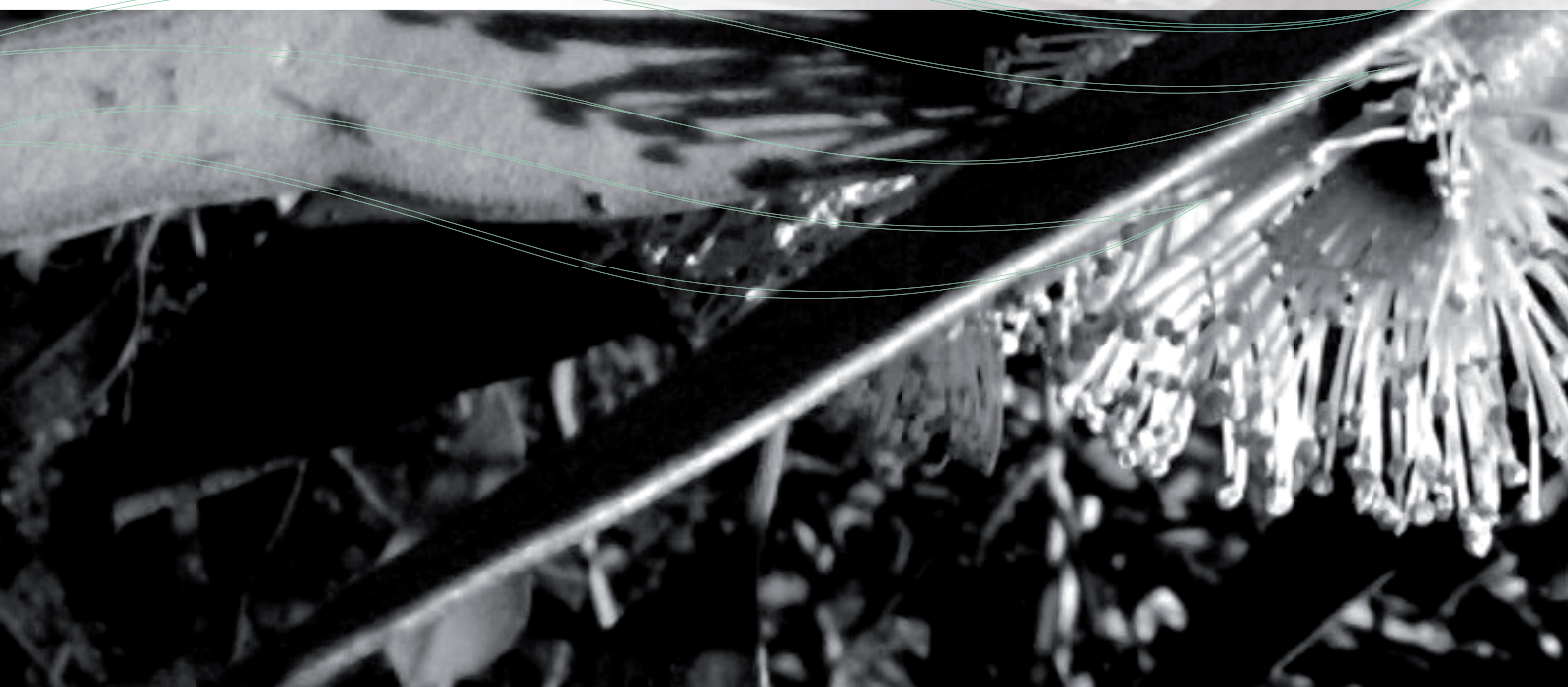
JANDAKOT
AIRPORT

JANDAKOT AIRPORT ENVIRONMENT STRATEGY 2009



JANDAKOT
AIRPORT

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FOREWORD

Jandakot Airport is an important piece of State infrastructure as Western Australia's major general aviation airport. The airport is located on an area of 622 ha of Commonwealth land, 16 km south of the City of Perth. The airport has been developed over a period of 45 years. The site includes areas of native bushland which contain rare flora the Grand Spider Orchid (*Caladenia huegelii*) and the Glossy Leaved Hammer Orchid (*Drakaea elastica*) and species which provide food for the Carnaby's Black Cockatoo (*Calyptorhynchus latirostris*). Part of the site is also within the Jandakot Groundwater Mound Underground Water Pollution Control Area. The Jandakot Mound provides part of Perth's drinking water supply.

The Environment Strategy 2009 describes how Jandakot Airport Holdings (JAH) will meet the environmental management requirements of the *Airports Act 1996*. It outlines environmental objectives, commitments and targets for the next five years and describes how JAH will minimise environmental impacts from its operations.

This Environment Strategy has been prepared in parallel with the Jandakot Airport Master Plan 2009 to address impacts from present and future airport operations. The Jandakot Airport Master Plan 2009 outlines the proposed future development of the airport for aviation, non aviation and conservation uses for the next 20 years. This will result in clearing of 167 hectares (ha) of native vegetation for the airport development, the rehabilitation of 90 ha of land formerly used for sand mining or funding to DEC in accordance with the EPBC Act Approval Conditions and the creation of a large contiguous conservation area of over 650 ha linking the presently isolated Ken Hurst Park with Jandakot Regional Park.

185 Grand Spider Orchids will remain insitu on the airport in conservation areas and 40 others will be translocated into conservation areas from around the airport.

The onsite conservation area will be 170 ha. Clearing native vegetation for development will result in the loss of 1.2% of the total Carnaby's Black Cockatoo habitat within 20 km of the airport. The effect of this habitat loss will be reduced through the rehabilitation of the 90 ha of land adjacent to the airport (or funding to DEC in accordance with the EPBC Act Approval Conditions). Ken Hurst Park, the Jandakot Regional Park and Jandakot Airport conservation areas are presently fragmented. The development includes a proposal for the rehabilitation of Precincts 7 and 8 to create a critical link which will form a continuous conservation area connecting the presently isolated Ken Hurst Park with Jandakot Airport Conservation Precincts and Jandakot Regional Park. JAH proposes to manage over half of this conservation area under a Conservation Area Management Plan.

In addition, the proposed airport development will connect the airport site to reticulated sewer, reducing the site's environmental impact on groundwater, including the Jandakot Mound.

The Minister for Infrastructure, Transport, Regional Development and Local Government Approved the Jandakot Airport Environment Strategy on 9 March 2010.

John Fraser
Managing Director
Jandakot Airport Holdings

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1.0

INTRODUCTION

Jandakot Airport Environment Strategy

1 INTRODUCTION

Jandakot Airport is Western Australia's major general aviation airport and the only one serving the Perth metropolitan region. The airport is located approximately 16 km south of the Perth City centre. The airport has been developed over a period of about 45 years and it covers an area of approximately 622 ha **(Figure 1)**.

On 1 July 1998 the Commonwealth Government sold a 50 year lease over Jandakot Airport, with an option of a 49 year lease extension to Jandakot Airport Holdings Pty Ltd (JAH). The lease requires JAH to manage and develop the airport.

In managing and developing the airport, JAH complies with the *Commonwealth Airports Act 1996* (the Act) and *Airports (Environment Protection) Regulations 1997* (the Regulations). In accordance with the Act, Jandakot Airport Holdings is required to have a Master Plan and an Environment Strategy reviewed and approved at least every 5 years by the Federal Minister for Infrastructure, Transport, Regional Development and Local Government (DITRDLG). The Environment Strategy describes how JAH will meet environmental management requirements of the *Airports Act 1996*.

This is the third Environment Strategy produced by JAH for the airport. The Environment Strategy 2004 built on the original Environment Strategy 1999. This Strategy, has been developed with consideration of changes in the context of operations, standards, future planning and continual improvement of environmental management at the airport.

1.1 BACKGROUND

Jandakot Airport has operated since 1963 and has three runways with supporting infrastructure. Aircraft movements are marginally under 400,000 per annum, which is below the theoretical operational capacity of 514,000. Operational facilities at the airport include runway and lighting systems, an air traffic control tower, general aviation control zone and other navigational aids. Other facilities at the airport include refuelling and fuel storage depots, aircraft maintenance facilities, pilot training schools and student accommodation, associated aviation support services and some non-aviation businesses. Further development of non aviation commercial buildings is proposed to continue under the Master Plan 2009.

1.2 INTEGRATION WITH MASTER PLAN

The Master Plan describes the concept for development of the airport for the next 20 years **(Figure 2)**. The Environment Strategy is prepared in parallel with the Master Plan and addresses both impacts from present airport operations and potential impacts from future airport development.

The development areas proposed by the Jandakot Airport Master Plan 2009 are as follows

- Aviation Operations 225 ha (36.2 %);
- 156 ha (25.1 %) Non-Aviation Development;
- Conservation 170 hectares (27.3%) with an additional 32 hectares (5.1%) (unless required for runway extensions and operations); and
- Roads and Services 39 ha (6.3 %).

1.3 ENVIRONMENTAL REGULATION (LEGISLATIVE FRAMEWORK)

The *Commonwealth Airports Act 1996* and subsidiary legislation forms the overarching legislative framework within which JAH leases and operates Jandakot Airport. JAH is required to comply with other Commonwealth and State Government legislation as far as this legislation does not conflict with the *Airports Act 1996*.

1.3.1 AIRPORTS ACT 1996

Jandakot Airport is leased and operated in accordance with the *Airports Act 1996* (the Act) and *Airports (Environment Protection) Regulations 1997*. Part 3 of the Regulations and Part 6 of the Act, establishes an environmental management regime at leased Commonwealth airports. The regime focuses on a cooperative approach, promoting awareness of environmental issues and ensuring that appropriate systems are in place to manage pollution. The regime is designed to achieve compliance with environmental standards, not simply identifying and prosecuting breaches.

This Environment Strategy is a requirement of both the Act and the Regulations.

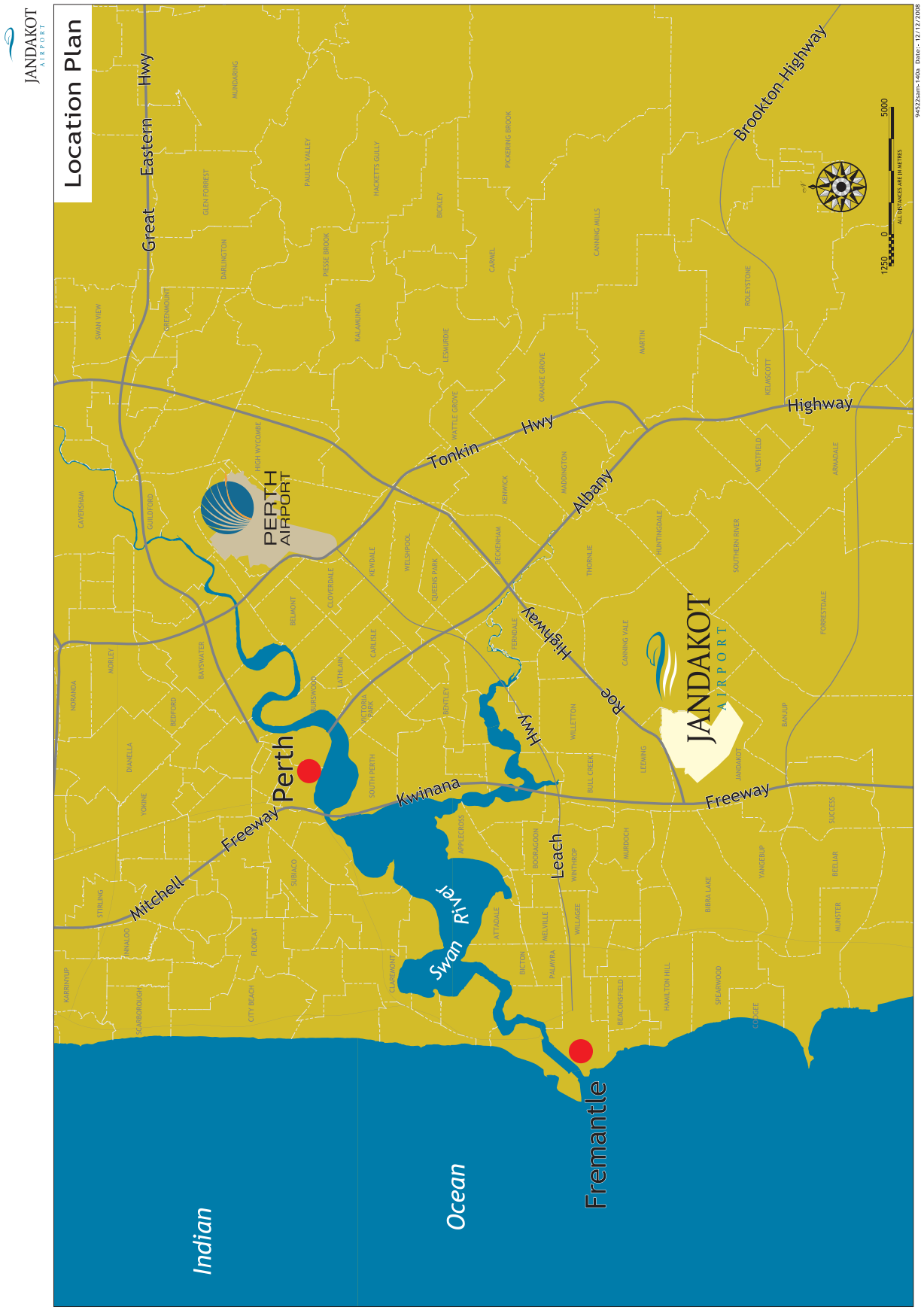
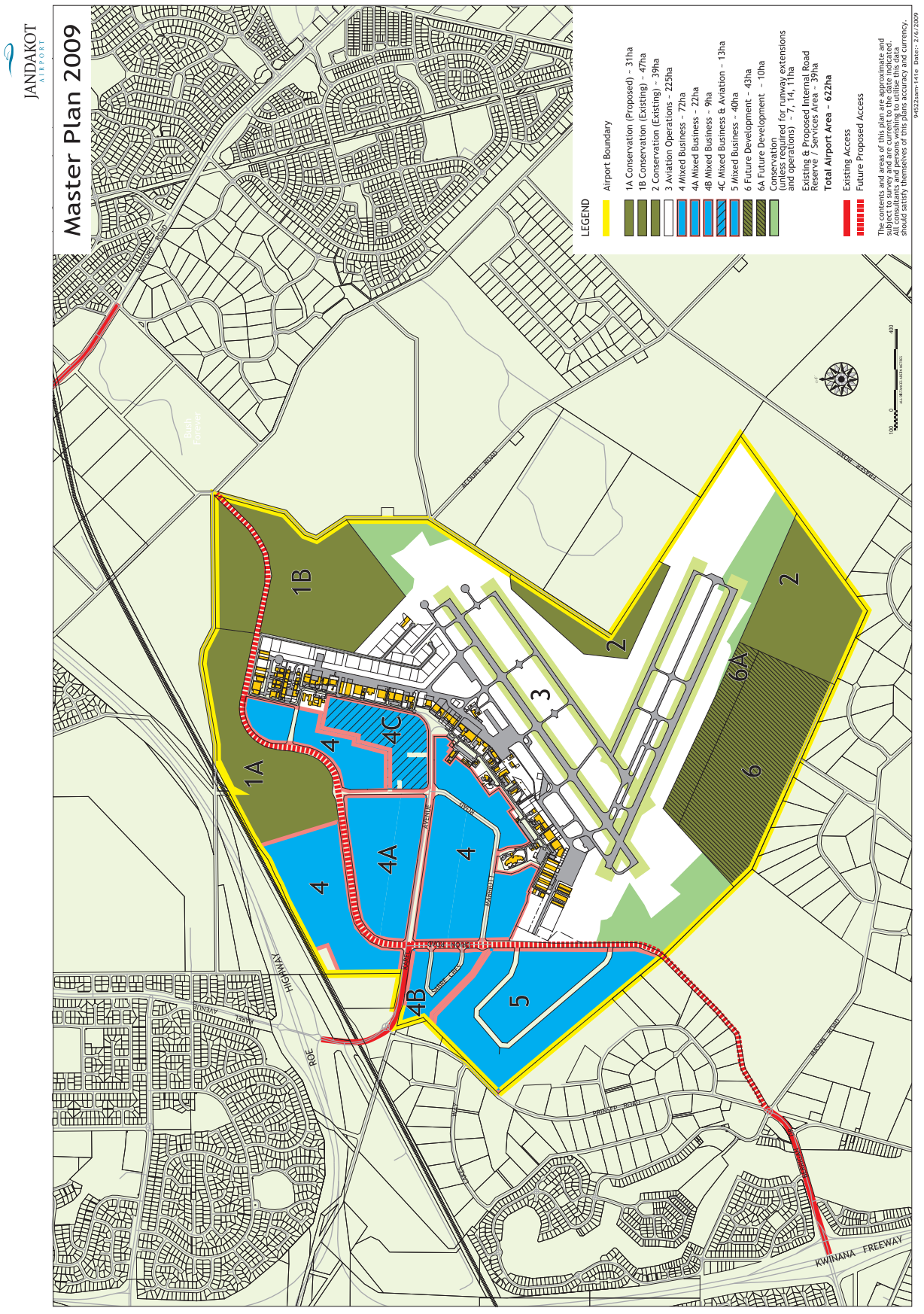

JANDAKOT AIRPORT
Location Plan
Great Eastern Hwy
Brookton Highway
Tonkin Hwy
Albany Highway
Roe Highway
Mitchell Freeway
Kwinana Freeway
Leach Hwy
Swan River
Perth
PERTH AIRPORT
JANDAKOT AIRPORT
Fremantle
Indian Ocean
1250 0 5000
ALL DISTANCES ARE IN METRES

FIGURE 2 - MASTER PLAN 2009



1.3.2 AIRPORTS (ENVIRONMENT PROTECTION) REGULATIONS 1997

The Regulations overall:

- Set standards and impose requirements in relation to environmental pollution (dealing with air, water and soil quality and noise emissions);
- Authorise the monitoring and remediation of breaches of environmental standards;
- Support environmental outcomes on leased Commonwealth airports.

The Regulations (and therefore the Environment Strategy) do not apply to pollution generated by aircraft, or to noise generated by aircraft in flight, landing, taking off or taxiing at the airport.

All users of Jandakot Airport have a duty under the *Airports (Environment Protection) Regulations 1997* to:

- Prevent pollution;
- Preserve:
    - local biota, ecosystems and native species habitats;
    - existing aesthetic, cultural, historical, social and scientific (including archaeological and anthropological) values;
    - vulnerable or endangered flora and fauna species;
    - endangered ecological communities;
    - sites of indigenous significance at the airport; and
- Prevent the generation of offensive noise.

The *Airports (Environment Protection) Regulations 1997* outline what must be addressed in an Environment Strategy. This is summarised in the following table.

TABLE 1: THE AIRPORTS (ENVIRONMENT PROTECTION) REGULATIONS 1997 OUTLINE

Issue to be addressed in the Environment Strategy	Section
Continuous improvement	2.5.15
Pollution prevention and reduction;	4, 5, 7
Development and implementation of an Environmental Management System	2
Conservation of natural, indigenous and heritage values	6,10,11
Consultation with the community and users of the airport	1.4
Communication of the Strategy to the community and users of the airport;	1.4, 2.6.4
Identification of environmentally significant areas;	6.1
Identification of sources of environmental impact;	4, 5, 6, 7, 8, 9, 10, 11
Proposed measures for preventing, controlling or reducing these impacts; and	2, 4, 5, 6, 7, 8, 9, 10, 11
Proposed studies, reviews and monitoring.	2, 4, 5, 6, 7, 8, 9, 10, 11

The Regulations also include a requirement for annual reports to be submitted to DITRDLG.

1.3.3 COMMONWEALTH ENVIRONMENT AND HERITAGE LEGISLATION

Commonwealth legislation, in addition to the *Airports Act 1996* and *Airports (Environment Protection) Regulations 1997*, which apply to the airport include:

- *Environmental and Biodiversity Conservation Act 1999 (EPBC Act);*
- *Australian Heritage Council Act 2003;*
- *Native Title Act 1993; and*
- *Aboriginal and Torres Strait Islander Heritage Protection Act 1984.*

These Acts protect matters of national environmental significance, significant environmental impacts on Commonwealth land, national heritage and indigenous heritage at Jandakot Airport.

1.3.4 WESTERN AUSTRALIAN ENVIRONMENT AND HERITAGE LEGISLATION

Some State environmental legislation can apply to Jandakot Airport under the provisions of the *Commonwealth Places (Application of Laws) Act 1970*

and regulation of environmental issues can therefore occur through state agencies in selected circumstances, typically in instances where Commonwealth legislation does not exist (ie waste management).

State legislation only applies to Commonwealth leased airports where it does not conflict with the *Airports Act 1996* or the *Airports (Environment Protection) Regulations 1997*. Where legislation conflicts, the *Airports Act 1996* and the *Airports (Environment Protection) Regulations 1997* take precedence.

State legislation which is applicable to the airport includes:

- *Dangerous Goods Safety Act 2004;*
- *Environmental Protection (Controlled Waste) Regulations 2004;*
- *Occupational Safety and Health Act 1984; and*
- *Aboriginal Heritage Act 1972.*

These items of legislation regulate hazardous and dangerous goods management, waste transport and disposal, occupational health and safety and Aboriginal heritage at Jandakot Airport.

1.4 CONSULTATION AND PUBLIC COMMENT

The *Airports Act 1996* specifies that a full consultation process is required prior to submission of the draft Environment Strategy to the Minister.

This includes:

- Local government and State government advice of the intention to submit an Environment Strategy to the Minister;
- Newspaper advertisement of public comment period;
- A 60 business day public comment period; and
- Consideration of all public comments in preparation of the Environment Strategy.

A wide range of stakeholders including State and local government and community representatives have been consulted over the past 3 years and were formally consulted in August 2008 through workshops held during the course of preparing the current draft Jandakot Airport Master Plan 2009 and the Jandakot Airport Environment Strategy 2009. The draft Environment Strategy and Master Plan have also been subject to a 60 business day public comment period prior to finalisation.

Consultation has occurred with the State Department of Water (DoW) and the Commonwealth Department of Environment, Water, Heritage and the Arts (DEWHA) on how development can best be designed and managed to minimise any risks to groundwater quality.

Acknowledging the potential impact the proposed new development could have on the environmental values at the airport, JAH have consulted widely, including the State Department of Environment and Conservation, DEWHA and Kings Park and Botanic Gardens. Options for onsite conservation, rehabilitation and provision of ecological linkages have been identified as appropriate and beneficial management responses. As described in the Master Plan 2009, the proposed airport development has been referred to DEWHA for consideration under the EPBC Act.

The Minister for the Environment, Water, Heritage and the Arts approved the EPBC Act referral on 25 March 2010 subject to conditions.

The Minister for Infrastructure, Transport, Regional Development and Local Government approved the Jandakot Airport Environmental Strategy on 9 March 2010.

The Environment Strategy 2009 has been placed on the Jandakot Airport Holdings website.

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2.0

ENVIRONMENTAL MANGEMENT APPROACH

Jandakot Airport Environment Strategy

2 ENVIRONMENTAL MANAGEMENT APPROACH

This section describes the Environmental Management Approach by way of description of the current and proposed Environmental Management Framework and the associated responsibility for its implementation.

2.1 ENVIRONMENTAL MANAGEMENT FRAMEWORK

JAH propose to manage, maintain and develop Jandakot Airport in a safe, balanced and environmentally responsible manner. The Environment Strategy outlines the JAH Environment Policy and JAH's commitments and targets for the next five years.

Figure 3 illustrates the current Environmental Management Framework, as developed for implementation of the approved Environment Strategy 2004.

The primary components of the Environmental Management Framework include:

- The JAH Environment Strategy;
- The JAH Environment Policy;
- The Environment Strategy Commitments and Targets;
- Tenant Environmental Management Plans;
- JAH Environmental Management System;
- Management Plans;
- Environmental Site Assessments;
- Tenant Audits;
- Incident Reporting;
- Environmental Improvement Programs;
- Environmental Site Register;
- JAH Policies and Procedures;
- Quarterly Reporting to the airport Environment Officer; and
- Annual Reports to DITRDLG.

Under the Environment Strategy 2004, achievement of the Environment Strategy objectives and commitments is facilitated by the JAH Environmental Management System (EMS) and the development of management plans for specific issues. Within JAH's EMS are some of the implementation tools required to ensure the Environment Strategy commitments are met. These include the Environmental Site Register, and specific policies and procedures. The EMS is complemented by Management Plans for specific issues and Tenant Environmental Management Plans.

JAH is required to provide Annual Environment Reports to DITRDLG.

2.2 PROPOSED ENVIRONMENTAL MANAGEMENT FRAMEWORK

The Environmental Management Framework has been reviewed in conjunction with the development of the Environment Strategy 2009. The review identified that the Environmental Management System required greater integration with the other elements of the Framework to ensure that the Environmental Management System will be the primary implementation tool for the Environment Strategy 2009.

As can be seen in **Figure 4**, the elements of the proposed Environmental Management Framework are essentially the same as those in **Figure 3**. Existing elements (policies, management plans) have or will be reviewed to ensure that these integrate smoothly with the JAH Environmental Management System and any new elements (continuous improvement).

There are some additional elements, such as:

- The Sustainability Framework;
- The Annual Environmental Action Plan;
- Annual Review; and
- 5 Year Review.

All of these new elements have been incorporated into the JAH Environmental Management Framework to ensure that the JAH Environmental Management System is integrated with existing systems in place at the airport.

The elements of the proposed Environmental Management Framework are discussed further in the following sections.

