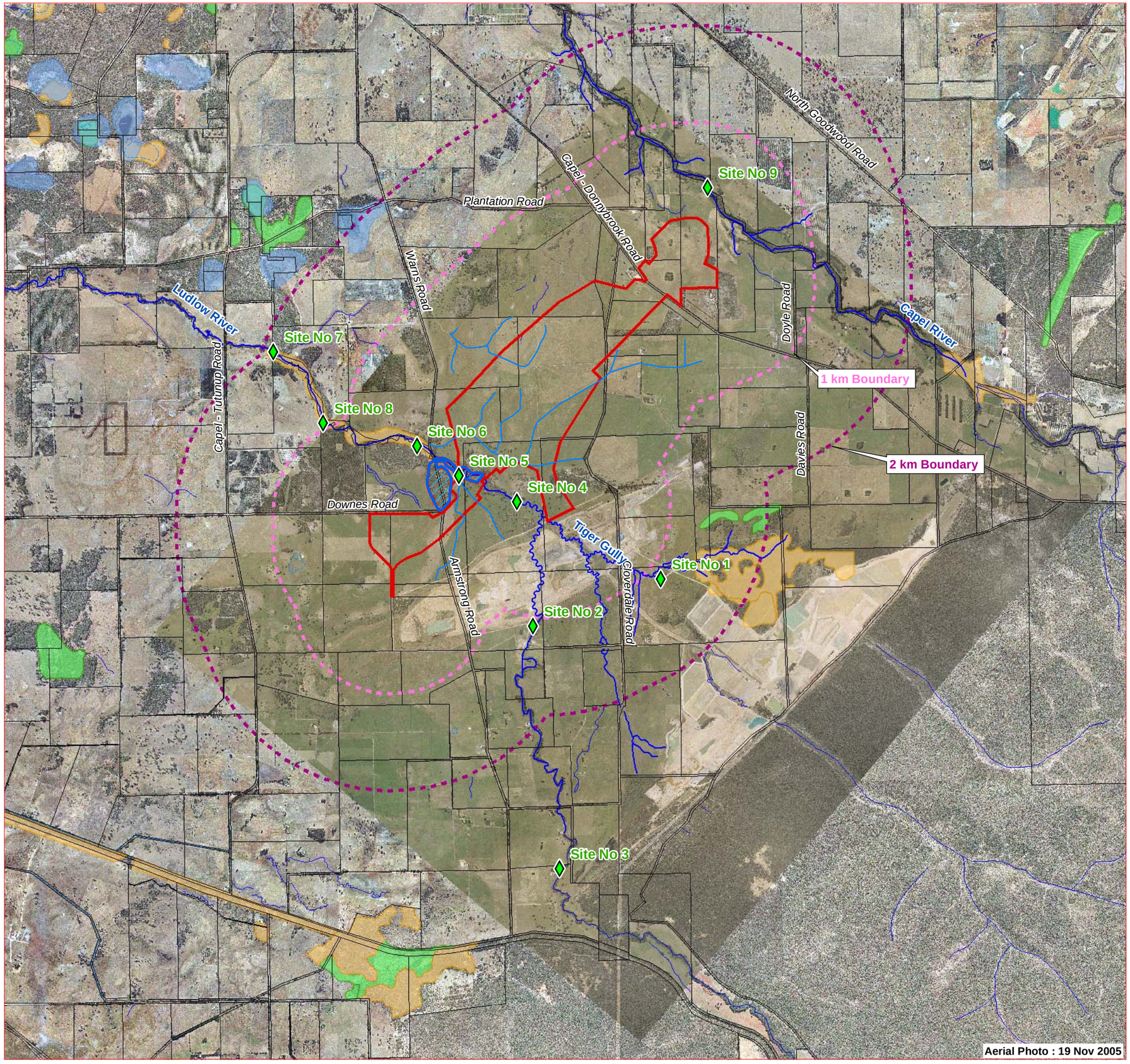


ILUKA

CLOVERDALE

VEGETATION DISTURBANCE

ORIG: S.Jones			
DRAWN: S.Jones			
SCALE: 1:5,000			
DATE: 9 August 2006	DWG No: CV veg to clear v2	A3	FIGURE: 10