FIGURE 3 - ENVIRONMENTAL MANAGEMENT APPROACH

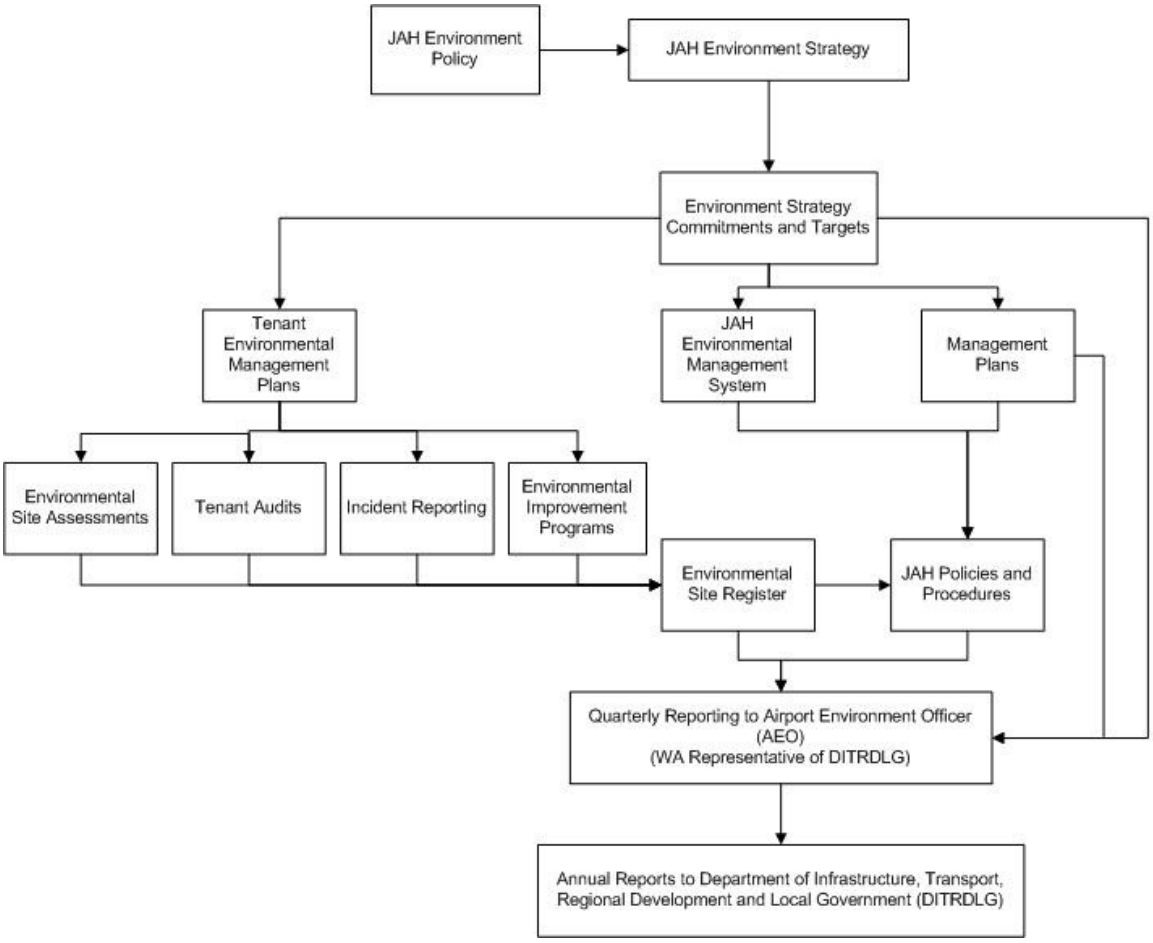
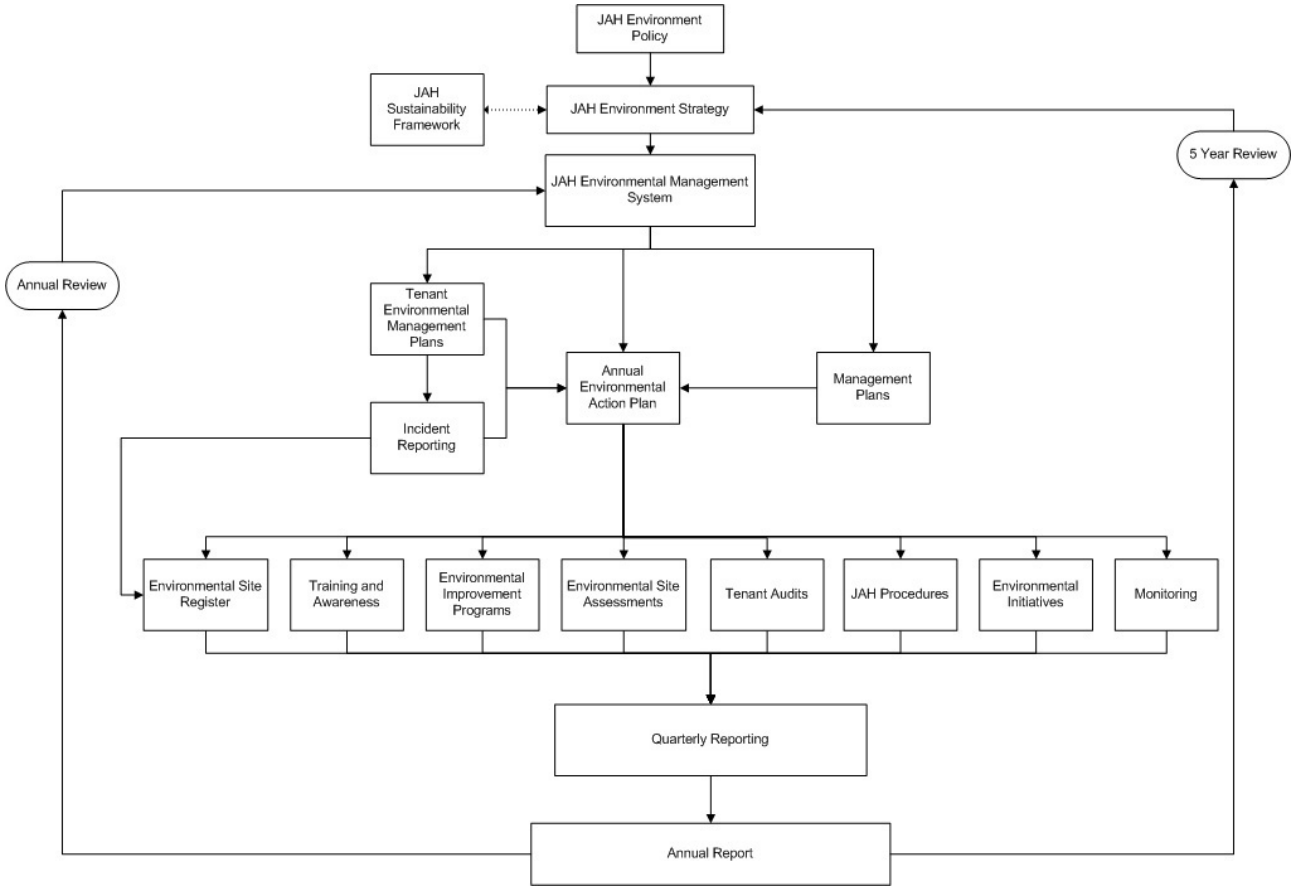


FIGURE 4 - PROPOSED ENVIRONMENTAL MANAGEMENT APPROACH



2.3 ENVIRONMENT POLICY

JAH's Environment Policy guides the management of the natural environment at Jandakot Airport. The Policy is as follows:

Jandakot Airport Holdings Pty Ltd (JAH) manages and operates Jandakot Airport, Perth's premier General Aviation Aerodrome. Jandakot Airport covers an area of 622 ha, 27.3% of which is Conservation Area.

JAH recognises its responsibility to maintain and protect the quality of the environment in and around its operations. In accepting this responsibility, JAH has committed to:

- Developing and managing Jandakot Airport in an environmentally sound manner;
- Complying with environmental legislation and regulations; working with relevant authorities and the community to seek specific objectives to minimise environmental impacts and prevent pollution;
- Pursuing opportunities to reduce, re-use and recycle waste products;
- Continually measure, monitor, report and improve upon the environmental performance defined by the objectives and targets;
- Promote JAH's commitment to the environment, employees, tenants, customers and neighbours.

Jandakot Airport employees, contractors and tenants all have a duty to fulfil environmental responsibilities.

2.4 SUSTAINABILITY FRAMEWORK

The Sustainability Framework, developed by GHD Pty Ltd for Jandakot Airport in 2009, outlines a number of sustainability objectives and initiatives which will be undertaken at the airport in the long term (Refer to Appendix A). Those initiatives which will be undertaken by JAH in 2009-2014 have been included as commitments under specific Action Areas.

2.5 ENVIRONMENTAL MANAGEMENT SYSTEM

The Airports (Environment Protection) Regulations 1997, require JAH to undertake the "…development and adoption of a comprehensive environmental management system for the airport that maintains consistency with relevant Australian and international standards".

JAH commenced implementation of its Environmental Management System (EMS) based on AS/NZS ISO 14001 in 2004.

JAH's EMS includes a number of policies and procedures to ensure that the environment at the airport is protected.

The EMS will be reviewed and updated to incorporate tenant Environmental Management Plans (Refer to Section 2.5.2) and the various new and updated Management Plans which have been developed for the airport. The proposed new structure for the JAH Environmental Management Approach is illustrated in **Figure 4.**

2.5.1 MANAGEMENT PLANS

A number of environmental issues at the airport are managed through specific management plans.

Existing Management Plans for the airport include:

- Flora and Vegetation Management Plan;
- Environmental Weed Management Plan;
- Fauna Management Plan;
- Feral Animal Management Plan;
- Dieback Management Plan;
- Ecological Restoration Management Plan;
- Fire Management Plan; and
- Cultural Heritage Management Plan.

New management plans and strategies currently under development for the airport include:

- Local Water Management Strategy;
- Water Efficiency Management Plan;
- Rehabilitation Plan;
- Conservation Management Plan;
- Jandakot Airport Offset Plan;
- Jandakot Groundwater Mound Management Plan; and
- Construction Envrionment Management Plan.

These are in addition to Tenant Environmental Management Plans, to be developed by all tenants at the airport, which are discussed further in Section 2.5.2.

Further information on both existing and new management plans is detailed in Sections 4 to 10. All management plans will be updated over the next five years to reflect changes in conservation areas and development at the airport.

2.5.2 TENANT ENVIRONMENTAL MANAGEMENT PLANS

Jandakot Airport tenants are responsible for managing their own operations in an environmentally responsible manner. In the past, new high risk tenants were required to complete environmental management plans (EMPs) for their operations. This requirement has been expanded to include all tenants at Jandakot Airport.

There are four kinds of EMPs for tenant operations. These include:

- Clearing Environmental Management Plans – these are required for clearing native vegetation at the airport;
- Construction Environmental Management Plans – these are required for any construction activity at the airport and will include a Petrols, Oils, Lubricants and Chemicals Inventory for each tenant site;
- Operational Environmental Management Plans – these are required for normal tenant operations on the commencement of a lease and for issue of a certificate of occupancy; and
- Demolition Environmental Management Plans – these are required for demolition of structures at the airport.

JAH is developing guidelines for tenant EMPs.

2.5.3 INCIDENT REPORTING

Tenants are required to report all environmental incidents to JAH for investigation, including all chemical spills which are greater than 2L or come into contact with soil. All incidents are subject to an initial investigation, including in situ testing where required. The initial investigation determines whether remediation, an Environmental Site Assessment and/or an Environmental Improvement Program is required. Where soil and/or groundwater contamination occurs an Environmental Site Assessment or Environmental Improvement Program is likely to be required in addition to an initial investigation (Refer to Sections 2.5.7, 2.5.8 and 4).

The Environment Manager inspects tenant sites during tenant audits for evidence of spills to determine whether any have occurred which have not been reported. These are also subject to an initial investigation and further action as required, as per reported spills above.

2.5.4 ANNUAL ENVIRONMENTAL ACTION PLAN

The annual Environmental Action Plan (EAP) is a schedule of all of the environmental actions to be undertaken within the year. Actions will be derived from:

- The Sustainability Framework;
- Environment Strategy Commitments;
- Tenant Environmental Management Plans;
- Incident reports;
- Management Plans; and
- Annual Reviews.

This will include updating the Environmental Site Register, training, the implementation of Environmental Improvement Programs, conducting Environmental Site Assessments, conducting tenant audits, the implementation of new environmental initiatives reviewing and updating JAH procedures, reporting, monitoring, and both annual and five yearly reviews. These are discussed in more detail in the following sections.

JAH's progress against the Annual Environmental Action Plan will be documented in both its Quarterly and Annual reports.

2.5.5 ENVIRONMENTAL SITE REGISTER

JAH maintains as part of its EMS an Environmental Site Register (ESR), as required by the *Airports (Environment Protection) Regulations 1997*. The Register is kept electronically and contains information relating to the following items:

- Contaminated sites at the airport, including any contaminated site assessments or remediation undertaken;
- Environmental incidents and complaints;
- Results of environmental monitoring;
- Aerobic Treatment Unit (ATU) maintenance;
- Tanks and chemical storage; and
- Environmental audits.

New discoveries of significant cultural objects, species or ecological communities will be included in the ESR.

2.5.6 TRAINING AND AWARENESS

Training and awareness are integral to the effectiveness of the EMS, with employees, contractors and tenants having a good understanding of the issues surrounding environmental management of the airport, along with regulatory requirements, internal standards, policies and objectives.

Training is provided to all employees at induction, relevant to their position. Environmental training is conducted to make personnel aware of:

- The Environment Policy, the JAH EMS, and management and operational procedures;
- The environmental impacts and risks of their own work activities and the environmental benefits of improved personal performance;
- Their roles and responsibilities in achieving JAH's environmental objectives and conformance with the JAH EMS, including emergency preparedness and response;
- The potential consequences of not complying with management procedures and operational procedures; and
- Examples of non-conformance where possible, and the causes of non-conformance.

Individual staff training needs are reviewed through JAH's annual performance review process and in monthly staff meetings.

Contractors are required to perform work in an environmentally responsible manner. Contractors at the airport are required to undertake induction training, which is supervised by the Jandakot Airport Environment Manager.

2.5.7 ENVIRONMENTAL IMPROVEMENT PROGRAM

Where remediation is required, tenants must develop an Environmental Improvement Program. This details both the actions which will be undertaken for contamination remediation and ongoing monitoring to validate that the remediation has been successful.

2.5.8 ENVIRONMENTAL SITE ASSESSMENTS

On the termination of a lease, JAH undertakes an Environmental Site Assessment (ESA) of the tenant site. An ESA determines whether a site will require investigation for contamination and associated remediation.

Remediation is undertaken in accordance with an Environmental Improvement Program.

2.5.9 TENANT AUDITS

Tenants are audited by the JAH Environment Manager to determine their compliance with the JAH Environment Strategy. The frequency of tenant audits is dependent on the tenant risk classification. Tenants which are deemed high risk are audited much more frequently than tenants which are medium or low risk.

Tenants have historically been characterised as high, medium or low risk, according to the frequency of their business activities. The classification key for determining which tenants are high, medium or low risk will be reviewed to ensure a more objective, standardised approach to describing the environmental risk posed to the environment by tenants' operations, which takes into account both the risks posed by normal tenant operations and the control measures undertaken by the tenant to manage environmental risk and the residual risks from tenant operations.

Following the review of tenant risk classifications, a new audit schedule will be developed and implemented by JAH.

2.5.10 ENVIRONMENTAL INITIATIVES

Environmental initiatives are specific environmental management actions in addition to those already described above. Some examples of the environmental initiatives JAH intend to undertake in the next five years include:

- Connection of new development to deep sewer;
- Shuttle bus service to Murdoch Rail Station;
- Tenant waste survey;
- Seed collection; and
- Commence rehabilitation of Precincts 7 and 8 or such other requirements of the Offset Plan.

2.5.11 ENVIRONMENTAL PROCEDURES

JAH's environmental procedures are updated regularly to reflect changes in legislation, development and information. Jandakot Airport's environmental procedures include:

- Building Procedure for Septic Tanks;
- Animal Welfare Procedure;
- Aircraft Paint Stripping Procedure;
- Aircraft Washdown Procedure; and
- Storage of Empty Drums Procedure.

These are specific management procedures or work instructions for particular issues.

2.5.12 MONITORING

JAH undertakes regular groundwater monitoring. All groundwater quality testing is undertaken by a NATA accredited laboratory. When Precinct 5 is constructed, additional monitoring bores will be installed to monitor groundwater quality. These monitoring bores are discussed further in Section 4.

JAH will develop and implement an air quality monitoring program within the next 5 years. This is discussed further in Section 5.

JAH will undertake monitoring of weeds and native flora and fauna species on the airport site, through follow up surveys. These are discussed further in Section 6.

Energy and water usage is monitored at the airport and JAH will continue to monitor these, to determine which areas should be targeted for energy and water reduction initiatives. This is discussed further in Section 8.

2.5.13 REPORTING

JAH will provide reports on any monitoring undertaken at the airport to the airport Environment Officer on a quarterly basis.

JAH will produce Annual Environmental Reports both for internal review purposes and submission to DITRDLG.

These reports include the following information:

- Progress of actions in the Annual Environmental Action Plan;
- Progress toward commitments in the Environment Strategy;
- Any additional contaminated sites;
- Remediation measures undertaken at known contaminated sites;
- Results of any investigations or monitoring undertaken; and
- Details of any environmental complaints or incidents.

2.5.14 REVIEW

The Environmental Management System is subject to an annual review following the compilation of the Annual Report. The Review outcomes will be used to formulate the Annual Environmental Action Plan.

Every five years, the complete Environmental Management Approach is reviewed in conjunction with the development of the new Environment Strategy. The last review was undertaken in 2009 and the next review will be undertaken in 2014 as part of the development of the Environment Strategy 2014.

2.5.15 CONTINUOUS IMPROVEMENT

JAH has demonstrated continuous improvement in both its day to day operations and new development at the airport. Initiatives encompassing this objective include:

- The introduction of Environmental Management Plans for all operations at the airport;
- A commitment to minimum 4 Star Green Star office development;
- Development of a Local Water Management Strategy;
- Development of a Water Efficiency Management Plan;
- Development of Design Guidelines to ensure that landscaping within commercial precincts is integrated with conservation areas to ensure no loss of conservation values;
- Implementation of Environmental Site Assessments as an environmental condition report of tenant sites;
- Consultation with State and Local Government authorities;
- Commissioning of a nursery to grow and support planting of native species for commercial and airside tenanted properties;
- Installation of deep sewerage and progressive connection of airport tenants which currently use onsite wastewater disposal systems;
- Sponsorship of a Rare Orchid Research Program with Kings Park and Botanic Gardens;
- Funding of a greenhouse to assist with the Rare Orchid Research Program;
- Retention of 185 Grand Spider Orchids in situ. (There are 164 in Precinct 1A, 20 in Precinct 1B and 1 in Precinct 2);
- Rehabilitation of 90 ha of degraded land to the east of the airport, creating a contiguous conservation corridor linking the presently isolated Ken Hurst Park to the north with Jandakot Regional Park in the south; and
- Reuse of topsoil from cleared areas in rehabilitation.

2.6 MANAGEMENT STRUCTURE AND RESPONSIBILITY

As the leaseholder of Jandakot Airport, JAH has the ultimate responsibility for environmental management at the airport.

Currently, there are 75 tenants who conduct operations at the airport. This number is likely to increase through the further development of the airport. All airports tenants are responsible for managing their own operations in an environmentally responsible manner in accordance with the Environment Strategy 2009.

Roles, responsibilities and authorities of JAH personnel are defined in the EMS to ensure effective implementation of control systems and procedures. All JAH staff, tenants and general users of the airport have a responsibility to protect the environment of the airport through the *Airport (Environmental Protection) Regulations 1997*, lease conditions and other applicable legislation.

The roles and responsibilities of specific JAH staff in the EMS are outlined in the sections below.

2.6.1 MANAGING DIRECTOR

The Managing Director is responsible for the overall environmental performance of Jandakot Airport. The Managing Director endorses the Environment Policy and ensures funds and resources are made available for environmental management. The Managing Director is also responsible for ensuring JAH staff fulfil their roles and responsibilities.

2.6.2 OPERATIONS AND TECHNICAL MANAGER

The Operations and Technical Manager is responsible for ensuring works are conducted in conjunction with the EMS, Environment Strategy and EMPs. The Operations and Technical Manager is also responsible for supplying equipment, technical advice and personnel resources for environmental management and emergency response.

2.6.3 ENVIRONMENT MANAGER

The Environment Manager is responsible for the progress of Jandakot Airport in meeting environmental

targets. The responsibilities of the Environment Manager include:

- Review of significant environmental incidents and actions;
- Management of environmental risk;
- Establishment of environmental objectives and targets;
- Implementation of programs to achieve objectives and targets;
- Day to day management of environmental issues;
- Preparation of JAH Management Plans;
- Identification of staff training needs and facilitation of training;
- Promotion of environmental awareness at Jandakot Airport;
- Providing advice to Jandakot Airport on environmental matters;
- Assisting JAH staff to discharge their environmental responsibilities;
- Emergency response;
- Records and communicating responsibility and authorities;
- Maintaining records of responsibilities and authorities; and
- Supporting, advising and communicating the efforts of the Executive, section managers, personnel and tenants.

2.6.4 TENANTS

The 75 tenants at Jandakot Airport conduct a range of aviation and non aviation related activities. The majority of these tenant activities are associated with the aviation industry including refuelling depots, maintenance services, training schools, student accommodation and aircraft parts supply. The non-aviation activities include office, warehouse and distribution. Some of the operations and work practices at the airport have the potential to impact on the environment. These include:

- Fuel and oil storage and usage;
- Energy and water usage;
- Domestic wastewater disposal;
- Aircraft washdown bays;
- Fire control;
- Paint stripping and spraying; and
- Aircraft ground movements.

New development both underway and proposed will include offices, warehouses and bulky goods retail. All new office buildings will have a minimum 4 Star Green Star Certified Rating, under the Green Star building rating tools developed Green Building Council of Australia (GBCA).

Airports tenants are responsible for managing their own operations in an environmentally responsible manner in accordance with the Environment Strategy 2009. The Environment Strategy 2009 will be made available to both tenants and the public on the Jandakot Airport Holdings website.

JAH have a number of requirements for tenants at the airport to ensure that tenants comply with their airport environmental management responsibilities. These include:

- Conditions in new and renewed leases;
- Tenant Environmental Management Plans (EMPs);
- JAH approval of development: All development concept plans must be provided to JAH for comment. Typically, JAH comments will include requirements for EMPs;
- Environmental Site Assessments for lease terminations;
- Consultative sessions held with tenants for the development of the Master Plan 2009 and Environment Strategy 2009;
- Meetings with tenants on an individual as well as group basis;
- Incident reporting;
- Tenant site audits; and
- Quarterly Skylines newsletter.

2.7 AIRPORT ENVIRONMENT OFFICER

Environmental regulation of the airport is carried out by the airport Environment Officer (AEO) who is the vested body of the Commonwealth Department of Infrastructure, Transport, Regional Development and Local Government (DITRDLG). The AEO liaises with JAH on issues of compliance with the airports Act and subsequent regulations.

2.8 COMMITMENTS

Whilst not a specific action area, the environmental management approach is the general framework through which JAH ensures proper environmental management at the airport. The commitments in this section are not specific to one environmental factor but highlight improvements to the environmental management approach that will facilitate the achievement of commitments in each of the Strategy action areas.

TABLE 2: SECTION 2.0 COMMITMENTS

Commitment	Target
Review and update JAH Environmental Management System (EMS).	JAH EMS, Management Plans and tenant EMPs integrated by 2014.
Review and update all Management Plans for environmental issues.	All Management Plans for environmental issues to be updated by 2014.
Guidelines for tenant Environmental Management Plans to be produced, assisting tenants to manage the environmental impacts of their activities.	70% of tenants to have Operational EMPs by 2013.
Development of Annual Environmental Action Plans (EAPs).	The first Annual EAP to be implemented by 2010.
All new JAH staff to undergo induction training. This training will include: energy, water, resource use, biodiversity management, waste management and the JAH EMS.	All new JAH staff to undergo induction training within 3 months of commencing work.
Review of tenant risk classification tool.	Appropriate classification of tenant risk by 2010.
Development of updated tenant audit schedule, in accordance with tenant risk classification.	An updated tenant audit schedule prepared by 2010.
Conduct regular audits of tenant sites.	All audits to be undertaken In accordance with tenant audit schedule by 2014.
All airport environmental procedures to be reviewed and updated.	All environment procedures to be updated by 2014.
Undertake monitoring of groundwater.	Identify any groundwater contamination on an ongoing basis.
Commence air quality monitoring.	Implement an air quality monitoring program by 2014.
Monitoring of biodiversity at the airport.	Undertake follow up flora and fauna surveys by 2014.
Monitoring of energy and water use.	Obtain accurate data on energy and water usage across the airport by 2010.
Quarterly reporting of monitoring to airport Environment Officer.	Quarterly reports to be compiled every quarter.
Undertake Quarterly and Annual Environmental Reports.	Annual reports to be compiled.
Review and update the JAH Environmental Management Framework.	Review to be complete by end of 2014.
Environment Strategy 2009 to be made available to tenants and the public on the JAH website.	Environment Strategy 2009 to be placed on the JAH website.
Compliance with conditions of EPBC Act Approval dated 25 March 2010.	Clearance of conditions as required by the Approval.

3.0

ENVIRONMENT STRATEGY ACTION AREAS

3 ENVIRONMENT STRATEGY ACTION AREAS

3.1 INTRODUCTION

Environmental action areas at Jandakot Airport have been identified through the previous Environment Strategy, environmental reviews, audits and the development of the JAH Environmental Management System (EMS).

These action areas have been classified as follows:

- Section 4: Soil and Water Quality;
- Section 5: Air Quality;
- Section 6: Biodiversity and Conservation Management;
- Section 7: Waste Management;
- Section 8: Water and Energy Management;
- Section 9: Noise Management;
- Section 10: Cultural Heritage; and
- Section 11: Airport Development.

These action areas are detailed in the following sections. Sections 4 through 10 are all operational action areas, and refer to normal expected operational conditions within the next five years. Each of these sections delineates:

- The existing environment at the airport pertaining to the action area;
- Potential impacts of airport operations on the natural environment at the airport;
- JAH's objectives for management of this action area;
- JAH's achievements in managing the environment; and
- JAH's commitments to ensure continuous improvement to environmental management at the airport from 2009-2014.

Section 11: Airport Development, differs from the other action areas as it refers to the impacts of development and the activities associated with it. This section identifies achievements and commitments specific to the further development of the airport as outlined in the Master Plan 2009.

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4.0

SOIL AND WATER QUALITY

Jandakot Airport Environment Strategy

4 SOIL AND WATER QUALITY

Groundwater and soil impacts are intimately linked, and as such, the impact of airport operations on groundwater and soil has been considered together. The southern part of the site is located within the northern boundaries of the Jandakot Groundwater Mound.

4.1 EXISTING ENVIRONMENT

4.1.1 GEOLOGY AND SOILS

The Armadale and Fremantle 1:50 000 Environmental Geology Series indicates Jandakot Airport consists of Quaternary superficial alluvial sediments, varying in thickness from around 30 m to 60 m. The sands unconformably overlay the older Osborne and Leederville formations, comprising of shale and siltstones.

The Swan Coastal Plain consists of a series of distinct dune systems aligned approximately north to south and extending from the coast to the Darling Scarp. The Quindalup and Spearwood dune systems lie closest to the coast, with the Bassendean dune system further to the east. Jandakot Airport lies approximately 3 km east of the Spearwood system boundary, within the Bassendean dune system (JAH, 2004b). Bassendean sands are Aeolian, or windborne, soils derived from particles washed up by the ocean and blown by wind to form dunes. These sands are characterised as pale grey, white, medium grained, moderately sorted quartz sand with black heavy minerals scattered throughout (Sinclair Knight Mertz 1999).

The topography of the airport and surrounding areas is generally flat, with local variations in height of 20 m or less. Most of the site has an elevation of 30 m AHD. High points of 45-50 m AHD occur in the south-eastern and south western corners (JAH, 2004b).

4.1.2 ACID SULPHATE SOILS

Until 2009, Acid Sulphate Soils (ASS) at the airport have been managed in accordance with WAPC Planning Bulletin 64. WAPC Planning Bulletin 64 has been superseded by a jointly prepared report by of the Department of Environment and Conservation (DEC) and the Western Australian Planning Commission (WAPC) entitled Acid Sulphate Soils Planning Guidelines (WAPC, 2009). The Guidelines outline a range of matters throughout various stages of the planning process to ensure the development of acid sulphate soils (ASS) affected areas is planned and managed to avoid potential adverse effects associated with the disturbance of ASS.

Planned developments at Jandakot Airport relate specifically to Principle 3 of the Guidelines, which state that where disturbance is unavoidable, development should be undertaken in a manner which mitigates adverse potential impacts to the natural and built environment, and achieves acceptable soil and water quality outcomes.

According to DEC Acid Sulphate Soil Risk Maps (DEC, 2009) the site is located in an area of low to moderate risk of ASS occurring within 3m of the soil surface, and that there are some areas onsite that are considered to have a high risk of ASS occurring within 3m of the soil surface.

The Draft Identification and Investigation of Acid Sulphate Soils Guideline (DEC, 2006), (which is referred to by Acid Sulphate Soils Planning Guidelines (WAPC, 2009) as the primary technical reference document for the ASS assessment process) states that any development site where excavations in areas of high risk, or dewatering within 500m of low to moderate risk areas will require a detailed ASS investigation and potentially an ASS and Dewatering Management Plan (ASSDMP).

Initial soil testing where sewers will be placed has identified potential acid sulphate soils (PASS). Consequently, an ASS and Dewatering Management Plan was developed for excavation and dewatering for installation of sewers. Excavation for sewer installation has been conducted in accordance with the ASSDMP. Some of the ASS management strategies include:

- Excavated soil is mixed with crushed limestone or limestone, on a dedicated treatment pad to minimise leachate;
- Stormwater runoff will be directed away from soil stockpiles;
- Leachate and runoff water from soil stockpiles will be collected and treated;
- Field soil testing and validation analysis will be undertaken during excavation;

- Dewatering water will be disposed of via a lined settlement basin, before overflowing into the adjacent stormwater storage basin;
- Field and laboratory analysis of dewatering effluent and groundwater; and
- Post construction monitoring (MPA Willams, 2008).

Any proposed deep excavation work at the airport will be subject to an ASS investigation and, where ASS are identified, ASS and Dewatering Management Plans will be developed as appropriate.

4.1.3 SURFACE WATER

Within Jandakot Airport there are no natural drainage channels or defined areas of surface water. A number of damplands are identified in lower areas of the landscape by the Geomorphic Wetlands of the Swan Coastal Plain Dataset (Department of Environment and Conservation 2008).

Development increases the area of impermeable surfaces such as roads, car parks, runways and apron areas, which concentrate run-off following a very intense rainfall event. Due to the extremely porous nature of the sandy soils at the site, this run-off is localised and short term. Drainage swales have been created in the north-eastern corner of the airport to collect run-off from sealed surfaces, as the majority are not provided with drainage. Due to the high permeability of the Bassendean soils, run-off generally infiltrates very quickly into sand surrounding the sealed area and tends not to concentrate in drainage basins.

4.1.4 WETLANDS

The wetlands that are mapped as occurring on the site are both Resource Enhancement category wetlands (Damplands) by the DEC Geomorphic Wetlands of the Swan Coastal Plain dataset (**Refer to Figure 5**). These are located in Precincts 1B and 2 on the Master Plan 2009, both of which are designated conservation areas.

Resource Enhancement Wetlands are wetlands which may have been partially modified but still support substantial ecological attributes and functions. Normally, a 50m buffer is required between Resource Enhancement Wetlands and development. The Environmental Protection Authority urges that all reasonable measures be taken to minimise the potential impacts on REWs and their buffers (WRC, 2001).

Jandakot Airport is proposing to retain these wetlands in conservation Precincts at the airport. Retention of the wetlands' conservation values is achieved by the management actions associated with the Conservation Area Management Plan (Refer to Section 6.1.8).

4.1.5 GROUNDWATER

The Jandakot Airport is partially located on the northern margin of the Jandakot Groundwater Mound, with the crest of the mound located just south of the airport (Davidson, 1995).

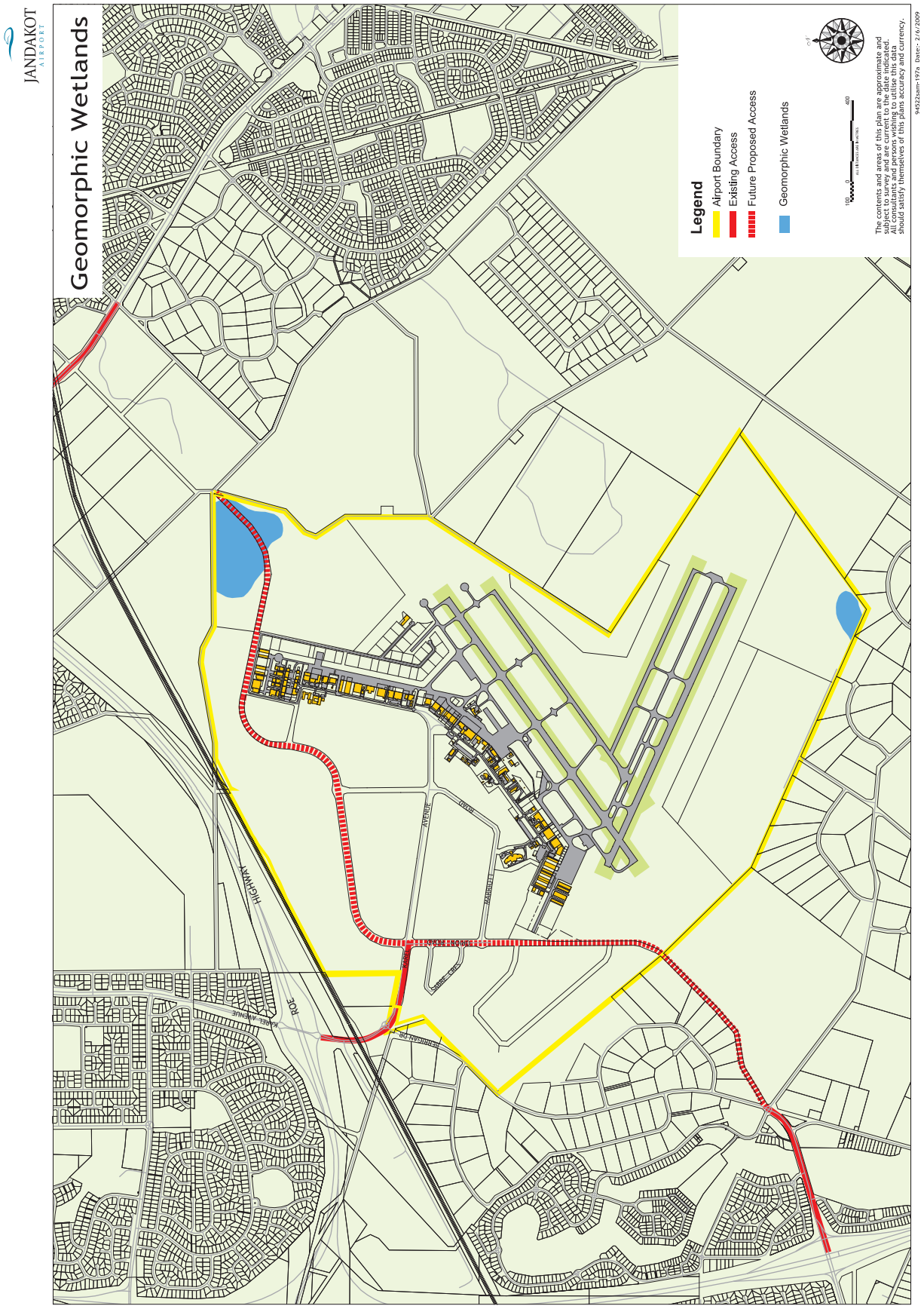
The shallow sand aquifer covers an approximate area of 760 km2, from the Swan River in the north to the Serpentine River in the south. The Jandakot Mound has primarily developed because the rate of infiltration exceeds the rate of horizontal groundwater flow through the aquifer. During the summer periods, when there is little or no recharge, the rate of horizontal groundwater flow exceeds vertical infiltrations resulting in a subsidence of the mound as the water table lowers. Throughout most of the airport site, the unsaturated zone consists of fine grey sands; with occasional coarse white and yellow sands in the central and north eastern parts of the site (Sinclair Knight Mertz 1999).

The Perth Groundwater Atlas (Water and Rivers Commission, 1997) indicates the maximum groundwater level for the aquifer is 1 to 7 m below the surface. The seasonal variation in groundwater levels is approximately 2 m and groundwater flow direction is south-east to north-west, away from the Jandakot Underground Water Pollution Control Area (UWPCA) (JDA 2006).

The water table elevation is highest during September-October and lowest during April-May. The saturation thickness at the central region of the mound is thought to be approximately 40m.

Groundwater flow is in a north to north westerly direction. The eastern areas of the site flow north towards the Canning River, whilst the western side of the airport site is characterised by a north-westerly flow direction, toward Bibra Lake (Dames and Moore, 1993).

FIGURE 5 - WETLANDS



4.1.6 UNDERGROUND WATER POLLUTION CONTROL AREA

The Jandakot Mound is gazetted as both a Public Drinking Water Supply Area (PDWSA) and an Underground Water Pollution Control Area (UWPCA) (**Figure 6**). The Department of Water (DoW) manages Western Australia's water resources including the Jandakot Mound and restricts land uses that may pose a threat to the quantity or quality of water available from the mound for public water supply.

Within the Jandakot UWPCA, a three-level priority system is used. The priority classifications are determined by land tenure, land use and water flow patterns (WRC, 2002).

Each priority classification is subject to the following management objectives:

- Priority 1 (P1) classification areas are managed to ensure that there is no degradation of the drinking water source by preventing the development of potentially harmful activities in these areas. The guiding principle is risk avoidance. This is the most stringent priority classification for drinking water sources. P1 areas normally encompass land owned or managed by State agencies, but may include private land that is strategically significant to the protection of the drinking water source (e.g. land immediately adjacent to a reservoir). Most land uses create some risk to water quality and are therefore defined as "Incompatible" in P1 areas.
- Priority 2 (P2) classification areas are managed to ensure that there is no increased risk of water source contamination/pollution. For P2 areas, the guiding principle is risk minimisation. These areas include established low-risk land development (e.g. low intensity rural activity). Some development is allowed within P2 areas for land uses that are defined as either "Compatible with conditions" or "Acceptable".
- Priority 3 (P3) classification areas are defined to manage the risk of pollution to the water source from catchment activities. Protection of P3 areas is mainly achieved through guided or regulated environmental (risk) management for land use activities. P3 areas are declared over land where water supply sources coexist with other land uses such as residential, commercial and light industrial development. Land uses considered to have significant pollution potential are nonetheless opposed or constrained (DoE, 2004).

A small portion of the airport land is within the UWPCA. The bushland area to the southwest and southeast of the airport is within the Priority 1 area of the UWPCA. Part of the southern runway is also located within the Jandakot UWPCA.

A portion of the new runway and the proposed Precinct 5 identified in the Jandakot Airport Master Plan 2009 are partly within the UWPCA (**Refer to Figure 6**). A groundwater pollution risk assessment and management strategy has been presented to the Department of Water (DoW) as part of the Environment Strategy and Master Plan.

Groundwater modelling has been undertaken by CyMod Systems in 2009 to determine the risk posed by a potential spill in Precinct 5 to the Jandakot UWPCA. The CyMod modelling indicates that any spills within Precinct 5 would take a minimum of ten years before the water quality at the nearest Water Corporation production bore would be affected. This allows time for remediation measures to be undertaken to address any contamination if there is a spill, before it affects the water quality at a production bore. The results of this report have been the subject of discussions with the Department of Water.

JAH commits to continue to work with the State Government to manage the potential environmental impacts with the JUWPCA.

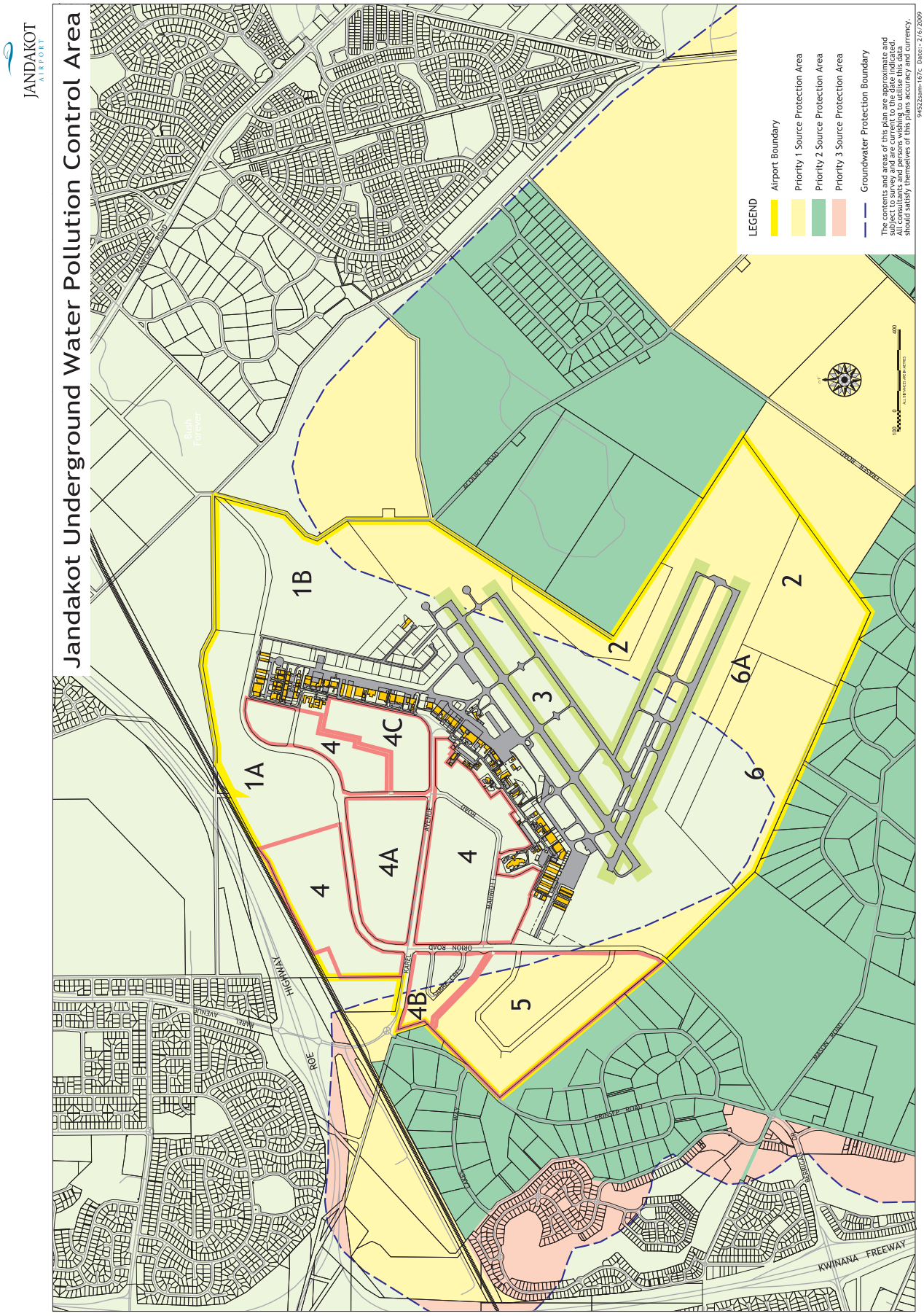
The EPBC Act Approval Conditions require the preparation and submission of a Jandakot Groundwater Mound Management Plan within 4 months of approval and prior to the commencement of any construction within Precinct 5.

4.1.7 CONTAMINATION

There are currently 17 sites on the Environmental Site Register for the airport as either known or suspected contaminated sites. Three of these sites have been appropriately remediated and closed out. Nine are currently in the process of being investigated and remediated. These sites are subject to individual Environmental Improvement Programs.

The remaining five sites are suspected to be contaminated. Groundwater monitoring is undertaken regularly and these sites will be subject to an Environmental Site Assessment on the expiry of the individual leases for those sites.

FIGURE 6 - JANDAKOT UNDERGROUND WATER POLLUTION CONTROL AREA



4.1.8 GROUNDWATER CONTAMINATION MANAGEMENT

JAH has a number of control measures in place in order to protect groundwater quality from the impact of airport operations. Some of these include:

- Environmental Management Plans;
- Regular audits of tenant operations;
- Aerobic treatment units (ATUs) for wastewater disposal;
- Installation of piped sewerage system;
- Local Water Management Strategy;
- Spill management campaigns;
- Spill management training;
- Groundwater monitoring bores; and
- Store safe education.

All tenants at the airport will have Environmental Management Plans (EMPs) for their operations by 2015, with 70% of tenants to have EMPs by 2013.

Reticulated sewer is progressively being installed at the airport. All new developments will be connected to sewer and JAH aims to connect existing tennants to sewer by 2020.

JAH will ensure that risks to groundwater quality are minimised through:

- The utilisation of Water Sensitive Urban Design and drainage best management practices in all new development; and
- The existing environmental management and regulatory framework at the airport.

4.1.9 SPILL MANAGEMENT

All staff and tenants at Jandakot Airport are required to comply with spill management procedures. Chemical spills are reported to JAH if they:

- Are greater than 2L; or
- Come into contact with soil.

Reported spills are initially investigated by the Environmental Manager. Following the initial investigation, the Environment Manager and the tenant determine appropriate control measures to reduce the risk of the spill recurring. The tenant implements control measures and, if necessary, the site is remediated. Where the remediation required will be ongoing, the site will be subject to an Environmental Improvement Program, which documents the remediation process.

4.1.10 LOCAL WATER MANAGEMENT STRATEGY

JAH have developed a Local Water Management Strategy (LWMS) in consultation with the WA Department of Water. This considers storm water, water reticulation, irrigation, effluent disposal and wastewater reuse. The LWMS incorporates and provides for the implementation of Water Sensitive Urban Design at the airport.

The LWMS enables JAH to:

- Ensure compliance with state and regional planning policies;
- Propose catchment management objectives and preliminary design objectives for all elements of the water cycle;
- Map surface and groundwater catchments, including waterways and wetlands;
- Identify critical water resource management issues, including water quality;
- Detail known historical land use and potential for contamination and acid sulphate soils;
- Review the impacts of potential future developments within the Jandakot UWPCA;
- Identify measures to minimise these impacts on the Jandakot UWPCA;
- Identify synergies between the management of stormwater, groundwater and wastewater;
- Propose a strategy to ensure that surface and ground water quality and quantity information is available at an appropriate time to inform future land use planning decisions;

- Recommend pre and post development monitoring frameworks; and
- Include the results of liaison with the Department of Water and relevant local governments on water management strategies.

The complete LWMS is attached in Appendix B.

4.1.11 POLLUTION PREVENTION

JAH has worked collaboratively with tenants, the airport Environment Officer and the Department of Infrastructure, Transport, Regional Development and Local Government to prevent pollution and reduce the extant pollution at the airport. Some examples of JAH's achievements to date in pollution prevention and reduction include:

- Development of Construction Environmental Management Plans, Demolition Environmental Management Plans and Operational Environmental Management Plans to reduce the risk of pollution on tenant sites;
- Where areas have been identified as requiring remediation (and where practicable), JAH manage this through Environmental Improvement Programs (EIPs) and continue to commission professional resources to progress areas of contamination.
- The former Air BP contaminated site has been remediated fit for commercial development; and
- Implementation of Environmental Site Assessments as an environmental condition report of tenant sites on termination or transfer of leases.

4.1.12 GROUNDWATER MONITORING

Regular groundwater monitoring will be undertaken at monitoring bores across the airport site, including at the new bores to be installed following clearing of Precinct 5. Monitoring will include all of the Substances listed in Schedule 2 of the *Airports (Environment Protection) Regulations 1997* against the limits outlined in Schedule 2. All groundwater samples will be tested in a NATA Accredited laboratory.

4.2 OBJECTIVES

JAH's objectives in this action area include:

- To minimise the impact on the Jandakot Groundwater Mound by airport operations;
- To minimise potential contamination to soil and groundwater;
- To identify and manage contaminated sites;
- To minimise impacts due to contaminated runoff from paved surfaces;
- To prevent contaminated waters entering stormwater drainage;
- To prevent surface waters becoming contaminated;
- To contain contaminated liquids;
- To comply with legislated standards; and
- To educate and inform airport users of pollution control measures.

4.3 ACHIEVEMENTS

Achievements to date since 2004 include:

- Aircraft washdown facilities equipped with quick-break detergents and plate separators. These facilities are provided free of charge to users;
- JAH has compiled a register of all underground storage tanks (USTs) and commenced the decommissioning and replacement of these with bunded above-ground storage tanks. Four existing USTs have been removed and no new ones installed, in accordance with JAH policy;
- In 2007, all stormwater drains were labelled with a frog logo to raise airport users' awareness of where these drains discharge;
- Three contaminated sites have been remediated and closed out;
- Maintenance schedules for ground support vehicles and aircraft were modified to include oil leaks as a priority issue;
- Two spill clean up training courses were conducted, in December 2006 and in March 2008, for staff and tenants;

- Herbicide procedures were modified to reduce overspray and minimise the potential for leaching to groundwater;
- All stormwater drainage mapping at Jandakot Airport was completed in 2007; and
- A groundwater modelling study was completed in 2009.

4.4 COMMITMENTS

Table 3: Section 4.0 Commitments

Commitment	Target
All deep excavation at the airport to be the subject of an Acid Sulphate Soil investigation.	ASS to be appropriately managed during excavation works.
Suspected contaminated sites to be investigated through Environmental Site Assessments of tenant sites on expiry of lease.	Existing contaminated sites to be identified and remediated appropriately.
To work with tenants to facilitate EMPs for all businesses.	70% of tenants to have EMPs by 2013 All tenants to have EMPs by 2015.
To ensure all wastewater is disposed of appropriately.	All wastewater to be disposed to sewer within 10 years.
To work with tenants to prevent and manage spills and discharges.	70% of tenants to have EMPs by 2013.
To implement the Local Water Management Strategy.	Implementation of the Local Water Management Strategy by 2011.
Groundwater monitoring to occur regularly.	For groundwater monitoring to be undertaken.
Preparation of a Jandakot Groundwater Management Plan.	Within 4 months of the EPBC Act approval.

5.0

AIR QUALITY

Jandakot Airport Environment Strategy

5 AIR QUALITY

Jandakot Airport, being a general aviation aerodrome, does not experience the same degree of impact on air quality as major Australian airports with larger aircraft. The main sources of air emissions at Jandakot Airport are emissions from ground based operations including ground based aircraft movement, refuelling, solvent emissions from painting, mechanical and maintenance workshop emissions, dust and the use of ozone depleting substances. Emissions from aircraft whilst in the air are controlled by the *Air Navigation (Aircraft Engine Emissions) Regulations* which are the responsibility of Air Services Australia.

Jandakot Airport Holdings receive a small number of complaints about air quality at the airport.

A number of these complaints have been in regard to dust from the Jandakot Recycling Waste Transfer Station, which is run by Veolia. Veolia undertook dust monitoring in 2007 and have been working with JAH to implement dust management measures.

The main impact on air quality during construction of new buildings at the airport is likely to be dust arising from exposed soil due to clearing of vegetation. Dust will be managed using bore water, other dust suppressants and minimising vehicle and machinery movement over exposed soil. This issue is addressed by Construction Environmental Management Plans for development sites. The operation of the new runway is expected to lead to decreased air emissions, as this will reduce ground delays.

JAH intend to undertake baseline ambient air quality monitoring to validate projections undertaken prior to the Environment Strategy 2004 which indicate that air quality surrounding Jandakot Airport is likely to be below relevant Commonwealth and State statutory levels.

5.1 EXISTING ENVIRONMENT

5.1.1 CLIMATE

Jandakot Airport has its own weather station, with more than 18 years of data recorded.

The Swan Coastal Plain Subregion has a Mediterranean climate. The area experiences a wide range of temperatures throughout the year, with an average maximum temperature of 24.2°C. In summer, maximum temperatures may reach 40°C, whilst in winter, minimum temperatures may reach <5°C (Bureau of Meteorology (BoM) 2007).

Rainfall tends to fall in winter, with a maximum monthly mean rainfall of 180 mm in July. The annual average rainfall at Jandakot Airport is 842 mm.