REVISIONS

Ver.	ORIG	DESIGN	DATE	COMMENTS
01	S.Jones	T.L.G	19.06.2006	Added aquatic survey sites

LOCATION DIAGRAM

Legend

- Area of disturbance
- Area of no mining
- 1 km Buffer
- 2 km Buffer

Drainage

- Watercourse Perennial
- Drain

WRC Wetlands Evaluation

- Conservation
- Resource Enhancement

EPP Wetlands

- Wetlands
- Aquatic Survey Sites

N

0 1 2 3 km

ILUKA

ORIG:	T.Flavel
DRAWN:	T.L.G
SCALE:	1:40,000
DATE:	22 May 06

CLOVERDALE

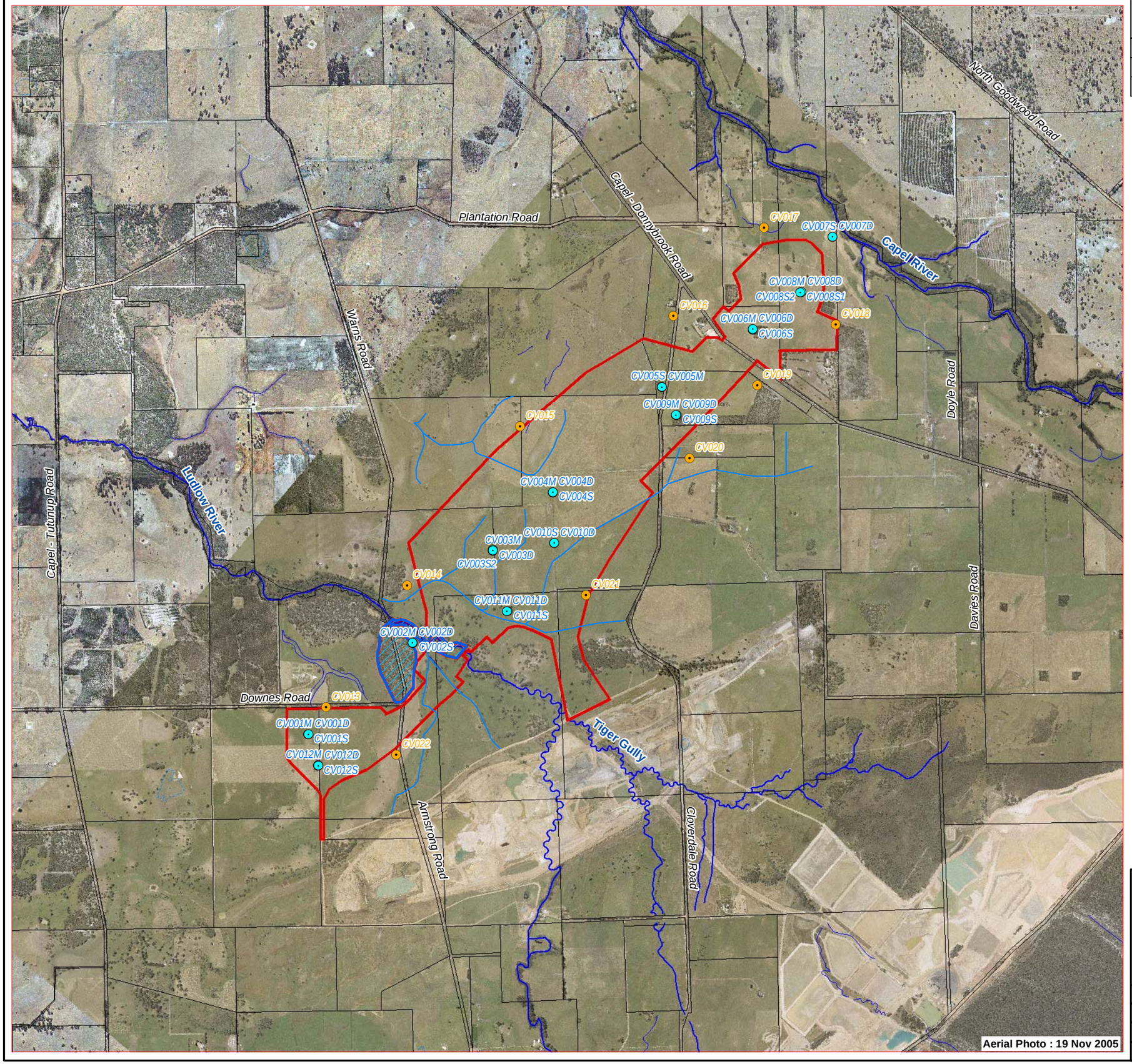
WETLANDS AND AQUATIC SURVEY SITES

DWG No: 163252 ver.00 A3 FIGURE: 11

REVISIONS

Ver.	ORIG	DESIGN	DATE	COMMENTS
01	S.Jones	T.L.G	19.06.2006	Added aquatic survey sites

LOCATION DIAGRAM



Legend

- Area of disturbance
- Area of no mining

Drainage

- Watercourse Perennial
- Drain
- Piezometer
- Proposed Piezometer

N

0 500 1,000 1,500 Meters

ILUKA

CLOVERDALE

WATER MONITORING

ORIG:	T.Flavel
DRAWN:	T.L.G
SCALE:	1:25,000
DATE:	22 May 06
DWG No:	163851ver.00
A3	FIGURE: 12

LOCATION DIAGRAM

Main Pit

Warns Road

Crossing location

Ludlow River

South Pit 1

Non-active channel

Downes Road

Drain

South Pit 2

Legend

- Area of disturbance
- Cloverdale Pits
- Water Features

Vegetation Condition (Mattiske 2005)