5.1.2 OZONE DEPLETING SUBSTANCES (ODS)

JAH are not aware of any Ozone Depleting Substances (ODS) in use at the airport, outside of aircraft. ODS can be present in refrigerators, air conditioning systems and fire extinguishers. JAH will continue to educate tenants to ensure that equipment which contain ODS are phased out and replaced with equipment which uses alternatives to ODS.

5.1.3 DUST

JAH have received a small number of complaints from tenants regarding dust management on the site. These complaints were all in relation to a waste transfer facility and construction activity on the site. A summary of the number of dust complaints received annually is in the table below:

Table 4: Number of Dust Complaints received Annually

	2004-5	2005-6	2006-7	2007-8
No. of Dust Complaints	5	3	0	3

Dust monitoring was undertaken at the waste transfer facility in 2007 and it was identified that PM10 (particulate matter 10 micron) concentration at the airport exceeded the NEPM standard for PM10 ambient air quality. Consequently, dust management measures were enacted at the waste transfer station.

In addition, all construction at the airport is undertaken in accordance with a Construction Environmental Management Plan. Construction Environmental Management Plans include measures for dust management during construction.

5.1.4 PUBLIC TRANSPORT

The nearest public transport route to the airport is currently a bus route on Karel Avenue, approximately 2km from existing development at the airport. JAH will continue to advocate for and facilitate public transport access to the airport.

5.2 OBJECTIVES

JAH's objectives in this action area include:

- To minimise air emissions from airport operations; and
- To comply with Commonwealth and State air quality legislation.

5.3 ACHIEVEMENTS

Achievements to date since 2004 include:

- JAH has worked closely with Veolia at Jandakot Recycling to implement dust management measures to reduce dust generated at the site.
- JAH supported a petition by a tenant in 2007 to the Public Transport Authority (PTA) to introduce a bus service from the new Murdoch train station once operational, however, the petition was unsuccessful.
- JAH has phased out the use of all ozone depleting substances in fire extinguishers on the airport site.

5.4 COMMITMENTS

TABLE 5: SECTION 5.0 COMMITMENTS

Commitment	Target
To develop a baseline ambient air quality monitoring program for the airport.	Implementation of ambient air quality monitoring program by 2014.
JAH will comply with relevant Commonwealth air quality and climate change legislation as it comes into effect.	Legislative compliance.
To educate tenants to phase out the use of Ozone Depleting Substances (ODS) at the airport.	No ODS in use at the airport (apart from exempt aircraft).
To work with tenants and contractors onsite to minimise dust.	A reduction in dust or air quality related complaints.
To advocate for and facilitate public transport access to the airport.	To apply for public transport networks to connect to the airport. In the interim, JAH will provide a shuttle bus service from Murdoch Station to the airport.

6.0

BIODIVERSITY AND CONSERVATION MANAGEMENT

Jandakot Airport Environment Strategy

6 BIODIVERSITY AND CONSERVATION MANAGEMENT

6.1 EXISTING ENVIRONMENT

6.1.1 FLORA AND VEGETATION

Jandakot Airport is located in the South-West Botanical Province of Western Australia, in the Darling Botanical District and the Bassendean System of the Drummond Botanical Subdistrict (Beard, 1981).

The Bassendean Vegetation System corresponds to the older leached sands of the Bassendean Dune System. This system extends discontinuously for the length of the Swan Coastal Plain, with the overall cover being Banksia woodland. In general, this low woodland is dominated by *Banksia attenuata*, *Banksia menziesii*, *Banksia ilicifolia*, *Eucalyptus todtiana* and *Nuytsia floribunda*, with a dense understorey of *sclerophyll* shrubs. These characteristics are typified at Jandakot Airport (Mattiske 2001a).

6.1.2 FLORA AND VEGETATION COMMUNITIES

Mattiske Consulting (2001a) mapped the vegetation communities at Jandakot Airport, determining that the area supports six of the communities described on the Swan Coastal Plain by Gibson et al. (1994) (**Figure 7**). These are listed below:

- H1 - Woodland of *Eucalyptus marginata* with *Banksia* spp. (similar to 21a1A – Gibson et al. 1994);
- H2 - Open woodland of *Banksia attenuata* and *Banksia menziesii* (similar to 23a – Gibson et al. 1994);
- J1 - Woodland of *Banksia ilicifolia* with *Banksia* spp. (similar to 22 – Gibson et al. 1994);
- K1-Disturbed open forest of *Eucalyptus rudis* with *Melaleuca preissiana* (similar to 11 – Gibson et al. 1994);
- K2 - Woodland of *Melaleuca preissiana* (similar to 4 – Gibson et al. 1994); and
- J2 - Heathland of *Beaufortia elegans* and *Hypocalymna* spp. (similar to 5 – Gibson et al. 1994).

6.1.3 CONDITION OF VEGETATION

The condition and value of the airport bushland has been mapped by Mattiske Consulting (2001, 2006). The condition of the native vegetation at the airport is variable (**Figure 8**). Most areas of bushland appear to have established tracks and fire fighting trails dividing portions of bushland and conservation areas into 2ha – 12ha parcels.

6.1.4 RARE AND ENDANGERED SPECIES

Two endangered flora species protected under the EPBC Act are identified as occurring within the site. These include:

- Grand Spider Orchid (*Caladenia huegelii*); and
- Glossy-leaved Hammer Orchid (*Drakaea elastica*).

Surveys by Mattiske (2001a, 2006, 2007), Department of Environment and Conservation (2005), Cardno BSD (2005) have identified locations of rare orchids on the Jandakot Airport site (**Figure 9**). The majority of occurrences of *Caladenia huegelii* (Grand Spider Orchid) have been found in Conservation Precincts 1A and 1B. Several occurrences have been flagged in Precinct 4 south of Karel Avenue and the survey undertaken by Cardno BSD 2005 identified one *Caladenia huegelii* at the end of the runway between Precincts 5 and 6.

Surveys done of the site in 2003 by DEC (formerly CALM) identified 4 *Drakaea elastica* (Glossy-leaved Hammer Orchid). A targeted spring flora survey by Mattiske in 2008 and 2009 did not locate any *Drakaea elastica* and considered that it is unlikely to be present in large numbers on the site.

JAH have consulted widely on management of the rare orchids on the airport site, including the State Department of Environment and Conservation, DEWHA and Botanic Gardens and Parks Authority.

A monitoring program has been developed by Mattiske Consulting in consultation with orchid specialists from Botanical Gardens and Parks Authority (BGPA) (**Refer to Appendix D**). In accordance with this monitoring program, JAH will undertake the following monitoring:

FIGURE 7 - VEGETATION COMMUNITIES

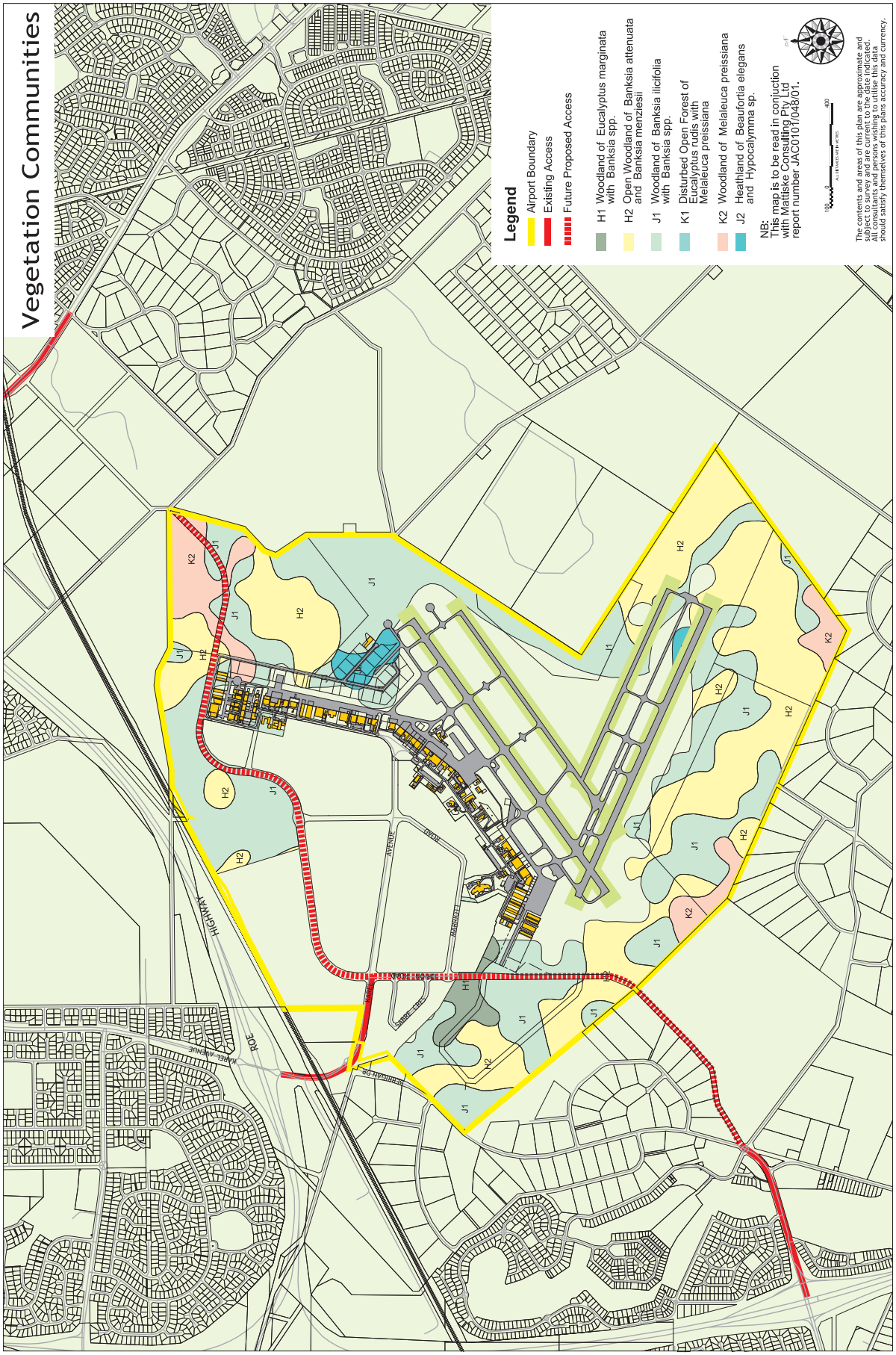


FIGURE 8 - VEGETATION CONDITION

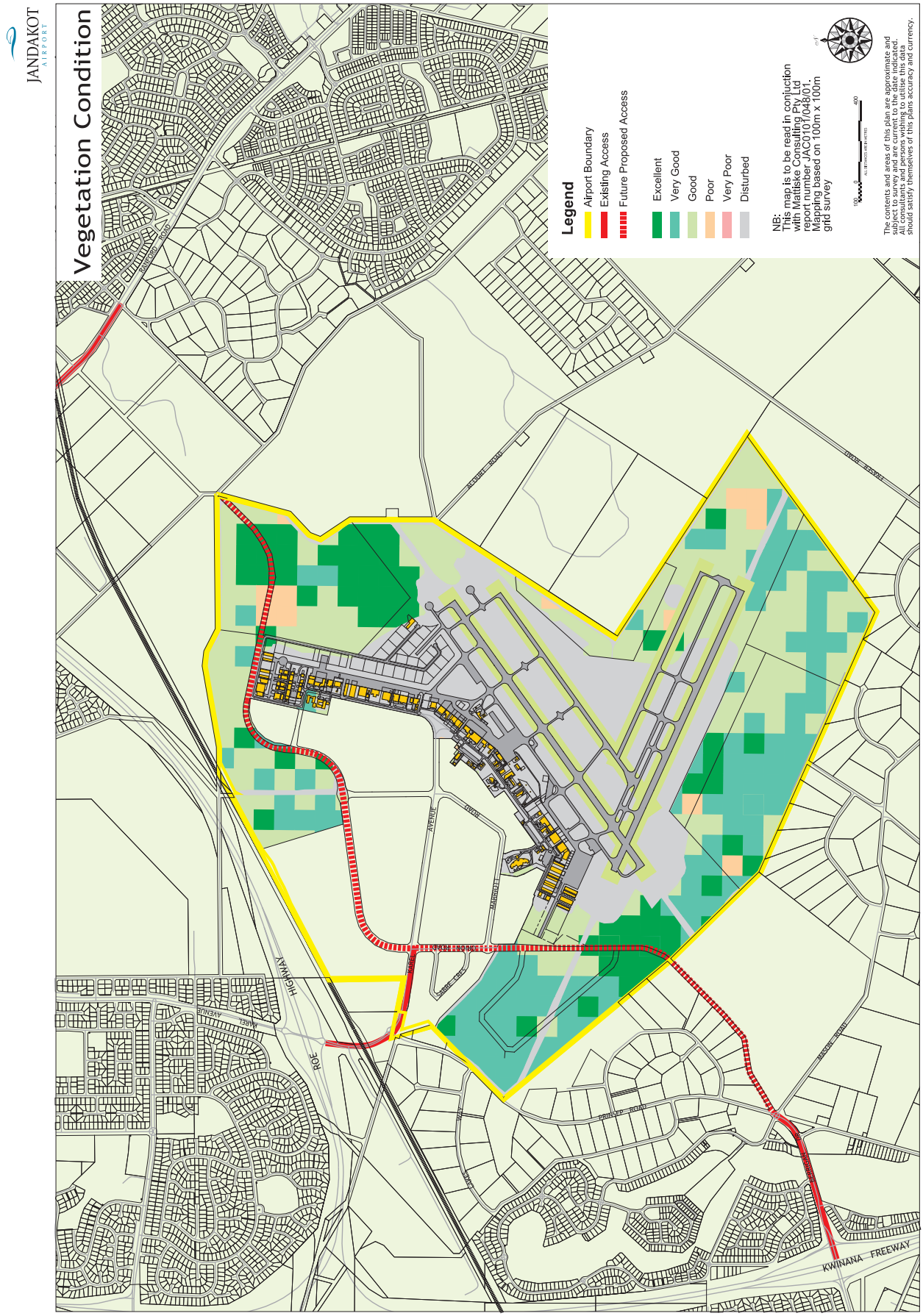
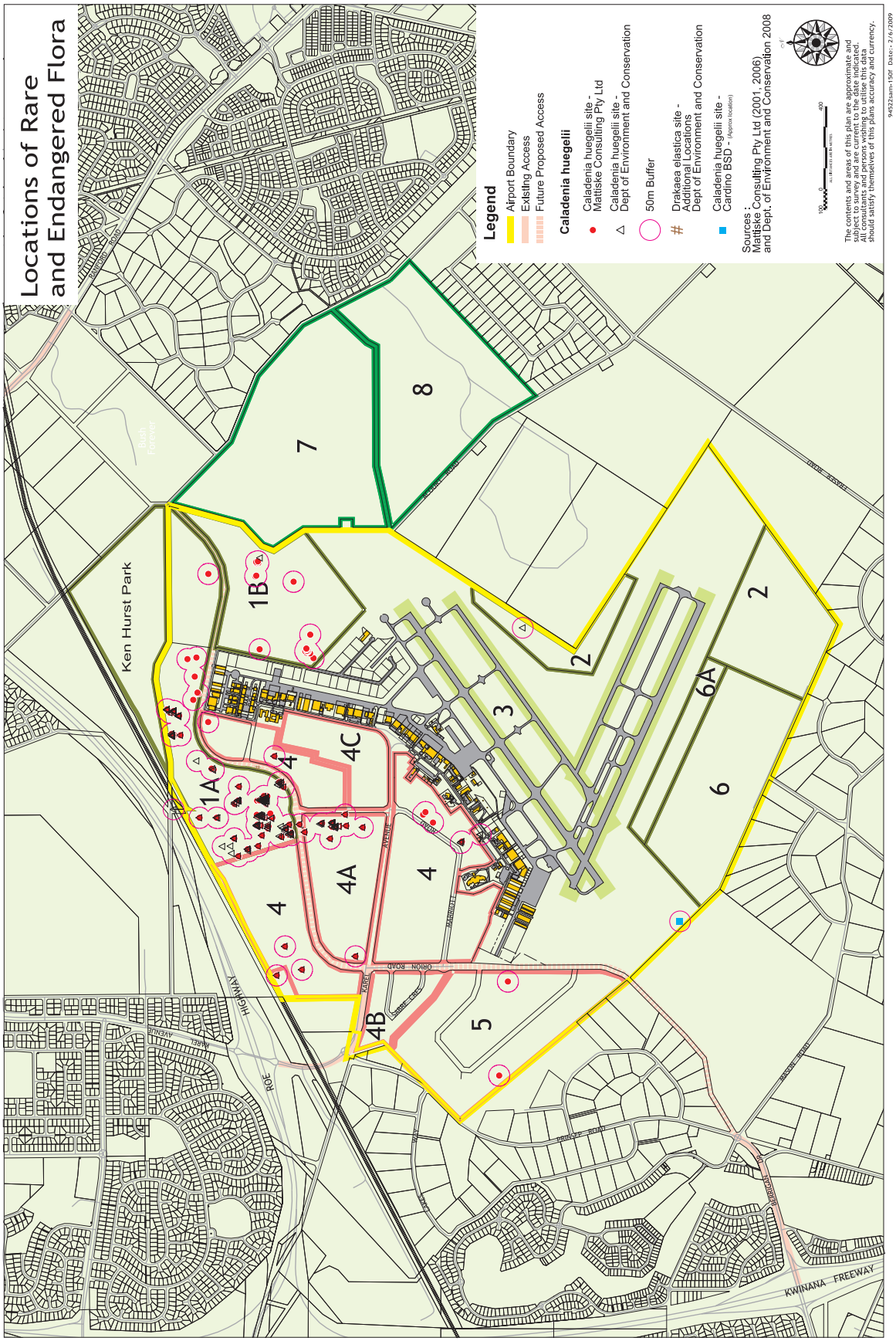


FIGURE 9 - RARE AND PRIORITY FLORA



- *Caladenia huegelii* monitoring – a series of permanent monitoring sites will be established in the spring of 2009 to capture approximately a third of the population (as currently known) in representative areas in different sections of Jandakot Airport. The timing of the field work will align with the peak of flowering. The peak of flowering may vary each year as rainfall events are not consistent. Therefore inspections of current populations will be undertaken prior to the work each year to assess and determine the optimum time for the field assessments to be undertaken. These monitoring sites will be assessed on an annual basis for three years. The monitoring will include re-assessing individual plants in permanent quadrats. Every three years an audit of all plants will be undertaken. Reporting will be supplied on an annual basis. After three years the monitoring program will be reviewed in consultation with BGPA orchid specialists (Mattiske, 2009); and
- *Drakaea elastica* monitoring – targeted searching within bushland areas on Jandakot Airport following discussions with BGPA orchid specialists will be undertaken in July/August 2009 and will include weekly checking of sites that may support the species (based on habitat preference information from BGPA orchid specialists). Additional targeted searching will be undertaken in consultation with orchid specialists from BGPA in potentially preferred habitats. Mattiske indicates that the targeted areas to be searched are the K1 and adjacent J1 communities in the northwest corner of the airport, in Figure 7. This approach is based on the current detailed knowledge of this species habitat preference (which is unlikely or restricted within the airport area). This work will be undertaken on a regular basis (fortnightly in early spring to late spring). As the basal leaf if quite distinctive this work does not need to align totally with the flowering period of this species. If any plants are located then a detailed monitoring program (along similar lines to that for *Caladenia huegelii*) will be determined in consultation with Kings Park orchid specialists (Mattiske, 2009).

6.1.5 INTRODUCED SPECIES

Ten weed species have been identified on the site. Skeleton Weed (*Chondrilla juncea*) is listed by the WA Department of Food and Agriculture as Priority 1 and Priority 2.

It is prohibited to move Priority 1 plants or their seeds within Western Australia. This prohibits the movement of contaminated machinery and produce including livestock and fodder.

Priority 2 plants must be treated to destroy and prevent propagation each year until no plants remain. The infested area must be managed in such a way that prevents the spread of seed or plant parts on or in livestock, fodder, grain, vehicles and/or machinery.

Weed management, including the management of Skeleton Weed, is addressed in a specified Weed Management Plan as part of the Conservation Area Management Plan. This will be updated to incorporate the proposed conservation areas.

JAH requires that only native species are to be planted onsite, as per Jandakot Design Guidelines November 2008. All new landscaping is in accordance with these Guidelines.

6.1.6 DIEBACK (PHYTOPHTHOPTERA CINNAMOMI)

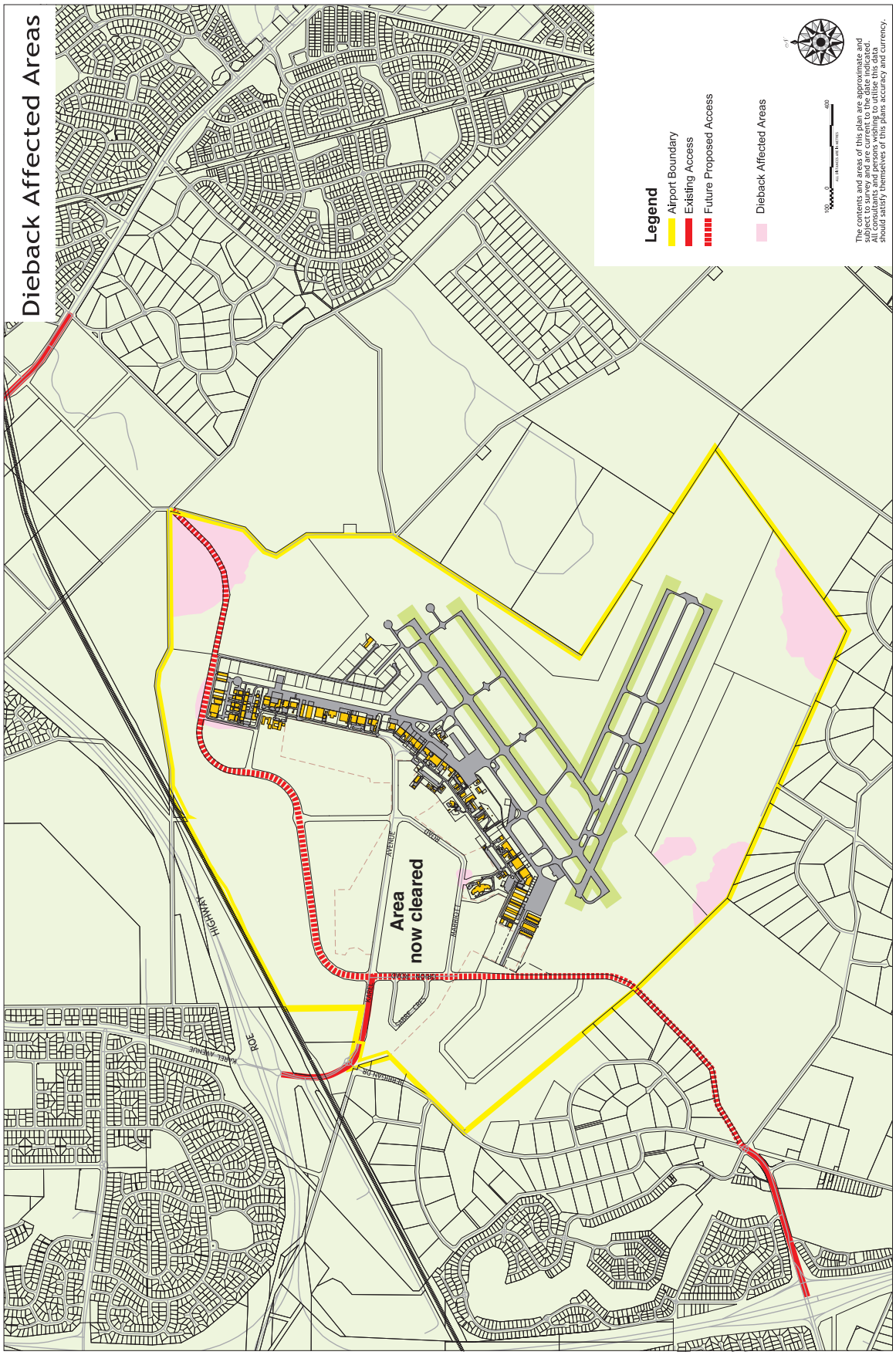
There are several dieback affected areas of bushland on the site (**Figure 10**). A Dieback survey and mapping was undertaken in 2005. Treatment is undertaken in affected areas and vehicle hygiene procedures are maintained to ensure that dieback disease is contained. JAH is currently working with two universities on studies and treatment of dieback.

A draft dieback management plan has been prepared by JAH in 2008.

Dieback infested areas cannot be cured and so the main management focus is to minimise its spread. The proposed management measures to be implemented at Jandakot Airport are detailed below:

- Restricting access to dieback areas;
- Strict hygiene measures involving the clean down of all machinery and vehicles;
- Prevent stormwater discharge from dieback infested areas into uninfested areas; and
- Phosphite (phosphonate) treatment through aerial spraying.

FIGURE 10 - DIEBACK AFFECTED AREAS



6.1.7 REHABILITATION OF PRECINCT 7 AND 8

Under the Master Plan 2009, approximately 90 ha of Precincts 7 and 8 are proposed for rehabilitation. Both former sand extraction areas to the east of the airport, Precinct 7 (Lot 166) is currently owned by the Crown, reserved to the City of Canning and Precinct 8 (Lot 167) is owned by the City of Canning.

JAH will undertake rehabilitation of these areas or make payments to DEC in accordance with the EPBC Act Approval Conditions to complement the retention of Conservation Precincts 1A, 1B and Ken Hurst Park and create an ecological corridor of over 650 ha via the Acourt Road Bushland through to the Jandakot Regional Park to the south (**Figure 11**). Jandakot Regional Park is approximately 3,800 ha which stretches as far south as Casuarina Prison (approximately 34 kilometres south east of the Perth central business district). Rehabilitation of Precincts 7 and 8 by JAH will have significant environmental benefits linking currently isolated areas of bushland with ongoing environmental management to ensure that the integrity and ecological values of the conservation bushland are retained.

Vegetative material in the form of salvaged tubers, seed, mulch and topsoil from staged clearing will be used in the rehabilitation of Precincts 7 and 8.

The rehabilitation of Precincts 7 and 8 will take place in a staged approach (described further in Section 11.3.5), in accordance with the Rehabilitation Plan (Refer to Appendix C), over a period of 7 years.

6.1.8 FLORA AND VEGETATION MANAGEMENT

Flora and fauna surveys are conducted to ensure that due consideration is given as part of any clearing approvals. These surveys are undertaken by suitably qualified professionals who possess an appropriate licence issued by the WA Department of Environment and Conservation under the Wildlife Conservation Act 1950.

A number of Environmental Management Plans have been prepared for the existing conservation areas. This includes issues such as rare flora, weed, fire and dieback management and integrate with the management plans for these issues.

Key environmental management issues associated with Jandakot Airport relate to preserving and enhancing the conservation values of a significant remnant bushland area subject to increasing pressure from urban development and disturbance.

Management issues include:

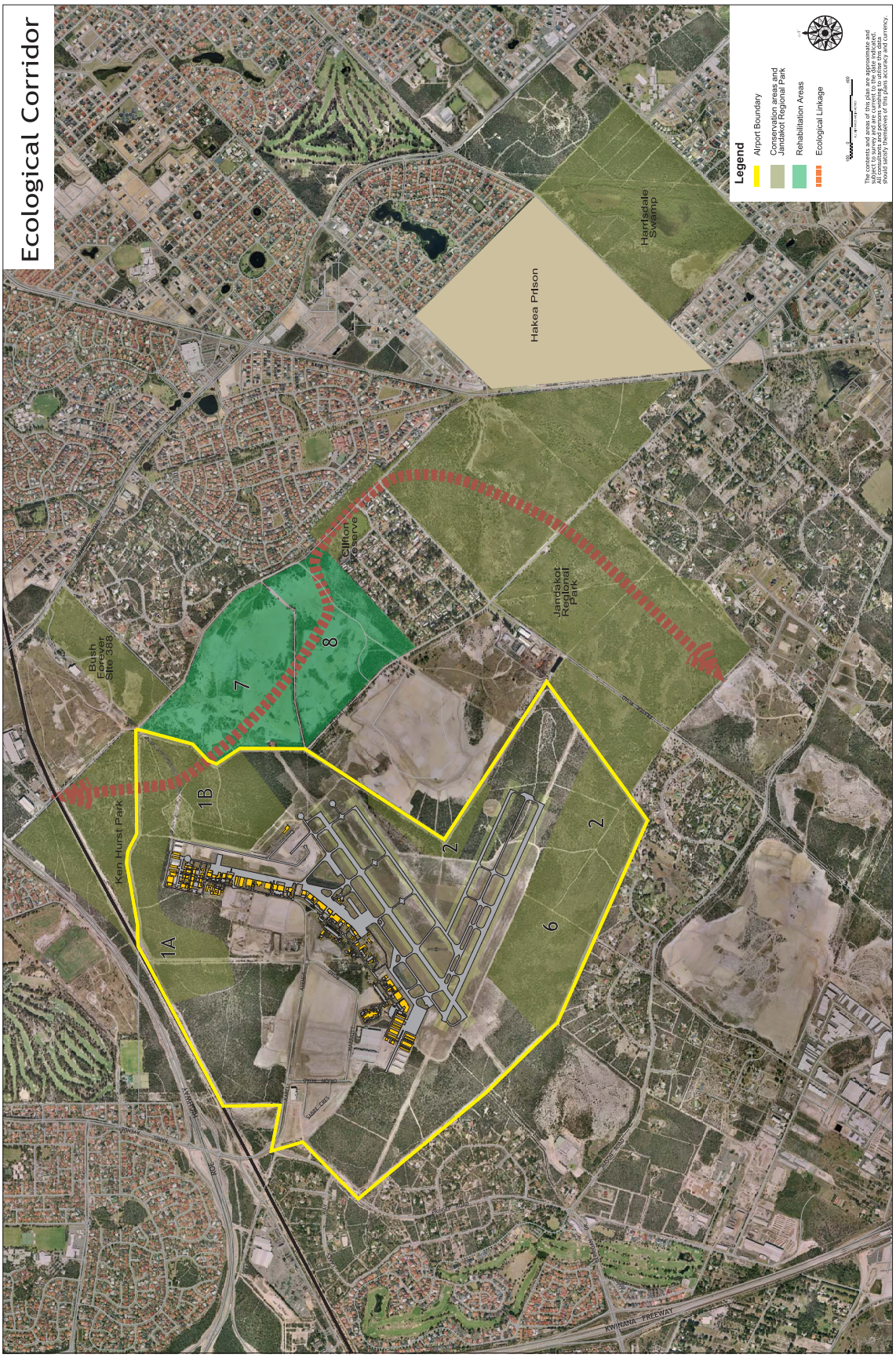
- Ecological issues, including vegetation disturbance, ecological restoration, disease control, introduced flora and fauna species control and native fauna protection;
- Protecting lives, property, vegetation communities, fauna habitats and biological processes from the effects of bushfires within and surrounding Jandakot Airport;
- Restoring disturbed areas located within the Jandakot Airport conservation precinct; and
- Managing operational requirements of JAH in balance with the conservation values of the site.

A number of Environmental Management Plans have been developed for addressing conservation area management at the airport. These are listed below:

- Flora and Vegetation Management Plan;
- Environmental Weed Management Plan;
- Fauna Management Plan;
- Feral Animal Management Plan;
- Dieback Management Plan;
- Ecological Restoration Management Plan; and
- Fire Management Plan.

These Environmental Management Plans will be reviewed during the development of a complete Conservation Management Plan to incorporate the new conservation area of Precinct 1A and the possible rehabilitation of Precincts 7 and 8 in accordance with the EPBC Act Approval Conditions.

FIGURE 11 - ECOLOGICAL LINKAGE



The Conservation Management Plan will address management of all conservation areas at the airport. This will include:

- An updated Flora and Vegetation Management Plan;
- An updated Weed Management Plan;
- An updated Fauna Management Plan (this will encompass both native fauna and feral animals);
- An updated Feral Animal Management Plan;
- An updated Dieback Management Plan;
- The Rehabilitation Plan for Precincts 7 and 8 (this replaces the Ecological Restoration Management Plan);
- An updated Fire Management Plan; and
- Requirements of the EPBC Act Approval.

6.1.9 FAUNA

A fauna assessment was carried out at Jandakot Airport in 2002 by Bamford Consulting Ecologists. A follow up survey was undertaken by ENV Australia in September 2008. The survey area comprises two habitat types: Banksia Woodland (H2 ,J1) and Melaleuca Woodland (K1, K2).

Of the two habitat types, the Banksia Woodland had higher value as fauna habitat because of its vegetation structure and habitat complexity, providing elements important to a variety of fauna. The presence of introduced weed species in the Melaleuca Woodland and the lack of ground cover in some areas led to it being classed as of lower value as fauna habitat.

Of 303 fauna species potentially occurring in the project area, 74 were recorded during the survey, consisting of 4 amphibian, 11 reptile, 46 bird and 13 mammal species, and representing 24% of the expected fauna for the project area.

One species recorded in the survey, Carnaby's Black Cockatoo (*Calyptorhynchus latirostris*) is listed as Endangered under the *Environment Protection and Biodiversity Conservation (EPBC) Act (1999)* and as Schedule 1 under the Wildlife Conservation Act (1950). Carnaby's Black Cockatoo generally requires large trees for roosting and tree hollows for nesting.

Evidence of feeding and roosting by Carnaby's Cockatoo was found at the site during the survey but not nesting. The feeding habitat extends across most of the native vegetation at the airport; however the roosting habitat consists of a small number of trees in three locations in the northern and central parts of the airport (**Figure 12**).

Other recorded species of conservation significance are the Western Brush Wallaby (*Macropus irma*) and the Southern Brown Bandicoot (*Isoodon obesulus fusciventer*), which are listed as Priority 4 and Priority 5 respectively by the Department of Environment and Conservation Western Australia. Habitat for these species is well represented elsewhere on the Swan Coastal Plain.

Habitats in the Jandakot Airport project area were well surveyed and are generally well represented in the Swan Coastal Plain region. The proposed disturbance by development, although likely to affect the representation of the habitats in the project area, will not have a significant impact on the broader representation of the habitats in the general area.

6.1.10 FAUNA MANAGEMENT

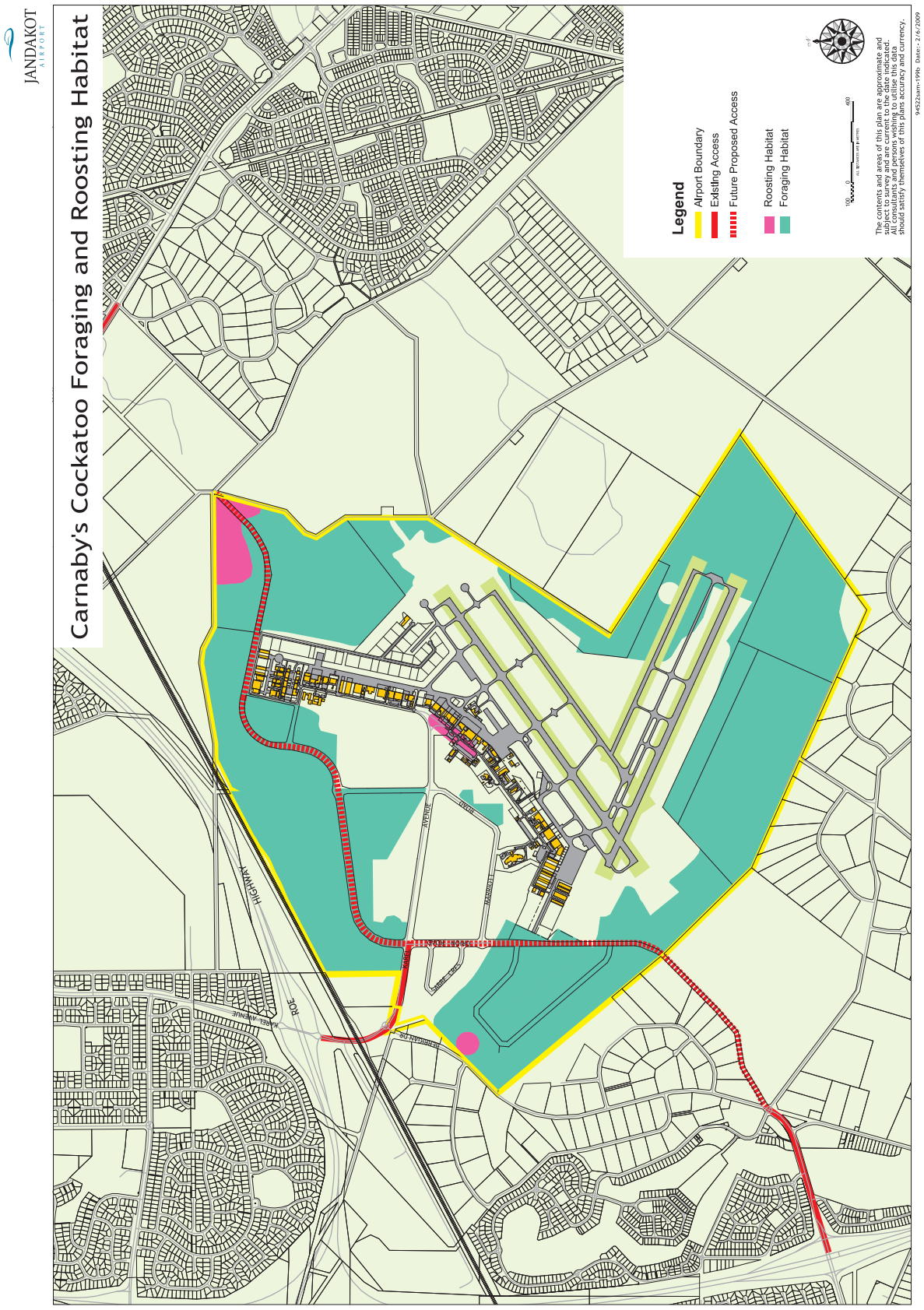
Jandakot Airport will continue to manage fauna to minimise risks to aviation operations, including the use of "Shu Roo" kangaroo deterrent system and bird fright cartridges, whilst maximising the biodiversity with the conservation area. In preparation for development works, fauna will be trapped and relocated to the conservation areas by specialist personnel. Management of Black Cockatoos is in line with airside safety management.

Management measures to address the impacts of clearing for development on fauna will be included in the Construction Environmental Management Plans and the Conservation Management Plan.

6.1.11 NATURAL HERITAGE

The *Australian Heritage Council Act, 2003* enables areas with natural and cultural significance to be listed on the Register of National Estate (RNE). All of the bushland at Jandakot Airport has been entered on the Register of the National Estate.

FIGURE 12 - CARNABY'S COCKATOO FORAGING AND ROOSTINGHABITAT



6.1.12 ENVIRONMENTALLY SIGNIFICANT AREAS

The *Airports (Environment Protection) Regulations 1997* indicate that the environmentally significant areas at the airport are based on recommendations in relation to biota, habitat and heritage from:

- The Australian Heritage Council;
- DEWHA; and
- relevant WA State Government bodies.

The Australian Heritage Council maintains the Register of the National Estate (RNE). As detailed in 6.1.11, all of the present bushland is listed on the RNE.

Under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), matters of national environmental significance (NES) require consideration from the Australian Government Minister for the Environment, Heritage and the Arts. This approval process is managed by DEWHA. There are seven matters of national environmental significance. These are:

- World Heritage properties;
- National Heritage places;
- Wetlands of international importance;
- Listed threatened species and ecological communities;
- Migratory species protected under international agreements;
- Commonwealth marine areas; and
- Nuclear actions (including uranium mines).

Jandakot Airport contains feeding habitat for Carnaby's Black Cockatoo (*Calyptorhynchus latirostris*), which is listed as Endangered under the EPBC Act (**Figure 12**). Two Endangered plant species, the Grand Spider Orchid (*Caladenia huegelii*) and Glossy-leaved Hammer Orchid (*Drakaea elastica*), have also been identified at Jandakot Airport.

Western Australian environmental legislation relevant to the determination of environmentally significant areas includes the *Wildlife Conservation Act 1950; the Environmental Protection Act 1986* and associated regulations and policies.

Under these items of legislation, the following matters would be considered factors in determining the environmentally significant areas at the airport:

- habitat for Carnaby's Cockatoo (*Calyptorhynchus latirostris*); and
- the presence of Declared Rare Flora, the Grand Spider Orchid (*Caladenia huegelii*) and the Glossy-leaved Hammer Orchid (*Drakaea elastica*).

In summary, the environmentally significant areas include all of the bushland at the airport, particularly that which is Carnaby's Black Cockatoo habitat. In addition, vegetation in proximity of a Grand Spider Orchid or Glossy-leaved Hammer Orchid is considered environmentally significant. For this reason, 27.3% of the airport land is proposed to be retained as conservation area and 185 Grand Spider Orchids will be retained in situ within this conservation area.

6.2 OBJECTIVES

JAH's objectives in this action area include:

- To identify environmentally significant areas;
- To manage protection of rare or endangered species within the Conservation Precincts;
- To forge a link between the presently fragmented Ken Hurst Park, Jandakot Regional Park and Jandakot Airport Conservation Areas;
- Successful rehabilitation of Precincts 7 and 8; and
- To retain flora, fauna and natural processes in designated conservation precincts.

6.3 ACHIEVEMENTS

Some of JAH's key achievements in biodiversity and conservation management include:

- Revegetation at the old Fire Training Area and the sand hill on the eastern edge of the site was completed in 2004;
- Tracks and trails not required for fire protection or other access purposes have been closed and remediated. Tracks in the north eastern area were closed and revegetated in 2006 and the tracks south west of Karel Avenue were closed and revegetated in 2007;

- A survey of Dieback affected areas was conducted in 2005 and indicated that there has been very little spread of the disease since the last survey;
- A Draft Dieback Management Plan has been prepared in 2008;
- Weed monitoring and weed control measures implemented for weed species including Skeleton Weed, Paterson's Curse and Victorian Tea Tree in 2005;
- Herbicide application procedures were modified in 2007 to reduce the potential for spray drift and groundwater contamination;
- A landscaping guideline has been formally adopted for use in landscaping of commercial and landside development with native species;
- Spring survey for declared rare flora (*Caladenia huegelii*) was undertaken by Cardno BSD in 2005;
- Bushland condition mapping was undertaken by Mattiske Consulting in 2006 to update their previous bushland condition study in 2001;
- Spring survey for declared rare flora (*Caladenia huegelii*) was undertaken by Mattiske Consulting in 2006 and 2007;
- Spring survey for declared rare flora (*Drakaea elastica*) was undertaken by Mattiske Consulting in 2008;
- The Shu Roo ultrasonic kangaroo deterrent system was further extended in 2005 to further reduce kangaroo incursions on to the runways;
- A fauna survey was conducted by ENV in Spring 2008 to update the previous study undertaken by Bamford Consulting in 2002;
- A Graceful Sun Moth (*Synemon gratiosa*) survey was undertaken in March and April 2009 by ENV;
- Biannual fox and rabbit baiting and quarterly feral cat trapping undertaken in 2006, 2007 and 2008.

6.4 COMMITMENTS

Table 6: Section 6.0 Commitments

Commitment	Target
Establishment of monitoring quadrats for Caladenia huegelli.	Quadrats established by October 2009.
Undertake an assessment of Caladenia huegelii monitoring quadrats in spring 2009.	To conduct this survey by November 2009.
Undertake an assessment of Caladenia huegelii monitoring quadrats in spring 2010.	To conduct this survey by November 2010.
Undertake an assessment of Caladenia huegelii monitoring quadrats in spring 2011.	To conduct this survey by November 2011.
Review of Caladenia huegelii monitoring.	To undertake a review by 2012.
Develop a monitoring program for Drakaea elastica as recommended by BGPA.	To develop this program by 2010.
Update the weed management plan.	For the Plan to be updated by 2011.
Use native species for landscaping in the development area.	Only native species to be planted onsite, as per Jandakot Design Guidelines November 2008.
Finalise and implement the Dieback Management Plan.	Implementation of the Dieback Management Plan by 2011.
Proposed rehabilitation of Precincts 7 & 8 or make payment to DEC in accordance with the EPBC Act Approval.	Precincts 7 & 8 rehabilitated in accordance with Rehabilitation Plan criteria by 2017.
Update the Conservation Management Plan, which incorporates management of conservation Precincts and rehabilitated areas and the requirements of the EPBC Act Approval.	Implementation of the updated Conservation Area Management prior to construction commencing.
Update the fire management plan.	For the Plan to be updated by 2011.
Update the flora and vegetation management plan.	For the Plan to be updated by 2011.
Update the fauna management plan.	For the Plan to be updated by 2011.
All translocation of fauna to be undertaken by qualified professionals.	Qualified professionals to be engaged prior to clearing.
Report against objectives and targets outlined in the Conservation Management Plan.	Reporting in accordance with the approved Conservation Management Plan.

7.0

WASTE MANAGEMENT

Jandakot Airport Environment Strategy

7 WASTE MANAGEMENT

This section considers both solid and liquid waste streams from both airport operations and tenants. Solid waste streams include construction and demolition waste, commercial wastes from airport operations and tenants and putrescible wastes from services such as aircraft maintenance facilities and flight schools which include accommodation. Liquid wastes are also generated by airport operations and commercial tenants. Traditionally, effluent from the airport has been disposed onsite via septic tanks and Aerobic Treatment Units (ATU). Hazardous liquid wastes, which include chemical and hydrocarbon waste, are transported and disposed in accordance with the WA *Environmental Protection (Controlled Waste) Regulations 2004*.

7.1 EXISTING ENVIRONMENT

7.1.1 EFFLUENT DISPOSAL

At present, none of the buildings at Jandakot Airport are connected to reticulated sewer and domestic wastewater systems on the site consist of septic tanks with leach drains and Aerobic Treatment Units (ATUs). All new commercial development will be connected to sewer and existing development will be progressively connected to sewer, to reduce the impact of domestic wastewater on groundwater quality.

7.1.2 SOLID AND HAZARDOUS WASTE DISPOSAL

All tenants at the airport store solid and recyclable waste in 240L Mobile Garbage Bins (MGBs). These bins are of solid plastic construction with lids. MGBs ensure that waste does not come into contact with and consequently does not contaminate stormwater and prevents vermin from accessing waste.

Solid and hazardous waste collection and disposal services are provided to all tenants onsite by waste contractors licensed under the *Environmental Protection (Controlled Waste) Regulations 2004*.

A tenant waste survey was conducted in 2006 to measure progress since the 2000 survey, however response rates were low and results inconclusive therefore the survey will be repeated in 2010.

Based on the number of solid waste bins and tenants at Jandakot Airport, it is estimated that, on average, 33 m^3 of solid waste is disposed per tenant per year.

7.1.3 RECYCLING

A co-mingled recycling service is provided to tenants at Jandakot Airport through waste contractors. Recyclable waste is stored in 240L MGBs with distinctive yellow lids to ensure recycling bins are clearly recognisable. Currently, 41% of tenants patronise the recycling service.

Based on the number of recycling bins and tenants at Jandakot Airport, it is estimated that, on average, 7 m^3 of recyclable waste is recycled per tenant per year.

JAH will promote the recycling service to all tenants to increase recycling uptake and minimise waste to landfill.

7.1.4 MONITORING

Tenant waste storage and disposal practices are monitored through regular tenant audits by JAH. As indicated in 2.5.9, a new tenant audit schedule will be developed and implemented.

Presently, there is no accurate record of the volumes of waste disposed by tenants of Jandakot Airport, as this information has not historically been provided by the waste contractors. JAH will undertake a baseline assessment of waste volumes disposed by tenants of the airport and biannual monitoring of waste volumes.

7.2 OBJECTIVES

JAH's objectives in this action area include:

- To minimise the quantities of waste produced;
- To ensure that wastes are properly stored, transported and disposed of;
- To encourage materials recycling;
- To progressively install reticulated sewer to the airport; and
- To prevent domestic wastewater from airport activities impacting upon groundwater quality and the Jandakot Underground Water Pollution Control Area (UWPCA).

7.3 ACHIEVEMENTS

7.3.1 WASTEWATER

- In 2005, JAH developed a maintenance register for all Aerobic Treatment Units (ATU) at the airport. Tenants are required to retain and provide auditable records for regular maintenance of all wastewater systems quarterly.
- The new commercial development will be connected to sewer and the installation of deep sewerage commenced in December 2007.

7.3.2 WASTE

- A tenant waste survey was conducted in 2006 to measure progress since the 2000 survey.

7.4 COMMITMENTS

Table 7: Section 7.0 Commitments

Commitment	Target
Connect all existing and new development to deep sewer.	All new development to be connected to deep sewer. All airport development connected to deep sewer by 2019.
Conduct a follow up tenant waste survey in 2009.	Accurate record of airport waste disposal.
Advertise recycling service annually.	Increase in recycling patronage.
Development of updated tenant audit schedule, in accordance with tenant risk classification.	For an updated tenant audit schedule by 2010.
Conduct targeted audits of tenant sites.	For all audits to be undertaken in accordance with tenant audit schedule by 2014.
Determine baseline waste volumes.	Record of airport waste disposal.
Biannual monitoring of waste volumes.	Record volume of waste to landfill.

8.0

WATER AND ENERGY MANAGEMENT

Jandakot Airport Environment Strategy

8 WATER AND ENERGY MANAGEMENT

8.1 EXISTING ENVIRONMENT

Jandakot water supply is provided by both scheme and groundwater. Irrigation is largely supplied from groundwater with some areas supplied from reclaimed wastewater. All electricity is provided via mains power. Improved water and energy use efficiency opportunities will be pursued in existing and new airport and commercial development.

JAH provides electricity and scheme water to all tenants and monitors consumption across the airport.

8.1.1 ELECTRICITY CONSUMPTION

The table below shows the annual electricity consumption at Jandakot Airport since the Environment Strategy 2004:

TABLE 8: ANNUAL ELECTRICITY CONSUMPTION SINCE 2004

	Reporting Period			
	June 2004 – June 2005	June 2005- June 2006	June 2006 – June 2007	June 2007 – June 2008
Electricity Consumption (kWh)	3,417,271	3,733,680	3,950,220	4,114,786

Electricity consumption has increased by 20% at Jandakot Airport. This is attributed to an increase in the number of buildings and businesses operating at the airport.

In 2010, JAH will conduct a baseline greenhouse gas emissions inventory of its greenhouse gas emissions. JAH will then monitor the airport's ground based greenhouse gas emissions annually to legislative requirements.

8.1.2 WATER CONSUMPTION

The table below shows the annual scheme water consumption at Jandakot Airport since the Environment Strategy 2004:

TABLE 9: ANNUAL SCHEME WATER CONSUMPTION SINCE 2004

	Reporting Period			
	August 2004 - August 2005	August 2005- August 2006	August 2006 -August 2007	August 2007 - August 2008
Scheme Water Consumption (kL)	71,370	53,665	53,127	56,754

Water consumption has decreased by 20% since the Environment Strategy 2004; however with the proposed commercial development, this is likely to increase over time.

8.1.3 SUSTAINABILITY FRAMEWORK

A Sustainability Framework has been developed for the airport (**REFER TO APPENDIX A**). This outlines the sustainability initiatives to be undertaken across Jandakot Airport at the infrastructure and land development scale in terms of reducing the use of energy, water, waste, materials and transport over the next 20 years. This Framework will commence implementation over the next 5 years.

8.1.4 GREEN STAR

The Green Star tools, developed by the Green Building Council of Australia (GBCA) are predictive building sustainability framework tools which provide an overall score to signify best practice. As these are Australia-wide tools, buildings with Green Star accreditation (i.e. 4 star and above) lead the market and are widely recognised as innovative buildings.

JAH has committed to ensuring that all new office buildings constructed at the airport have a minimum 4 Star Green Star Certified Rating, in accordance with the Green Star building rating tools developed by the Green Building Council of Australia (GBCA). This includes the proposed new green warehouse and distribution precinct in Precinct 5 of the Master Plan 2009.

8.1.5 WATER EFFICIENCY MANAGEMENT PLAN

In consultation with the Water Corporation, Western Australia's largest water and wastewater services provider, JAH has developed a Water Efficiency Management Plan for the next 5 years.