- 3
- 4
- 5

Aerial Photo : 19 Nov 2005

N

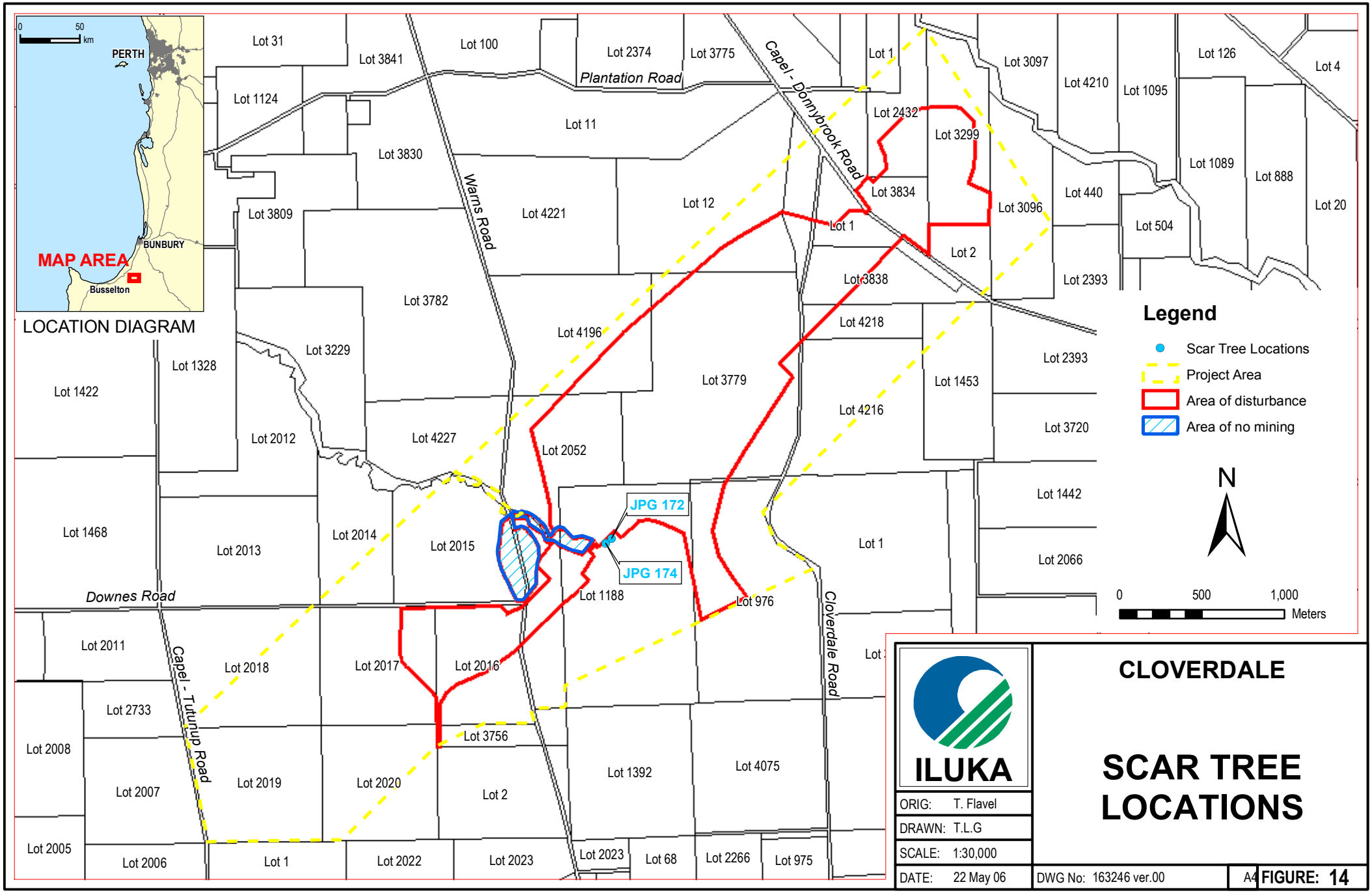
0 500 Metres

ILUKA

CLOVERDALE

Distance from Pits to Ludlow River and vegetation

ORIG: S.Jones				
DRAWN: S.Jones				
SCALE: 1:5,000				
DATE: 10 August 2006	DWG No:CV Pit2Veg&Lud V2	A3	FIGURE: 13	


0 50 km
PERTH
BUNBURY
MAP AREA
Busselton
LOCATION DIAGRAM
Lot 31
Lot 3841
Lot 100
Lot 2374
Lot 3775
Plantation Road
Capel - Donnybrook Road
Lot 1
Lot 3097
Lot 4210
Lot 1095
Lot 126
Lot 4
Lot 1124
Lot 11
Lot 2432
Lot 3299
Lot 3830
Warns Road
Lot 3809
Lot 4221
Lot 12
Lot 3834
Lot 3096
Lot 1089
Lot 888
Lot 440
Lot 20
Lot 504
Lot 1
Lot 2
Lot 3838
Lot 2393
Lot 3782
Lot 4196
Lot 4218
Lot 3229
Lot 1328
Lot 1422
Lot 3779
Lot 1453
Lot 2393
Lot 4216
Lot 3720
Lot 2012
Lot 4227
Lot 2052
Lot 1442
Lot 1468
Lot 2013
Lot 2014
Lot 2015
JPG 172
JPG 174
Lot 1188
Lot 976
Lot 1
Lot 2066
Downes Road
Cloverdale Road
Lot 2011
Capel - Tuturup Road
Lot 2018
Lot 2017
Lot 2016
Lot 2733
Lot 3756
Lot 2008
Lot 1392
Lot 4075
Lot 2007
Lot 2019
Lot 2020
Lot 2
Lot 2005
Lot 2006
Lot 1
Lot 2022
Lot 2023
Lot 2023
Lot 68
Lot 2266
Lot 975
Legend
Scar Tree Locations
Project Area
Area of disturbance
Area of no mining
N
0 500 1,000
Meters
ILUKA
CLOVERDALE
SCAR TREE LOCATIONS
ORIG: T. Flavel
DRAWN: T.L.G
SCALE: 1:30,000
DATE: 22 May 06
DWG No: 163246 ver.00
A4
FIGURE: 14