The objectives of the Plan are to:

- Assess current water used on site from all sources (eg. scheme, self supplied groundwater, recycled, reclaimed etc);
- Identify inefficiencies and potential water conservation measures (including savings);
- Prepare an action plan to implement water conservation actions;
- Provide a platform for annual reporting on implementation of water conservation actions; and
- Monitor existing tenant usage and direct new developments to be water wise in design and construction.

The WEMP includes the following actions during the next five years:

- Advise tenants of improved Waterwise procedures as they come to hand through the quarterly Skylines newsletter;
- Plant Stage 1 commercial development area with drought-resistant native plants;
- Plant tenant sites (commercial development area) with drought-resistant native plants;
- Install green rating appliances and dual flush toilet systems in new commercial buildings; and
- Install water meters to each new commercial development tenanted site.

8.2 OBJECTIVES

JAH's objectives in this action area include:

- To reduce airport water demand;
- To reduce airport energy demand;
- To encourage the use of alternative sources of energy and water; and
- To reduce airport non-renewable resource use.

8.3 ACHIEVEMENTS

Achievements to date since 2004 include:

- Tenants encouraged to use water and energy efficiently;
- Timers for the plant nursery have been installed to limit watering times and save water;
- Completion of the first 4 Star Green Star Certified Rating office building at the airport;
- Development of a Water Efficiency Management Plan in consultation with the Water Corporation of Western Australia; and
- Development of a Sustainability Framework for Jandakot Airport.

8.4 COMMITMENTS

TABLE 10: SECTION 8.0 COMMITMENTS

Commitment	Target
To implement the Sustainability Framework for Jandakot Airport.	Implementation of Sustainability Framework by 2014.
To develop a baseline greenhouse gas emissions inventory.	Legislative Compliance.
To monitor and report on energy usage at the airport.	Accurate record of airport energy usage by 2010.
To ensure new office buildings constructed at the airport have a minimum 4 Star Green Star Certified Rating.	All new office buildings at the airport with a minimum 4 Star Green Star Rating.
Implement a Water Efficiency Management Plan.	Reduction in water use.
To monitor and report on water usage at the airport.	Accurate record of airport water usage per tenanted facility by 2010.

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9.0

NOISE MANAGEMENT

Jandakot Airport Environment Strategy

9 NOISE MANAGEMENT

Aircraft noise is the most obvious potential environmental impact on the community surrounding Jandakot Airport. The regulations (and therefore the Environment Strategy) do not apply to pollution generated by aircraft, nor to noise generated by aircraft in flight, landing, taking off or taxiing at the airport, which are covered by the *Air Services Act 1995, the Air Navigation (Aircraft Energy Emissions) Regulations* and *Air Navigation (Aircraft Noise) Regulations*, which are regulated by Air Services Australia.

The Airport (Environment Protection) Regulations do, however, apply to noise derived from tenant and construction operations. Noise from aircraft is covered in the Jandakot Airport Master Plan 2009.

9.1 EXISTING ENVIRONMENT

9.1.1 AIRCRAFT NOISE

The nearest house to the airport is within 750 metres of the southern end of the main runways, while the closest housing to the north-west of the main runways is approximately 1.5 km. The closest urban residential development to the airport is approximately 2.5 km north-east of the main runways (WAPC, 2006).

Prior to 2006-7, aircraft noise complaints were not recorded and complainants were given the contact details for Airservices Australia (ASA). In 2006-7, aircraft noise complaints were recorded in the Environmental Site Register prior to complainants being given ASA's contact details. A summary of the number of noise complaints received by JAH is presented in the table below:

Table 11: Number of Aircraft Noise Complaints

	2004-5	2005-6	2006-7	2007-8
Aircraft Noise	0	0	36	28
Ground Noise	0	1	0	0

A number of initiatives both onsite and offsite mitigate the impacts of aircraft noise. These include:

- The Fly Neighbourly policy, which all aircraft flying at Jandakot Airport must comply with;
- The Jandakot Airport Consultative Committee, which comprises representatives from Cockburn, Canning, Melville and Gosnells City Councils, Air Services Australia (ASA), Civil Aviation Safety Authority (CASA), Department of Planning and Infrastructure (DPI), industry members, community action group representatives and JAH staff; and
- Jandakot Airport Noise Information Package for local residents and prospective local residents, which is available on JAH's website.

Whilst JAH informs prospective local residents through the Jandakot Airport Noise Information Package, JAH encourages local councils and the WA Planning Commission to adopt mechanisms for informing prospective residents about noise impacts from Jandakot Airport.

9.1.2 GROUND NOISE

Ground based noise at the airport is predominantly from tenant operations and construction activities.

Tenant Operational Environmental Management Plans are required to address noise management and all tenants will be required to have an Operational Environmental Management Plan in place by 2015.

Construction activities are required to be undertaken in accordance with a Construction Environmental Management Plan, which must include noise management measures.

Due to the relatively benign land uses proposed in the commercial precincts (office, showroom, storage and warehouse) it is unlikely that there will be any significant noise impacts created offsite. The majority of the commercial precincts are remote from residential areas, and where they adjoin rural-residential areas or where particularly noisy activities are proposed to be located on the Airport, consideration of buffers as outlined in State Policy will be used to determine suitable locations for such activities and suitable noise attenuation measures for the sites and buildings.

9.1.3 MONITORING

Should there be complaints regarding ongoing excessive ground based noise, noise monitoring will be undertaken. This monitoring will be undertaken in accordance with the *Airports (Environment Protection) Regulations 1997* and the relevant Australian Standards, against the limits outlined in Schedule 4 of the *Airports (Environment Protection) Regulations 1997*.

9.2 OBJECTIVES

JAH's objectives in this action area include:

- To minimise the impact of ground based noise on tenants, employees and visitors at Jandakot Airport.

9.3 ACHIEVEMENTS

- A new Australian Noise Exposure Forecast (ANEF) for aircraft operations at Jandakot Airport was endorsed by Airservices Australia in 2009.
- Tenant noise emissions – China Southern have built a new engine testing facility with sound proof baffles which significantly reduce the ground noise from their operations.
- The number of noise complaints received by JAH has reduced.

9.4 COMMITMENTS

TABLE 12: SECTION 9.0 COMMITMENTS

Commitment	Target
Continue to promote the "Fly Neighbourly" principles to airport users by the distribution of campaign flyers.	Annual distribution of Fly Neighbourly principles material to all tenants.
Disseminate relevant noise amelioration measures suggested by the Jandakot Airport Consultative Committee to airport users.	To ensure noise amelioration measures are distributed within one month of suggestion.
Review and update the Jandakot Noise Information Package.	To review and update the JNIP by 2012.
Encourage local councils and the WA Planning Commission to adopt mechanisms for informing prospective residents about noise impacts from Jandakot Airport.	Formal approach to WAPC by 2012.
For all tenants to have operational Environmental Management Plans.	No increase in ground based noise complaints.
Construction Environmental Management Plans required for all construction activities.	No increase in ground based noise complaints.

10.0

CULTURAL HERITAGE

Jandakot Airport Environment Strategy

10 CULTURAL HERITAGE

10.1 EXISTING ENVIRONMENT

10.1.1 NATIVE TITLE

Two applications of Native Title lodged with the National Native Title Tribunal are applicable to Jandakot Airport. Both the claims cover the Perth Metropolitan Region. The Native Title Claims covering Jandakot Airport are the Combined Metropolitan Working Group (WC03/6 WAD6006/03– Active) and the Ballaruks Peoples (WC95/86 WAD149/98– Active) (AIC, 2008).

10.1.2 INDIGENOUS HERITAGE

O'Connor et al, (1990) conducted an extensive ethnographic and archaeological survey for aboriginal sites at Jandakot Airport. The ethnographic survey was conducted through the review of the existing ethnographic database, consultation with Aboriginal people from the Jandakot region and site visits with Aboriginal spokespersons. This study concluded that there were no previously recorded sites and no new sites of significance at Jandakot Airport.

Australian Interaction Consultants conducted an extensive ethnographic and archaeological survey for aboriginal sites at Jandakot Airport in 2008, which confirmed the findings of the O'Connor et al survey in 1990. This survey included liaison with the WA Department of Indigenous Affairs, review of previously conducted surveys in the vicinity of the Airport, an archaeological survey and an ethnographic survey with a number of groups, including those with a Native Title Claim: the Combined Metropolitan Working Group, Independent Aboriginal Environment Group, Ballaruk and Bibbulmun groups and the Jacobs family.

Three sites (artefact scatters) were previously recorded on a register of Aboriginal heritage sites kept by the Western Australian Department of Indigenous Affairs however none of these sites could be located in 2008. Updates have been submitted to the Department of Indigenous Affairs for these three sites. In conclusion, the study found:

No new ethnographic or archaeological sites were identified; however, it was identified that:

- There is potential for intact archaeological deposits which may contain cultural materials in undisturbed areas of Jandakot Airport. Monitoring of activities is recommended;
- Previously identified sites (DIA 4309 Princep Road, DIA 4310 Kelso Road and DIA 4311 Acourt Road) are no longer sites within the meaning of Section 5 of the Act;
- DIA 3513 Lukin Swamp could not be located within Jandakot Airport;
- At this time, a Section 18 application is not required for the Jandakot Airport Master Plan to proceed.

10.1.3 EUROPEAN HERITAGE

The Jandakot Airport site, prior to development of the airport, was settled in 1867 for grazing purposes and was gazetted as the Jandakot Agricultural Area in 1899 (Dames and Moore, 1993). No European heritage sites have been registered with the National Trust, Western Australian Heritage Council or the City of Cockburn. There are also no visible signs of European heritage on site.

10.1.4 HERITAGE MANAGEMENT

JAH has a Cultural Heritage Management Plan for managing heritage values at the airport.

This Plan will be reviewed and updated to incorporate the findings of the AIC study.

10.1.5 CONSTRUCTION AND HERITAGE

All development must be undertaken in accordance with a Construction Environmental Management Plan (CEMP). CEMPs will include a procedure whereby, should construction personnel discover any culturally significant artefact, expert archaeological advice will be sought. This will include liaison with the WA Department of Indigenous Affairs and relevant Aboriginal communities as appropriate.

10.2 OBJECTIVES

JAH's objectives in this action area include:

- To minimise the impact of airport activities on cultural heritage areas; and
- To minimise the impact of airport development on cultural heritage areas.

10.3 ACHIEVEMENTS

Achievements to date since 2004 include:

- The airport site was resurveyed for Indigenous archaeological and ethnographic heritage by Indigenous Heritage Consultants in 2008.

10.4 COMMITMENTS

Table 13: Section 10.0 Commitments

Commitment	Target
Review and update Cultural Heritage Management Plan.	Plan reviewed by 2010.
Monitoring of clearing and earth disturbance for Aboriginal and European heritage by construction personnel.	No disturbance to archaeological artefacts without approval.

11.0

AIRPORT DEVELOPMENT

Jandakot Airport Environment Strategy

11 AIRPORT DEVELOPMENT

This section of the Environment Strategy presents the current and proposed development of the Jandakot Airport in accordance with the Master Plan 2009. It includes the mission statement and development objectives, historical context to development of the site, the potential environmental impacts of the proposed development and how these impacts will be mitigated and managed.

11.1 DEVELOPMENT CONCEPT

Jandakot Airport Holding's vision is to successfully develop and manage Jandakot Airport as a strategically significant aviation hub with a supporting business campus hub. Objectives have been established to achieve the vision relating to airport safety and security, airport capacity and operating efficiency, environmental and sustainability compatibility and financial viability.

11.1.1 DEVELOPMENT OBJECTIVES

The following objectives relevant to the environment have been established while preparing the Master Plan:

Improve and manage environmental inputs by:

- Identifying and protecting areas of environmental significance;
- Managing environmental outcomes;
- Strengthening neighbour land use planning through the adoption of consistent zones and land uses in the Master Plan that reflect adjoining local government areas;
- Supporting the Airservices Australia noise complaint line;
- Facilitating the Jandakot Airport Community Consultative Committee;
- Ongoing education and promotion of the Fly Neighbourly Campaign;
- Implementing and maintaining airport and tenant Environmental Management Plans;
- Promoting standard operating procedures for aircraft running and engine testing;
- Commitment to the principles of sustainability in terms of reducing the airport's overall use of energy, water, waste, high embodied energy materials and private vehicle use; and
- Ensuring that the principles of sustainability are implemented both in land development and the built form of the estate.

The development objectives of the airport aim to define land uses and generate a development plan which:

- Integrates and has consideration for the aeronautical requirements, development strategy and conservation issues on the airport; and
- Uses the latest 'best practice' planning solutions.

Ensure the financial viability of Jandakot Airport by:

- Upgrading and maintaining existing infrastructure; and
- Sustainable commercial development of surplus land.

11.2 HISTORICAL CONTEXT TO LAND USE

Most of Jandakot Airport is reserved Public Purpose – Commonwealth Government in the Perth Metropolitan Region Scheme (MRS). Airport land has been divided into three general land uses:

- Airport Movement Area and Facilities;
- Conservation Precincts; and
- Non-Aviation Development.

The principles for Jandakot Airport's future development were approved in the 2000 and 2005 Master Plans and are continued in the Master Plan 2009.

The major components of the Master Plan 2009 are:

- The Fourth runway;
- Conservation Precinct 1A and 1B for the protection of rare orchids;
- Proposed Eastern access road;
- Commercial development of Precinct 5;
- Proposed rehabilitation of Precincts 7 and 8 or make payment to DEC in accordance with the EPBC Act Approval Condition; and
- Potential future commercial and aviation development of Precinct 6.

11.3 POTENTIAL ENVIRONMENTAL IMPACTS

In accordance with the EPBC Act no more than 167 hectares of native vegetation is to be cleared within Precincts 1B, 3, 4 and 5. Clearing must be undertaken in a staged manner, with clearing only to occur in areas in which construction will commence in the following 12 months.

11.3.1 THE FOURTH RUNWAY

Provision of the planned fourth runway and associated taxiways is the most significant aviation planning issue for the airport. Its provision will significantly increase safety at the airport. In addition, the opening of the fourth runway will reduce delays and consequently reduce emissions from aircraft.

This will entail clearing of approximately 39 ha of vegetation to the north of Precinct 2 to accommodate the runway and associated grassed runoff area. Fauna from the cleared area will be progressively directed into the larger retained area to the south, away from airport operations.

11.3.2 CONSERVATION PRECINCT FOR THE PROTECTION OF RARE ORCHIDS

The previously approved Master Plan proposed that Precinct 1A be developed for commercial land use. Subsequent flora surveys have identified a number of Grand Spider Orchids (*Caladenia huegelii*) on site, some of which were in the proposed development precinct.

Following consultation with the Department of the Environment, Water, Heritage and the Arts, JAH proposes to retain Precinct 1A, previously identified for commercial development, for conservation. This Precinct contains the majority of the rare flora at the airport and, importantly, maintains an ecological linkage to Ken Hurst Park which is bushland reserve to the north of the Jandakot Airport. Ken Hurst Park has the largest known population of the Grand Spider Orchid (*Caladenia huegelii*).

JAH have consulted widely, including the Department of Conservation and Environment WA, Botanic Gardens and Parks Authority and propose the exchange of Precinct 1A for Precinct 5. This will ensure that the majority of the orchids are retained in situ. This will have environmental benefits of maintaining the orchid population on Jandakot in a contiguous link with the orchid population at Ken Hurst Park within a total contiguous bushland habitat area of 129 ha.

Preservation of Precincts 1A and 1B (78 ha) for conservation will maintain the ecological linkage to Ken Hurst Park, an area of 51 ha of bushland, which also supports the Grand Spider Orchid (*Caladenia huegelii*). This will ensure that retention of habitat including pollinators (specific species of wasp) and mycorrhizae (soil fungi). The opportunity for a joint management of Ken Hurst Park will also be investigated with key stakeholders.

Precincts 1A, 1B and 2 will be conserved in perpetuity with the exception of that land required for the eastern access road.

11.3.3 EASTERN ACCESS ROAD

To facilitate access to the new commercial areas from the north east, a new access road (Eastern Link) is proposed through Precinct 1B. This will consist of a dual carriage way approximately 10 m wide for an estimated length of 375 m. The construction of the road will require clearing of 6 ha of vegetation, re-contouring including battering of some slopes.

Precinct 1B will retained for conservation. The Construction Environmental Management Plan (CEMP) for the Eastern link access road will include:

- Pre clearing salvage, seed collection and removal of topsoil;
- Construction of fencing and fauna underpasses (culverts) at strategic locations; and
- Revegetation with tree species along the road verges will reduce the potential for traffic impacts on fauna particularly Black Cockatoos.

The precise location of the East Link road is yet to be determined.

11.3.4 COMMERCIAL DEVELOPMENT

In exchange for the reservation of Precinct 1A, the development of Precinct 5 (40 hectares), is proposed. It is isolated from the remaining conservation precinct and is next to the existing commercial area. Precinct 5 is proposed for a "green distribution and warehouse" precinct.

The majority of this precinct is within in the Jandakot Groundwater Mound Area. JAH have established that this Precinct can be designed to ensure that it poses no additional risk to groundwater quality. This will be in the form of a risk assessment and a combination of structural and non structural stormwater controls and the existing Airport Environmental regulations.

Commercial precincts will be cleared on a staged basis and seed and plant material will be salvaged, as well as topsoil removed, for the rehabilitation of Precincts 7 and 8.

11.3.5 REHABILITATION OF PRECINCT 7 AND 8

Under the Master Plan 2009, Precinct 6 is proposed for future aviation and non-aviation development, subject to the successful rehabilitation of approximately 90 ha of Precincts 7 and 8, former sand extraction areas to the east of the airport or with payments to DEC in accordance with the EPBC Act Approval Conditions.

The areas currently form a buffer to the airport from surrounding urban development and are not suitable for development. JAH propose to undertake rehabilitation of these areas to complement the retention of Conservation Precincts 1A, 1B and Ken Hurst Park and create an ecological corridor of over 650 ha via the Acourt Road Bushland through to the Jandakot Regional Park to the south (**Figure 12**). Jandakot Regional Park is approximately 3,800 ha which stretches as far south as Casuarina Prison (approximately 34 kilometres south east of the Perth central business district). Rehabilitation of Precincts 7 and 8 by JAH will have significant environmental benefits in linking currently isolated areas of bushland with ongoing environmental management to ensure that the integrity and ecological values of the conservation bushland are retained.

Vegetative material in the form of salvaged tubers, seed, mulch and topsoil from staged clearing will be used in the rehabilitation of Precincts 7 and 8.

The rehabilitation of Precincts 7 and 8 will take place in a staged approach, in accordance with the Rehabilitation Plan (Refer to Appendix C), over a period of 7 years.

Baseline surveys will be carried out on the remnant site vegetation and immediately connecting areas of similar landform prior to any on-ground works to address the following:

- Vegetation – species diversity, species cover, condition and health;
- Fauna – feral and natives;
- Presence of *Phytophthora cinnamomi* (Dieback);
- Extent of erosion;
- Level of disturbance;
- Presence of weeds; and
- Activity of feral animals.

Local provenance seed collection will occur in all JAH precincts. All seed collection will be undertaken by suitably licensed operators and statutory returns recording all seed collected will be submitted to DEC on a quarterly basis.

Plants are proposed to be salvaged from areas to be cleared at the airport and areas in Precincts 7 and 8 which will be disturbed by earthworks. Plants to be salvaged include small, understory plant species and larger, slow growing iconic species such as *Xanthorrhoea preissii*, (Grass tree) *Macrozamia reidlei* (Zamia) and *Nuytsia floribunda* (Western Australian Christmas Tree). Salvaged plants will be transplanted into pots, and stored in the Jandakot Airport nursery and managed until planted out.

Plant propagation will be undertaken in nurseries certified as accredited under the Nursery Industry Accreditation Scheme Australia (NIASA) guidelines. Upper storey Banksia woodland species (*Banksia, Allocasuarina* and *Eucalyptus* spp.) will be propagated in nurseries, with the majority of understorey species to be derived from direct seeding, natural regeneration and salvaged plant return.

The surface of the rehabilitation area will be recontoured as required with topsoil and mulch from cleared areas at the airport. Where recontouring may require clearing of vegetation, clearing permits will be obtained from the WA Department of Environment and Conservation.

Rehabilitation areas will be progressively fenced and subject to weed management spraying. Rabbit baiting will be undertaken in the rehabilitation area.

After initial plantings, rehabilitation areas will be irrigated until plants are well established. Each rehabilitation zone will be irrigated for two years.

Rehabilitated areas will be monitored biannually against agreed bushland regeneration success criteria.

11.3.6 FUTURE DEVELOPMENT

Precinct 6 is an area of 53 ha proposed to be developed for commercial and aviation uses in the longer term (10–20 years) following meeting the requirements of the EPBC Act Approval. The development of Precinct 6 is conditional on the rehabilitation of these areas to a set of objective criteria as outlined in the Rehabilitation Plan (Refer to Appendix C) and will involve ongoing environmental management by JAH.

11.3.7 CONSTRUCTION

Management measures to control environmental issues during the construction period are included in Construction Environmental Management Plans. These issues include:

- Clearing of vegetation;
- Stormwater run off , erosion and sediment control;
- Dewatering;
- Dust generation from earthworks;
- Waste minimisation;
- Noise;
- Heritage;
- Dieback and soil management;
- Fauna management; and
- Other requirements identified in the EPBC Act Approval.

11.4 DEVELOPMENT ENVIRONMENTAL COMMITMENTS

In the next five years, JAH's commitments include:

Table 14: Section 11.0 Commitments

Commitment	Target
New development on the site to be undertaken in an environmentally responsible manner.	Prepare and implement Construction Environmental Management Plans for all new development.
Preparation of a Construction Environmental Management Plan for the eastern access road through Conservation Precinct 1B.	Prepare and implement Construction Environmental Management Plan for eastern access road route.
Develop criteria for rehabilitation of Precincts 7 & 8 to ensure that they will be to an acceptable standard.	Precincts 7 & 8 rehabilitated in accordance with Rehabilitation Plan criteria by 2017.
No more than 167 hectares of native vegetation within precinct 1B, 3, 4 and 5 to be cleared..	Prepare and implement management plan for the staged clearing.

12.0

IMPLEMENTATION

Jandakot Airport Environment Strategy

12 IMPLEMENTATION

JAH's Environmental Management System (EMS) provides the tools and framework within which this Environment Strategy is implemented. The EMS is reviewed and updated as required to ensure information and management measures are current and work towards continual improvement.

12.1 ACTION AREA COMMITMENTS AND TARGETS

The table below presents a summary of all of the commitments and targets.

Table 15: Summary of all Commitments and Targets

Action Area	Commitment	Target
Environmental Management System	Review and update JAH Environmental Management System (EMS).	JAH EMS, Management Plans and tenant EMPs integrated by 2014.
	Review and update all Management Plans for environmental issues.	All Management Plans for environmental issues to be updated by 2014.
	Guidelines for tenant Environmental Management Plans to be produced, assisting tenants to manage the environmental impacts of their activities.	70% of tenants to have Operational EMPs by 2013.
	Development of Annual Environmental Action Plans (EAPs).	The first Annual EAP to be implemented by 2010.
	All new JAH staff to undergo induction training. This training will include: energy, water, resource use, biodiversity management, waste management and the JAH EMS.	All new JAH staff to undergo induction training within 3 months of commencing work.
	Review of tenant risk classification tool.	Appropriate classification of tenant risk by 2010.
	Development of updated tenant audit schedule, in accordance with tenant risk classification.	An updated tenant audit schedule prepared by 2010.
	Conduct regular audits of tenant sites.	All audits to be undertaken In accordance with tenant audit schedule by 2014.
	All airport environmental procedures to be reviewed and updated.	All environment procedures to be updated by 2014
	Undertake monitoring of groundwater.	Identify any groundwater contamination on an ongoing basis.
	Commence air quality monitoring.	Implement an air quality monitoring program by 2014.
	Monitoring of biodiversity at the airport.	Undertake follow up flora and fauna surveys by 2014.
	Monitoring of energy and water use.	Obtain accurate data on energy and water usage across the airport by 2010.
	Quarterly reporting of monitoring to airport Environment Officer.	Quarterly reports to be compiled every quarter.
	Undertake Quarterly and Annual Environmental Reports.	Annual reports to be compiled.
	Review and update the JAH Environmental Management Framework.	Review to be complete by end of 2014.

Action Area	Commitment	Target
	Environment Strategy 2009 to be made available to tenants and the public on the JAH website.	Environment Strategy 2009 to be placed on the JAH website.
	Compliance with conditions of EPBC Act Approval dated 25 March 2010.	Clearance of conditions as required by the Approval.
Soil and Water Quality	All deep excavation at the airport to be the subject of an Acid Sulphate Soil investigation.	ASS to be appropriately managed during excavation works.
	Suspected contaminated sites to be investigated through Environmental Site Assessments of tenant sites on expiry of lease.	Existing contaminated sites to be identified and remediated appropriately.
	To work with tenants to facilitate EMPs for all businesses.	All tenants to have EMPs by 2015.
	To ensure all wastewater is disposed of appropriately.	All wastewater to be disposed to sewer within 10 years.
	To work with tenants to prevent and manage spills and discharges.	70% of tenants to have EMPs by 2013
	To implement the Local Water Management Strategy	Implementation of the Local Water Management Strategy by 2011.
	Groundwater monitoring to occur regularly.	For groundwater monitoring to be undertaken
	Preparation of a Jandakot Groundwater Management Plan.	Within 4 months of the EPBC Act approval.
Air Quality	To develop a baseline ambient air quality monitoring program for the airport.	Implementation of ambient air quality monitoring program by 2014.
	JAH will comply with relevant Commonwealth air quality and climate change legislation as it comes into effect.	Legislative compliance.
	To educate tenants to phase out the use of Ozone Depleting Substances (ODS) at the airport.	No ODS in use at the airport (apart from exempt aircraft).
	To work with tenants and contractors onsite to minimise dust.	A reduction in dust or air quality related complaints.
	To advocate for and facilitate public transport access to the airport.	To apply for public transport networks to connect to the airport. In the interim, JAH will provide a shuttle bus service from Murdoch Station to the airport.
Biodiversity and Conservation Management	Establishment of monitoring quadrats for Caladenia huegelli.	Quadrats established by October 2009.
	Undertake an assessment of Caladenia huegelii monitoring quadrats in spring 2009.	To conduct this survey by November 2009.
	Undertake an assessment of Caladenia huegelii monitoring quadrats in spring 2010.	To conduct this survey by November 2010.
	Undertake an assessment of Caladenia huegelii monitoring quadrats in spring 2011.	To conduct this survey by November 2011.
	Review of Caladenia huegelii monitoring.	To undertake a review by 2012.
	Develop a monitoring program for Drakaea elastica as recommended by BGPA.	To develop this program by 2010.
	Update the weed management plan.	For the Plan to be updated by 2011.
	Use native species for landscaping in the development area.	Only native species to be planted onsite, as per Jandakot Design Guidelines November 2008.
	Finalise and implement the Dieback Management Plan.	Implementation of the Dieback Management Plan by 2011.
	Proposed rehabilitation of Precincts 7 & 8 or other land in accordance with the EPBC Act Approval.	Precincts 7 & 8 rehabilitated in accordance with Rehabilitation Plan criteria by 2017.

Action Area	Commitment	Target
	Update the Conservation Management Plan, which incorporates management of conservation Precincts and rehabilitated areas and the requirements of the EPBC Act Approval.	Implementation of the updated Conservation Area Management prior to construction commencing.
	Update the fire management plan.	For the Plan to be updated by 2011.
	Update the flora and vegetation management plan.	For the Plan to be updated by 2011.
	Update the fauna management plan.	For the Plan to be updated by 2011.
	All translocation of fauna to be undertaken by qualified professionals.	Qualified professionals to be engaged prior to clearing
	Report against objectives and targets outlined in the Conservation Management Plan.	Reporting in accordance with the approved Conservation Management Plan.
Waste Management	Connect all existing and new development to deep sewer.	All new development to be connected to deep sewer. All airport development connected to deep sewer by 2019.
	Conduct a follow up tenant waste survey in 2009.	Accurate record of airport waste disposal.
	Advertise recycling service annually.	Increase in recycling patronage.
	Development of updated tenant audit schedule, in accordance with tenant risk classification.	For an updated tenant audit schedule by 2010.
	Conduct targeted audits of tenant sites.	For all audits to be undertaken in accordance with tenant audit schedule by 2014.
	Determine baseline waste volumes.	Record of airport waste disposal.
	Biannual monitoring of waste volumes.	Record volume of waste to landfill.
Water and Energy Management	To implement the Sustainability Framework for Jandakot Airport.	Implementation of Sustainability Framework by 2014.
	To develop a baseline greenhouse gas emissions inventory.	Legislative Compliance.
	To monitor and report on energy usage at the airport.	Accurate record of airport energy usage by 2010.
	To ensure new office buildings constructed at the airport have a minimum 4 Star Green Star Certified Rating.	All new office buildings at the airport with a minimum 4 Star Green Star Rating.
	Implement a Water Efficiency Management Plan.	Reduction in water use.
	To monitor and report on water usage at the airport.	Accurate record of airport water usage per tenanted facility by 2010.
Noise management	Continue to promote the "Fly Neighbourly" principles to airport users by the distribution of campaign flyers.	Annual distribution of Fly Neighbourly principles material to all tenants.
	Disseminate relevant noise amelioration measures suggested by the Jandakot Airport Consultative Committee to airport users.	To ensure noise amelioration measures are distributed within one month of suggestion.
	Review and update the Jandakot Noise Information Package.	To review and update the JNIP by 2012.
	Encourage local councils and the WA Planning Commission to adopt mechanisms for informing prospective residents about noise impacts from Jandakot Airport.	Formal approach to WAPC by 2012.

Action Area	Commitment	Target
	For all tenants to have operational Environmental Management Plans.	No increase in ground based noise complaints.
	Construction Environmental Management Plans required for all construction activities.	No increase in ground based noise complaints.
Cultural Heritage	Review and update Cultural Heritage Management Plan.	Plan reviewed by 2010.
	Monitoring of clearing and earth disturbance for Aboriginal and European heritage by construction personnel.	No disturbance to archaeological artefacts without approval.
Airport Development	New development on the site to be undertaken in an environmentally responsible manner.	Prepare and implement Construction Environmental Management Plans for all new development.
	Preparation of a Construction Environmental Management Plan for the eastern access road through Conservation Precinct 1B.	Prepare and implement Construction Environmental Management Plan for eastern access road route.
	Develop criteria for rehabilitation of Precincts 7 & 8 to ensure that they will be to an acceptable standard.	Precincts 7 & 8 rehabilitated in accordance with Rehabilitation Plan criteria by 2017.
	No more than 167 hectares of native vegetation within precinct 1B, 3, 4 and 5 to be cleared..	Prepare and implement management plan for the staged clearing.

12.2 PERFORMANCE MONITORING

Ongoing evaluation is a key activity in order to ensure that the Jandakot Airport is achieving its environmental objectives and targets. This involves measuring performance, evaluating compliance with legislation and standards, and ensuring that the EMS adequately addresses environmental impacts.

Performance indicators which are recorded by JAH include:

- Groundwater monitoring of liquid wastes and hazardous materials storage;
- Quantity and quality of waste water and air emissions;
- Solid and liquid waste disposal volumes;
- Noise emissions from aircraft run-ups outside of designated areas;
- Fauna hazard sightings and management;
- Maintenance of conservation areas;
- Power consumption;
- Water consumption; and
- Vehicle fuel efficiency.

All monitoring must be undertaken by a suitably qualified person; with an appropriate industry recognised qualification. All monitoring must be performed in accordance with the relevant Australian Standards, the *Airports (Environment Protection) Regulations 1997* and appropriate state legislation.

Performance monitoring will also be undertaken in accordance with the Conditions of the EPBC Act Approval.

12.3 CONTINGENCY AND CORRECTIVE ACTION

Findings and recommendations reached through evaluation processes are documented so that corrective action can be tracked. The JAH EMS includes procedures to identify and control non-conformance, including:

- Incidents;
- Complaints;
- Emergencies;
- Uncontrolled documentation;
- Inaccurate monitoring equipment; and
- Legal non-compliance.

Responsibilities are defined for taking corrective action to control non-conformance and for initiating and completing preventative action to eliminate the causes of non-conformance.

The Environment Manager coordinates all corrective and preventative action on environmental issues including changes to practices and procedures. Priority for the allocation of resources is related to the respective environmental impact and the need for mitigation.

13.0

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Jandakot Airport Environment Strategy

13 REFERENCES

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Jandakot Airport Environment Strategy

APPENDIX A
JANDAKOT AIRPORT SUSTAINABILITY FRAMEWORK

APPENDIX A – JANDAKOT AIRPORT SUSTAINABILITY FRAMEWORK

JANDAKOT AIRPORT SUSTAINABILITY FRAMEWORK		
KEY PERFORMANCE CATEGORIES	OBJECTIVES	INITIATIVES
Energy and Greenhouse Gases	Objectives	Initiatives
Renewable Energy	To enable the provision of on-site renewable power for operational consumption.	Use of on site renewable energy generation through installation of systems where feasible such as: · Building Integrated Photovoltaics – replacement of conventional building materials (e.g. roof, facades, tiles) with photovoltaic materials. · Rooftop Photovoltaics – Photovoltaics to be installed on the roof of certain buildings. · Stand-alone Solar or Wind Systems – These systems would be located within the site boundaries.
Energy Efficiency	To enable design outcomes and technologies that reduces the overall energy consumption.	· All mechanical services are designed to operate at a substantially less energy load, when compared to a similar facility. · Natural (day) lighting to used as part of an energy efficient lighting strategy, where artificial lighting is the most energy efficient per lumen. · Installation of energy efficient lighting (e.g. compact fluorescent lighting/LED) and appliances with high energy star ratings in all buildings to reduce energy demand.
Energy Use Monitoring	Monitor operational energy use to reduce consumption within desired targets.	· Installation of sub-metering and other demand management technology to reduce energy consumption for substantive uses. · Energy management protocol to be established that monitors all metered uses and aims to target a high degree of energy utilisation across the airport.
Local Urban Water Management	Objectives	Initiatives
Water Efficiency	Reduce the use of potable scheme water through provision of water efficient fixtures and fittings.	· Installation of water efficient fixtures and fittings with minimum 6-star WELS rating, covered as part of Water management Strategy
Increasing Non-Potable Water Supply (Wastewater)	Increase non-potable water use by harvesting wastewater to displace current potable water use.	· To be investigated further and covered as part of the lot-level BMP's in Water Management Strategy
Water Use monitoring	Monitor and manage the use of potable water consumption in buildings and across the development.	· All buildings to have water meters installed for major water uses.
Landscaping and Irrigation	Minimise water use through selection of drought tolerant plant species in landscaping.	The water management strategy (lot-level BMP's) considers; · Drought tolerant plant species (e.g. indigenous species and xeriscaping). · Water efficient irrigation systems will be used where possible (e.g. subsurface and drip irrigation).
Materials and Waste	Objectives	Initiatives
Reduction of Embodied Energy of Building Materials (Concrete)	To reduce the embodied energy and overall consumption of cement across the facility.	· Replacement of Portland cement substitutes for in situ, precast and stressed concrete where applicable in building design and infrastructure where feasible.
Reduction of Embodied Energy of Building Materials (Steel)	To reduce the embodied energy and overall consumption of steel across the facility.	· Use of steel with a postconsumer recycled content where feasible

JANDAKOT AIRPORT SUSTAINABILITY FRAMEWORK		
KEY PERFORMANCE CATEGORIES	OBJECTIVES	INITIATIVES
Sustainable Timber	To encourage the use of recycled timber products or timber from sources with environmentally responsible forest management practices.	· Specification of timber products used in construction have been sourced from either: · reused timber; · postconsumer recycled timber; and/or · Forest Stewardship Council (FSC) Certified timber.
Recycling Construction and Demolition Waste	To reduce generation of construction waste going to land fill.	· Maximise the practice of recycling building materials during the construction and demolition phases.
Waste Management Plan	To reduce generation and encourage recycling of operational waste within commercial buildings.	· Development of a Waste Management Plan to align with Environment Strategy.
Transport	Objectives	Initiatives
Public Transport / Shuttle Bus	To provide employees and visitors with good access to public transport networks. To reduce the vehicle kilometres travelled (VKT) of employees to the airport.	· Transport strategy to be developed to address public transport and non-motorised travel. · Provision of regular shuttle bus services between the airport and Cockburn Central Bus/Rail Interchange.

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Jandakot Airport Environment Strategy

APPENDIX B
LOCAL WATER MANAGEMENT STRATEGY

VDM CONSULTING

Jandakot Airport

Local Water Management Strategy

Issue No. 2

October 2009

Document Control Record

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Contents

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1. Introduction

VDM Environmental has been engaged by Jandakot Airport Holdings Pty Ltd (JAH) to prepare a Local Water Management Strategy (LWMS) in support of the 2009 Jandakot Airport Master Plan and Environmental Strategy.

Jandakot Airport is the principal general aviation airport in Western Australia, and is strategically important to the growth and development of Western Australia's tourism, business and leisure industry. The Jandakot Airport is located approximately 16km south of Perth, and covers an approximate area of 622ha (Figure 1). The Airport is located within the City of Cockburn, however, the area is Commonwealth land and falls under the *Airports Act 1996*. Currently there are 125 tenanted businesses situated at Jandakot Airport, employing approximately 650 staff, and contributing in excess of $200m/a to the local economy. The development of Jandakot Airport will result in an increase in direct and indirect employment opportunities in the local area, both at the construction and operational stages.

This report provides an overview and considers the constraints and opportunities in the context of the proposed Master Plan 2009 land use change. This document is consistent with principles contained within the Department of Environment WA and Swan River Trust's *Decision Process for Stormwater Management in Western Australia* (DoE and SRT, 2005), the *Stormwater Management Manual for WA* (DoW, 2004-2007) and *Liveable Neighbourhoods* (WAPC, 2008). This document outlines the water management principles for the development of Jandakot Airport at a structure planning level and should act as a guide for structure and subdivision planning.

1.1 Scope of Works

Under this LWMS, the following broad topics were considered:

- Storm water
- Water reticulation
- Irrigation
- Effluent disposal / reuse on site

The scope of works also included:

- Ensuring compliance with state and regional planning policies;
- Proposing catchment management objectives and preliminary design objectives for all elements of the water cycle;
- Mapping of surface and groundwater catchments and sub-catchments, including significant water resources such as waterways and wetlands, and identifying critical water resource management issues, including water quality;
- Consulting with the lead environmental consultant to review historical land use and potential for contamination / acid sulfate soils.
- Reviewing the impacts of potential / future development within the Jandakot Ground Water Mound, and identifying measures for minimising and reducing impacts on the mound;
- Identifying synergies in regards to the management of stormwater, groundwater and wastewater for supply of fit-for-purpose needs;
- Proposing a strategy to ensure that surface and ground water quality and quantity information is available at an appropriate time to inform future land use planning decisions;
- Recommending a monitoring framework, pre and post-development; and

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- Liaising with Department of Water and local council on water management strategies.

1.2 Principles and Objectives

The following objectives for stormwater management within the Jandakot Airport have been adopted in accordance with the Stormwater Management Manual for WA (DoE, 2004):

- Water Quality – maintain or improve the surface and groundwater quality within the development areas relative to pre-development conditions;
- Water Quantity – maintain the total water cycle balance within development areas relative to the pre development conditions;
- Water Conservation – maximise the reuse of stormwater;
- Ecosystem Health – retain natural drainage systems and protect ecosystem health;
- Economic Viability – implement stormwater management systems that are economically viable in the long term;
- Public Health – minimise the public risk, including risk of injury of loss of life, to the community;
- Protection of Property – protect the built environment from flooding and water logging;
- Social Values – ensure that social, aesthetic and cultural values are recognised and maintained when managing stormwater; and
- Development – ensure the delivery of best practice stormwater management through planning and development of high quality developed areas in accordance with sustainability and precautionary principles.

The principles which will be applied to the proposed re-development to address the water management objectives are (DoW, 2004-2007):

- Incorporate water resource issues as early as possible in the land use planning process;
- Address water resource issues at the catchment and sub-catchment level;
- Ensure stormwater management is part of total water cycle and natural resource management;
- Define stormwater quality management objectives in relation to the sustainability of the receiving environment;
- Determine stormwater management objectives through adequate and appropriate community consultation and involvement;
- Ensure stormwater management planning is precautionary, recognises inter-generational equity, conservation of biodiversity and ecological integrity;
- Recognise stormwater as a valuable resource and ensure its protection, conservation and reuse; and
- Recognise the need for site specific solutions and implement appropriate non-structural and structural solutions.

These objectives will be achieved through the actions and strategies identified in this LWMS.

1.3 Previous Regional and Local Studies

Previously completed regional studies which cover aspects of the subject site relating to the land use,

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drainage management and environmental issues include:

- 2009 - Local Scale Groundwater Modelling of Jandakot Airport;
- 2009 - Local Scale Groundwater Solute Transport Modelling of Jandakot Airport;
- 2007 - Jandakot Airport Development – Integrated Urban Water Management Plan (Belleng VDM) – The document outlines the integrated water management strategies for the Jandakot Airport Development, such as stormwater design, management of water usage, effluent discharge, stormwater treatment and wetland acknowledgement;
- 2006 – Jandakot Airport Development – Review of Drainage and Water Management Issues (JDA Consulting Hydrologists) – The study reviewed groundwater levels and direction of flow, review of Jandakot Underground Water Protection Area, surface water movement, topography and surrounding wetlands;
- 2005 – Jandakot Airport – Master Plan – A review of the approved 2000 Jandakot Airport Master Plan, incorporating various updates of the previous plan; and
- 2004 – Jandakot Airport – Environment Strategy – This document outlines the environmental strategy for Jandakot Airport, incorporating environmental management approach, environmental policy, environmental management system, existing environment and potential impacts.

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2 Background

2.1 Location

The subject site is located off Karel Avenue, Jandakot, within the City of Cockburn Local Government Area (LGA). The subject site is approximately 16 kilometres south of the City of Perth and 13 kilometres east of the Port of Fremantle (JAH, 2005) (refer Figure 1). Jandakot Airport is the major general aviation airport in the Perth Region, and the main facility catering for aviation training (JAH, 2005). It is a significant land use in the metropolitan region occupying some 622 hectares of land (JAH, 2005). The land is owned and governed by the Federal Government, and Jandakot Airport Holdings have a 50 year lease on the land (JAH, 2005).

2.2 Historical and Existing Land Use

The proposed area for the development is currently used as the Jandakot Airport, Commercial Activities and some areas of nature conservation bushland. Land to the north is urbanised. An old sand quarry and Lukin swamp are located to the east, while the site is bound by Roe Highway and urban land to the west.

Some of the proposed development lies on the Jandakot Underground Water Pollution Control Area (JUWPCA (refer Figure 2). Management measures for construction above the JUWPCA are outlined in the Jandakot Groundwater Protection Policy.

2.3 Climate

The study area experiences a typical Mediterranean climate, characterised by hot, dry summers, and mild, wet winters. A weather station is located at the airport (site 009172 Jandakot Aero), and indicated that the site receives an average annual rainfall of 843.7 millimetres (refer Figure 3, BoM, 2008). Typically, June and July are the wettest months of the year (Figure 3). The summer months, between November to March, generally receive minimal rainfall, which is typical to the Mediterranean climate (Figure 3). The annual average daily maximum temperature for Jandakot Airport is 24.2ºC, with the minimum temperature averaging at 11.3 ºC (BOM, 2008). The wind speed and direction is generally controlled by the movement of high and low pressure systems and land/sea breeze circulation (JAH, 2004), with morning winds being generally easterly, changing to westerly in the afternoon (BOM, 2008).

2.4 Surface Geology

Geological mapping indicates that the site is located within the Bassendean Dunes System (Gozzard, 1986 as cited in JDA, 2006). The Bassendean Dune System consists of low to very low relief Pleistocene sand dunes, intervening sandy and clayey swamps and gently undulating sand plain (Wells et al., 1986). These sands contain little silt or clay, and very low levels of nutrient elements, with any nutrient content being associated with organic matter (Bolland, 1998). The dunes are usually low lying hills with poorly drained areas between the hills (Bolland, 1998), and drainage is often restricted by an iron/organic hardpan (Wells et al., 1986). The scattered, rounded, shallow lakes and swamps contain water, coloured brown by organic material, and are low in salinity but high in acidity (Wells et al., 1986).

2.5 Topography

The topography of Jandakot Airport and surrounding areas is generally flat, with local variations in height being mainly 20 metres or less (JAH, 2004). Most of Jandakot Airport has an elevation of approximately 30 metres Australian Height Datum (AHD). High points of 45-50 metres AHD occur in the south-eastern and south-western corners of the airport, and undulating terrain exists at the northern end of the airport (JDA, 2006).

2.6 Vegetation

The Jandakot Airport is located within the South-West Botanical Province of Western Australia, within the Darling Botanical District and the Bassendean System of the Drummond Botanical Subdistrict (JAH, 2005). The Bassendean Vegetation System corresponds to the older leached sands of the Bassendean Dune System. This system extends discontinuously for the length of the Swan Coastal Plain, with the overall cover being Banksia woodland. In general, this low woodland is dominated by *Banksia attenuata*, *Banksia menziesii*, *Banksia ilicifolia*, *Eucalyptus todtiana* and *Nuytsia floribunda*,

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with a dense understorey of *sclerophyll* shrubs. These characteristics are typified at Jandakot Airport. Numerous surveys have been completed within the area, finding a total of 317 vascular plants, with 291 species being native (JAH, 2005).

2.7 Surface Water

There are no natural drainage channels or defined areas of surface water within Jandakot Airport (JAH, 2005). There are, however, six dampland areas scattered throughout the Jandakot Airport site (refer Figure 5). Two of the damplands located on the site have been identified as conservation wetlands, where management priority is to preserve (JAH, 2005).

An artificial drainage basin has been created in the north-eastern corner of the airport to collect run-off from the sealed surfaces, as the majority are not provided with drainage (JAH, 2005). Due to the high permeability of the Bassendean soils, run-off generally infiltrates very quickly into sand surrounding the sealed area and tends not to concentrate in the artificial basin (JAH, 2005).

2.8 Ground Water

JDA (2006) state that the approximate depth to Average Annual Maximum Groundwater Levels (AAMGL) across Jandakot site is 3.9 metres and 3.0 metres. Groundwater elevation varies seasonally by approximately 2.0 metres (JDA, 2006). This study also found that the regional groundwater flow is mainly northward, towards the Swan River and away from the JUWPCA.

Infiltration testing was completed by JDA (2006), and it was found that infiltration of stormwater for the proposed development should be possible given the depth to groundwater and permeability.

2.9 JUWPCA

The boundary of the JUWPCA was proclaimed in 1975 (WRC, 1998). The reason for proclamation was for the protection of groundwater source known as the Jandakot Mound (WRC, 1998). This water source provides a part of Perth's metropolitan water supply, (approximately 2.8% of the total Perth Water supply). *A water supply strategy for Perth to Mandurah to 2021* (WAWA, 1995) identifies that "P1 classification applies to areas where the groundwater is naturally of high quality, has strategic importance, and where development can be directed to other less sensitive areas. Jandakot Airport Holdings propose a warehouse development at precinct 5 shown on figure 4." Development Precinct 5 has not been tested for water quality, and as such is not known if the water quality is naturally higher than surrounding areas. The site retains no strategic importance for future groundwater supply, as it contains no wellhead protection zones, flows are away from the JUWPCA, and is located on Federal (not state) land. Due to the conservation significance of Area 1 (refer Figure 4), development of this area cannot be undertaken elsewhere.

Development within a Public Drinking Water Source Area (PDWSA) is based on the management priority level (P1, P2, and P3). Priority levels can be assessed as follows (DoW, 2004-2007):

- **Priority 1 (P1)** classification areas are managed to ensure that there is no degradation of the drinking water source by preventing the development of potentially harmful activities in these areas. The guiding principle is risk avoidance. This is the most stringent priority classification for drinking water sources. P1 areas normally encompass land owned by state agencies, but may include private land that is strategically significant to the protection of the drinking water source (e.g. land immediately adjacent to a reservoir). Most land uses create some risk to water quality and are therefore defined as "incompatible" in P1 areas.

- **Priority 2 (P2)** classification areas are managed to ensure that there is no increased risk of water source contamination/pollution. For P2 areas, the guiding principle is risk minimization. These areas include established low-risk land development (e.g. low intensity rural activity). Some development is allowed within P2 areas for land uses that are defined as either "compatible with conditions" or "Acceptable".

- **Priority 3 (P3)** classification areas are defined to manage the risk of pollution to the water source from catchment activities. Protection of P3 areas is mainly achieved through guided or regulated environmental (risk) management for land use activities. P3 areas are cleared over land where water supply sources co-exist with other land uses such as residential, commercial and light industrial development. Land uses considered to have significant pollution potential are nonetheless opposed or constrained.

The P1 area at Jandakot airport is an area to the western extremity of the airport land that follows

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around to the Jandakot Bushland area to the south and west of the airport.

A Western Power Development to the North of Jandakot Airport is currently used as a warehousing and transport depot, and is located within the P1 area. Furthermore, this facility is partially over a wellhead protection zone. Aerial photography shows little or no stormwater management at this location. Furthermore, it appears that high risk materials i.e. fuels are used within this site.

Development to the west of the airport includes rural residential, residential and a golf course. Parts of these developments straddle wellhead protection zones. Residential areas and golf courses are possible sources of nutrients through the application of fertilizers.

A large industrial subdivision has been developed just north of Armadale Road and this is partly over a well head protection zone.

The retail development at the junction of Berrigan Drive and Jandakot Road is within a well head protection zone and substantial portions of the Kwinana Freeway are not only within the JUWPCA boundary but over well head protection zones.

The proposed development Precinct 5 is not near well head protection zones or well heads themselves. Furthermore, the majority of Jandakot Airport Holdings (JAH) is not classified as within the JUWPCA.

The *Metropolitan Water Supply, Sewerage and Drainage Bylaws 1981* provide for the protection of public water supply areas and underground water pollution control areas. Table 1 overleaf provides a review of the relevant bylaws and their relevance to the proposed development.

Table 1. Relevant Bylaws for Proposed Development (*Metropolitan Water Supply, Sewerage and Drainage Bylaws 1981)*

Metropolitan Water Supply, sewerage and Drainage By-laws 1981		**Relevance to the Proposed Development**
5.4.1	In a pollution area the use, storage and transport of pesticides, the disposal of pesticide containers and the disposal of spilled pesticides shall be in compliance with the provisions of the *Health (Pesticides) Regulations 1956*[5] as amended from time to time.	JAH do not propose to store or dispose of pesticides in the proposed development area.
5.4.5	In a pollution area installation or operation of septic tanks, leach drains, soak wells and other apparatus for the disposal of domestic waste waters shall be carried out in conformity with the *Health (Treatment of Sewage and Disposal of Effluent and Liquid Waste) Regulations 1974* as amended from time to time and where the site is within 100 m of a production well a person shall obtain prior consent for the installation or operation from the Commission which may impose further conditions and restrictions as to the siting, construction or operation of the apparatus, in which event the Commission shall meet any consequential extra cost incurred in the initial construction of the apparatus.	The development will be connected to deep sewerage, and hence no impact on the JUWPCA will occur. The installation of reticulated sewerage which does not currently exist at the airport, will reduce the impact on the JUWPCA.
5.4.6	In a pollution area or a part of a pollution area a person shall not dispose of or discharge onto or into the ground, or into any lake, swamp or drain industrial wastes, chemicals, radioactive material, petroleum or petroleum products, polluted water, or refuse unless that person has been granted permission in writing by the Commission to do so.	The proposed design will discharge" only surface water to the ground water and treat all other water.
5.5.1	A person shall not establish an offensive trade in accordance with the provisions of the *Health Act 1911*, in a pollution area, unless they have obtained the consent of the Board to do so, and unless they comply with any conditions which the Board may impose in relation to the establishment of that offensive trade.	The proposed development will be warehouse services and offices. We propose to obtain approval with conditions from the board. These conditions being: • Stormwater runoff from hardstand areas through biofiltration swales. • Road runoff through biofiltration swales. • Roof runoff direct to groundwater or to rainwater tank. • Internal areas to be collected, tested and disposed of accordingly (i.e. to sewer). • Design guidelines to ensure best management practice is incorporated into the design.

		• Construction Environmental Management Plan to manage impacts on the JUWPCA during construction. • Street sweeping during operation. • Environmental Management Plan to be updated with emergency response and contingency planning in case of spills within the JUWPCA. • Limit tenants operations through design guidelines by identifying that no bulk chemical or no chemical storage operations be allowed within the JUWPCA area.
5.5.2	The establishment or operation of any premises for the storage, packaging, formulating, processing, manufacturing, sale, testing or use of chemicals or other substances liable to pollute underground water in a pollution area shall be subject to the following terms, provisions and conditions — (a) application shall be made to the Commission in writing for a permit to operate existing or proposed premises and the application shall set out — (i) The process or processes of manufacture, packaging, storage, formulating, testing, or use of all raw materials and fuels, intermediate products and final products including waste material and effluents whether gaseous, liquid or solid. (ii) The quantities of raw materials, and fuels used and the intermediate and final products, waste materials, effluents, being or proposed to be produced. (iii) The methods proposed to treat and dispose of any wastes, by-products and effluents; including stormwater and wash down water where this may be or could become polluted. (iv) Plans and procedures proposed to prevent pollution of underground water, including emergency plans and procedures for contingencies such as accidental spillage or malfunction of any manufacturing, storage, transport or treatment process or system, both on and off the premises where this is applicable.	The following can be identified from the proposed development: (i) Offices and warehousing is proposed within the development area. No bulk chemical or chemical storage operations are allowed within the development area. (ii) No effluent will be discharged to the JUWPCA. Stormwater values will be defined as par t of the Water management strategy (WMS). No chemicals or wash down/storm water from storage areas will be discharged to JUWPCA. (iii) Biofiltration swales will be utilized to manage storm water from roads and hardstand areas. Roof runoff will be returned to the groundwater mound. Sewer will be connected to the Water Corporation's reticulated sewerage system. Internal drainage, including waste fire water, will be collected and disposed to the sewer reticulation system or offsite. (iv) Emergency management plans and procedures will be provided as part of the Environmental Management Plan for the JAH Management area. The emergency procedures manual will include: • Operational checklists for spills and incidents • Emergency Contact information, key contractors, government departments, etc • Clean-up criteria (soil removal methods, water testing

	(v) Such other information required by the Commission to assess the pollution risk to underground water and to assist with measures to prevent pollution.	methods). • Post-spill sampling program, (v) A detailed Water management strategy for the 2009 Master Plan is currently being drafted. It is the aim of this document to provide detail on the water management and environmental impacts throughout the development.
5.5.4	Any person handling petroleum and other flammable liquids in a pollution area shall store and handle those liquids in accordance with the *Flammable Liquids Regulations 1967* [7], as amended from time to time and in addition shall comply with the following requirements — (a) Underground tanks for the storage of petroleum products shall not be installed within 100 m of a production well. (b) All underground tanks for the storage of petroleum products shall be installed in impervious containment structures or membranes approved by the Commission capable of preventing any leakage from the storage tank to the ground or ground water. (c) Any bunds or compounds on any premises licensed under the *Flammable Liquids Regulations 1967* [7], as amended from time to time, shall be constructed so that the walls and floor of the bund or compound are of impervious material to the approval of the Commission. (d) Where a person intends to store flammable liquids in a pollution area, they shall apply to the Commission for its prior approval, setting out the location of proposed structures, buildings and tanks and shall abide by any conditions which the Commission may impose.	(a) No underground petroleum or flammable liquid tanks are proposed within the JUWPCA development area (b) Refer (a) (c) All bunds and compounds are to meet *Flammable Liquids Regulations 1967* (d) No flammable liquids are to be stored within the proposed development area.
5.6.2	Regardless of any other provision of these by-laws, a person shall not establish within a priority 1 or a priority 2 source protection area — (a) a ground storage tank system; (b) any automotive business premises; or (c) An elevated storage tank system inside a wellhead protection zone.	None of these items are proposed as part of the proposed development area.

2.10 Wellhead Protection Zones

A "wellhead protection zone" is defined as an area within a pollution area that surrounds a wellhead, the extent of which is identified on the plans (refer Figure 6).

It is important to note that there are no wellhead protection zones within or near the proposed development Area 5 (The closest being located at the golf course to the west of the development, approximately 800 metres away). Areas 7 and 8 both contain wellhead protection zones. Jandakot Airport Holdings has agreed to revegetate these as conservation areas.

2.11 Soil Contamination

Soil contamination can occur from a variety of sources and may affect the soil or the groundwater. As precinct 5 is within the JUWPCA, it is important to identify all possible contaminating activities. Historically, the site has been used for various purposes (including sand quarry and Bibra Lake speedway), and some of these land uses may have resulted in site contamination. A search of the Department of Environment and Conservation (DEC) Contaminated Sites Database (2008) has found that the Jandakot Airport has previously been classified as 'Contaminated – remediation required'. The database also shows that the site has been remediated. The remedial works included excavation, soil screening and off-site disposal (DEC, 2008). The site is classified as 'Remediated for restricted use' (DEC, 2008).

2.12 Acid Sulfate Soils

Acid sulfate soils are naturally occurring soils which contain iron sulfides, which, when exposed to air and water, oxidise to produce sulfuric acid, iron precipitates and concentrations of dissolved heavy metals (WAPC, 2003). A preliminary assessment of the presence of acid sulfate soils was completed using the Western Australian Planning Commission's Planning Bulletin No.64 – Acid Sulfate Soils (WAPC, 2003). The acid sulfate soil risk maps in the Planning Bulletin No.64 identify the majority of the Jandakot Airport site as having a moderate to low risk of actual acid sulfate soils (AASS) and potential acid sulfate soils (PASS) occurring within 3 metres of the surface (refer Figure 7). A small area on the south west boundary is classified as having a high risk of ASS or PASS within 3 metres of the surface (Figure 7). It is recommended that preliminary field testing for acid sulfate soils is completed prior to any development taking place.

3 Water Management Strategy

The proposed water management strategy for the Jandakot Airport is consistent with water sensitive design practices and meets the key design principles and objectives for the subject site, as detailed in Section 1.2.

The stormwater drainage system of the Jandakot Airport will be designed using a major/minor approach. The minor drainage system is defined as the system of underground pipes, swales, kerbs, gutter etc designed to carry runoff generated by low frequency Average Recurrence Interval (ARI) storms, typically less than 5-year ARI events. The major drainage system is defined as the arrangement of roads, drainage reserves, compensation/infiltration basins and open space planned to provide safe passage of stormwater runoff from extreme events which exceeds the capacity of the minor system.

Water quality management will be achieved through a treatment train approach including the application of source controls, stormwater detention and maximising infiltration opportunities.

3.1 Water Conservation, Efficiency and Sustainability Initiatives

The key components to water sustainability are conservation, recycling and reuse. Using an integrated approach to the planning, design, implementation and operation will result in beneficial outcome in both the economical and environmental aspects of the future re-zoning and development of the Jandakot Airport.

In line with the overall water management strategy and Water Sensitive Urban Design (WSUD) principles which will be implemented as a part of future development of Jandakot Airport, various water conservation and sustainability initiatives will be put in place within the development. These initiatives focus on the efficiency of the supply and reticulation of potable water to and throughout the development, as well as the maximisation of water re-use capabilities due to the scarcity of water as a vital natural resource. WSUD principles promote maximising infiltration through source control Best Management Practices (BMPs), minimising the effective impervious area of the subject site. Consequently, the adoption of appropriate surface and groundwater management strategies is vital to the viability of total water cycle management and its requirements to maximise water conservation, recycling and reuse.

The water management strategy is therefore a whole system approach that seeks to reduce pressure on potable supplies through the application of the following principles:

- More efficient use of the existing water resource through demand management;
- Apply water of an appropriate quality for its various uses;
- An effective increase in supply through the replacement of potable water supplies with alternative sources such as recycled water and harvested rainwater; and
- Adoption of WSUD measures in order to reduce pollutant impact upon the receiving waterways, and natural peak environmental flow rates.

3.2 Demand Management

The demand for potable drinking water to the proposed industrial establishments within Jandakot Airport will focus on maximising efficiency in its delivery. This will be achieved though the adoption of measures that will ultimately ensure that only the required amounts of potable water fit for human consumption are used within the individual industrial setups.

Such measures include, but are not limited to the following:

- Owner awareness and education;
- Installation of water efficient fixtures and fittings within the development;

- Installation of water saving devices within the development (e.g. dual flush toilets, water efficient shower heads);
- Landscaping open spaces with drought resistant plants through xeriscaping (i.e. landscaping that emphasises water conservation); and
- Establishing system pressure controls.

3.3 Supply Substitution

In order for the water management strategy to be integrated, it is imperative that attention must be directed to the management of reusable effluent and other non-potable water sources so that it can substitute potable water where its application is not needed. This will ultimately minimise the stress on drinking water supply and ensure that water management strategy measures are in place throughout the development.

One such measure is the utilisation of rainwater harvesting from covered roofed areas for internal use, landscaping and fire fighting purposes.

3.4 Structural Water Sensitive Urban Design Measures

Several WSUD elements have been identified and should be further investigated and detailed in an Integrated Urban Water Management Plan (IUWM) during cell structure planning stage. These elements are summarised below:

Scale	Ownership and Maintenance	Best Management Practice
Lot	Lot owner	Infiltration: ▪ Garden strips/landscaped swales with soil amendment ▪ Porous pavements ▪ Soakwells Hydrocarbon management Rainwater tanks Sediment traps Access roads
Street	Jandakot Airport Holdings	Access Roads: ▪ Infiltration swales Sediment traps Dual carriageways (if required): ▪ Infiltration swales

3.5 Lot Level BMPs

Lot level BMPs have been identified based on guidance from the Department of Water's Stormwater Management Manual for Western Australia (DoE, 2004) and Stormwater Management at Industrial Sites (DoW, 2006). The following items directly relate to the drainage philosophy for Jandakot Airport:

- Roof water reused through Rain Water Tanks for non-potable purposes;
- Minor chemical storage and workplace areas suitably bunded. When spills occur, treated and disposed according to DoW (2006). No major chemical storage allowed;
- Rainwater from hardstand areas disposed to landscaped bio-swales
- Suitable landscaping (xeriscape);
- Where practical, retention or detention systems should be used to manage peak

stormwater flows within the on-site stormwater management system;

- Controlled release points should be built into any stormwater retention basin to avoid embankment failures under extreme rainfall conditions;

- Uncontaminated stormwater runoff from roofs, paths and landscaped areas should not be allowed to mix with processed effluent, stored chemicals or stormwater runoff from areas susceptible to chemical spills (such as wash-down stations, refuelling hardstands etc). Where practical, processing areas involving chemicals should be weatherproof or covered. These areas should drain to separate areas for treatment and removal of chemical residues prior to waster water disposal; and

- Paved areas exposed to rainfall where dust, litter or spilt substances accumulate should be regularly cleaned using methods that prevent fluid drainage or leaching into the surrounding environment.

Figure 8 provides a conceptual stormwater management layout at lot level.

3.5.1 Infiltration

Given that the majority of the subject site is underlain by Bassendean sands, and stormwater is likely to be infiltrate as close to source as possible. It must be noted, however, that before any infiltrated stormwater runoff reaches the groundwater, treatment and retention of nutrients must be achieved. Each lot will retain up to 1 in 1, 1 hour ARI post-development storm event. This will be undertaken via infiltration basin/s or infiltration galleries under impermeable areas (such as carparks, roads and runways).

It is proposed that the 1 in 1 year, 1 hour ARI storm event will be treated prior to infiltration. It is recommended that stormwater be infiltrated through at top layer of sandy loam (soil amendment), for treatment and retention of nutrients, before reaching the groundwater. The areas subject to soil amendment can be restricted to:

Garden strips/landscaped areas – along the boundaries or adjacent to carparks In commercial lots can collect lot runoff and provide storage for the 1 year ARI event;

Swale drains – with bioretention systems adjacent to lot boundaries, carparks and runways as control measures for groundwater level and water quality treatment; and

Porous pavements – porous pavements can be considered for open car parks in areas at low risk of hydrocarbon contamination. Typically they are constructed from modular paving or block paving. Their use in high traffic areas is not recommended due to increased risk of clogging.

3.5.2 Hydrocarbon management

There are a number of proprietary oil and grease separators available. Typically, most of these systems utilise a detention tank with an inverted pipe outlet to separate the cleaner stormwater from the floating oil and grease. These systems are more appropriate when used in treating runoff from clearly isolated oil and grease source areas with high hydrocarbon pollution potential, such as petrol stations, garages, car/aeroplane wash areas etc.

Fuel, oil and grease removal options include:

- Petrol and oil traps;
- Inclined-plate separators;
- Chemical coagulation and launder system; and
- Dissolved air flotation units.

Hydrocarbon management systems will require identification at the lot development stage, and such, shall be identified and approved as a part of the Development Application.

3.5.3 Rainwater Tanks

Rainwater tanks capable of collecting stormwater directly from a roof or other above ground surfaces allows reuse of collected water for use as landscape water and in some cases toilet flushing and hot water use. A well designed system has the capability of reducing peak discharges entering receiving waters for frequent events, and thus has added flood mitigation benefits.

Rainwater tank design shall be undertaken as a part of the IUWMP, with tank installation and approval as a part of each lot's Development Application.

3.5.4 Sediment traps/Litter removal

All drainage should treat the 1 year, 1 hour storm event prior to discharge to a suitable infiltration system. Ownership and maintenance of the trap remains with the lot owner/lessee.

Treatment options to limit suspended soil particles and turbidity include:

- Sedimentation basins providing retention periods of at least several hours;
- Bio-retention systems and constructed swales;
- Chemical coagulation, using metal salts or polymers, following by settling systems;
- Sand or membrane filters, with periodic backwash;
- Employee awareness programs;
- Clearly marked recycle bins;
- Floor bucket traps;
- Trash racks/bar screens on process water drains; and
- Centrifugal litter separators.

Sediment trap/litter removal systems will be required to be identified at the lot development stage, and as such, shall be identified and approved as a part of the Development Application.

3.5.5 Wastewater from industrial/commercial practices

The wastewater streams from future industrial and commercial practices at Jandakot Airport will need to be identified and managed properly. The pollutants generated from industrial precincts need to be identified so that a suitable selection of wastewater management measures can be made. Due to the proximity to JUWPCA, a risk management approach needs to be adopted on a case by case basis for each business type at the subject site.

The reticulated sewage network at the site will reduce the likelihood of illicit discharges into the stormwater network. Wastewater form industrial/commercial uses may also require pre-treatment through a grease/oil separator prior to being discharged into the sewage network to meet Water Corporation sewer entry requirements. Wastewater must also be kept separate from 'clean' stormwater to maximise treatment effectiveness and prevent contamination of stormwater.

For wastewater discharge from prescribed premises, a licence will need to be obtained from the DEC's best practice guidelines for specific industries. Thorough planning of the locations for specific business will need to be undertaken, taking into consideration other factors such as noise, light, spill and odour. Another factor to consider is the potential risk of the business illegally discharging contaminated/untreated wastewater into the receiving environments. Wastewater management will be further identified as a part of the IUWMP for the development.

3.6 Street Level BMPs

Treatment of stormwater runoff via a combination of swales and bioretention systems is an important aspect in WSUD to address the expected heavy metals, hydrocarbons and other

pollutants generated from road surfaces. Appropriately designed swales and bioretention measures can help to manage loadings from such contaminants and also provide an ideal mechanism for removing suspended solids.

The generally flat grades of the subject site serve to provide a degree of attenuation and temporary storage within any proposed internal road network, which is critical to water quality treatment. Street sweeping may also be a viable option for reducing entrainment of contaminants via stormwater, improving the overall effectiveness of bioretention systems and reduce costs associated with maintenance.

The design of the street level BMPs will be undertaken as a part of the IUWMP for the development.

3.7 Recommended non-structural measures

Appendix A, attached, describes those non-structural BMPs that are recommended for use within Jandakot Airport redevelopment area. The table also provides a description of the BMPs, their benefits, the scale at which they should be applied and the suggested responsibilities for implementation. These non-structural BMPs are derived from the Stormwater Management Manual for Western Australia (DoE, 2004), and are based on known information from previous large scale site investigation work.

These recommendations:

- Seek to minimise nutrient export from the study area;
- Seek to minimise the use of mains water; and
- Are focussed on industrial land use with some public open space.

It should be noted that at the current stage of planning (review stage) it is too soon to specify BMPs for the development. More definitive BMP recommendations will be specified as part of the cell structure planning once the land use and associated industrial/commercial practices are further refined.

3.8 Surface Water Management

Stormwater management for the subject site will be consistent with the principles of water sensitive urban design, as well as the design principles and objectives stipulated in Section 1.2 of this LWMS.

Design concepts for managing stormwater within the subject site are as follows:

- Lot runoff – employ the use of drainage Soakwells and/or rainwater tanks to reduce direct runoff to the street conveyance system. This will increase detention periods and minimise peak flow rates;
- Flow conveyance – provide vegetated swales within the road median and beside road (and runway) pavements to convey runoff form minor storm events, in place of a conventional piped system. Incorporate bioretention media to treat runoff from storms up to 1 in 1 year 1 hour duration ARI event. Utilise the full road widths for major flood conveyance;
- Retention/Detention areas – provide adequate storage to attenuate post-development flow rates to pre-development conditions. Ensure that the required freeboard to finished lot levels is achieved; and
- Discharge to receiving environment – provide an outlet to the nearest local branch drain (most probably the constructed basin in north section of the site), ensuring that flow rates and water quality are within the design limits.

3.9 Road Network

The general internal road network will serve as the main stormwater conveyance system. Roadside swales will be used to convey stormwater from the site, in place of a conventional piped drainage system. The roadside swales will be sized to retain the 10 year ARI post-development storm event, whilst the road reserve will be sized to retain the 100 year storm event. Design will ensure that a 300 millimetre freeboard above the 100 year peak design stormwater height. This will ensure protection of lots from flooding for up to 1 in 100 year ARI events by utilising the full width of the road reserves.

Design guidelines from DoE (2004) stipulate the following main design criteria for these swales as a part of the drainage strategy for the subject site:

- Swale side slopes are to be at a maximum grade of 1:6, to maintain public safety and aesthetic values;
- To maintain conveyance and prevent ponding during low flows, the longitudinal slope should not be less than 1%. Where slopes are steeper than 4%, rifles should be constructed at regular intervals to prevent scouring and reduce flow velocity
- Swale dimensions and contributing catchment area should be selected to ensure 1 in 1 year ARI flow velocities for the swale are maintained at less than 0.5 metres per second, with maximum velocities not exceeding 1.8 metres per second; and
- Side batters should be constructed at 1:6 where possible and should not be steeper than 1:3.

The final swale design will be refined during detailed drainage design and will be reported at the IUWMP stage. The final swale design will depend on the following:

- Hydraulic requirements of each swale to ensure that the flows can be conveyed within the cross-section;
- Minimum slopes will vary dependent on whether the swales are grassed or vegetated (landscaped/planted); and
- Road reserve widths will also dictate swale design.

3.10 Groundwater Management

As previously stated, the regional groundwater flow direction is towards north and Swan River, and away from the JUWPCA. Separation between the groundwater table and the natural surface may vary, and it is strongly recommended that two year groundwater monitoring be conducted throughout the site prior to any developmental activities take place. In case that there is insufficient clearance above the groundwater level for the developments, engineering designs should be amended to ensure that risks to the underlying groundwater quality are minimised.

The minimum separation between finished lot levels and the AAMGL is to be 1.2m and 0.5m between the base of soakage structures and the AAMGL.

4 Risk Assessment and Priority Setting

4.1 Key Environmental Values:

The *Environmental Protection Act (1986)* defines environmental value as:

- "A quality of physical characteristics of the environment that is conducive to ecological health or public amenity or safety".
- "A quality of the environment identified and declared to be an environmental value under an environmental protection policy or regulation".

4.2 Risk Management

The following risk management and priority setting analysis was used to determine the action and implementation strategy/timing of management measures.

The steps are of the risk assessment are as follows:

STEP ONE:

Assess the probability of each impact occurring, using the table below as a guide.
Probability

Level	Likelihood	Description
1	Rare	Very unlikely / may occur only in exceptional circumstances
2	Unlikely	Known to have occurred in the industry
3	Probable	The event will probably occur, or has occurred under some conditions (e.g. yearly)
4	Likely	The event is expected to occur under some conditions or has occurred more than once at the site in recent years (e.g. weekly/monthly)
5	Almost certain	The event is a common or frequent occurrence or an ongoing impact (e.g. daily)

STEP TWO:

Assess the consequence of each impact on the environment, using the table below as a guide.

Level	Consequence	Description
1	Insignificant	Confined to immediate area, rapid clean-up, no environmental damage. Minor Injury to personnel resulting in no loses of work time.
2	Minimal	Confined to isolated area, rapid clean-up using internal resources, and minimal environmental damage. Minor injuries to personnel resulting in loss of work time.
3	Moderate	Impact confined to the development, clean-up may require external assistance, moderate environmental damage Injury causing significant lose work ability with lasting effects.
4	Major	Major environmental impact, extends beyond marina boundary, considerable clean-up using DoW and external sources. Injury which causes permanent inability to work with lasting long term effects.
5	Catastrophic	Severe environmental impact, extensive clean-up and recovery period, requires ongoing monitoring of JUWPCA and potential clean-up. Death or permanent debilitating injury.

STEP THREE:

Determine the seriousness of each impact, using the table below as a guide.

Risk Assessment Rating

When determining risk control strategies, the hierarchy of risk controls, summarized below, must be considered:

- **Elimination:** Stop using the equipment or substance, or stop undertaking the procedure, causing the risk (e.g. not storing volumes of hydrocarbons onsite);
- **Substitution:** Use an alternative substance, equipment or process which poses less risk (e.g. use water-based instead of solvent-based substances);
- **Isolation**: Separate receivers from the source of the risk (e.g. internal areas of the development discharge to separate sump that is discharged to sewer);
- **Engineering controls:** Reduce exposure to the risk by making physical changes to equipment, procedures or the work environment (e.g. redirect discharge through treatment barriers prior to discharge); and
- **Change work practices:** Adopt work procedures which minimise exposure to the risk (e.g. street sweeping to manage pollutant build-up).

		CONSEQUENCE				
		1	2	3	4	5
LIKELIHOOD		Insignificant	Minor	Moderate	Major	Catastrophic
5	Almost certain	5	10	15	20	25
4	Likely	4	8	12	16	20
3	Moderate	3	6	9	12	15
2	Unlikely	2	4	6	8	10
1	Rare	1	2	3	4	5

Extreme risk; immediate action required
High risk; senior management attention needed
Moderate risk; management responsibility must be specified
Low risk; manage by routine procedures

The assessment of potential impacts and likely environmental harm and adoption of appropriate Mitigation/Management measures ensure operations JAH protect the JUWPCA.

Table 2: Risk Assessment

Risk Identification and Analysis			Inherent Risk Rating			Control Strategy	Residual Risk Rating		Plan		Further Information
Risk Issue (Source / Event)	**Potential Causes**	**Impacts**	**Likelihood**	**Consequence**	**Risk Rating**	**Control Measures**	**Likelihood**	**Consequence**	**Residual Risk Rating**	**Further Actions Required**	
Stormwater pollution from hardstand areas within JUWPCA	Build-up of hydrocarbons, sediment within car parking and hardstand areas. Poor storage and management of materials.	Water Pollution within JUWPCA	5	4	20	Three management strategies are proposed – 1. Utilization of bioretention swales to treat and manage stormwater runoff from hardstand areas. This would require approximately 2% of the total impervious area to be landscaped as a bioretention basin.	3	3	9	Education of lessees of the management of stormwater at lots. Identify maintenance and monitoring plan for the development.	Control measure 1 is graphically provided as Figure 8. Control measure 2 would require a large infiltration basin will be required to be located closer to the runway – any basin that is inundated for a period of time may become a haven for birdlife, which can create a hazard for runway activity. Control measure 3 is not financially feasible for Jandakot Airport Holdings.
						2. Convey stormwater outside of the P1 area to a large (dry) detention/infiltration basin.	1	2	4	Maintenance and management will be required for the basin.	
						3. No development.	2	2	4	Area is retained in current form. Additional development areas will need to be assigned to the east and south areas of JAH, which has the potential to impact on rare flora and fauna.	
Stormwater from road reserves within JUWPCA	Build-up of hydrocarbons and other contaminants from road reserves	Water pollution	3	5	15	Bioretention swales along the road reserves to manage and treat stormwater. Low-lying areas to be utilized as overflow areas for large (100 year) storm events.	3	3	9	Management of any spills need to be managed through the JAH environmental management plan.	System utilizes best management practice for stormwater management.
Stormwater from road reserves within JUWPCA	Build-up of hydrocarbons and other contaminants from road reserves	Water pollution	3	5	15	Bioretention swales along the road reserves to manage and treat stormwater. Low-Lying areas to be utilized as overflow areas for large (100 year) storm events.	2	2	4	Management of any spills need to be managed through the JAH environmental management plan.	System utilizes best management practice for stormwater management.
Management of stormwater from roof areas	Sediment and debris	Water pollution	1	1	1	Beneficial recharge from roof water into declining Jandkot mound. Rainwater tanks can be designed to partially collect the stormwater from the roof runoff areas and reuse for beneficial ex-house reuse (irrigation). However, a cost-benefit analysis should be reviewed to identify if this is plausible.	1	1	1	Rainwater tanks to be reviewed as part of the building design guidelines.	Roof water is relatively clean. Zinc cladding and Asbestos are not to be used as building materials in future development.
Polluted fire water from commercial and industrial areas.	Used fire water can contain large amounts of pollutants, that may impact on the groundwater environment	Impact on groundwater and local surface water environments	4	4	16	All hardstand areas to be bunded separate to the external stormwater system. Water is to be retained within sumps that can contain large spill events or fire fighting activities (i.e. 2 hours fire fighting). Sumps/bunds to be tested and/or treated prior to discharge – either offsite or to sewer.	2	4	8	Education of lessees on the management of stormwater rand stormwater facilities.	
Sewerage entering groundwater	Septic tanks and ATUs may increase risk on groundwater contamination	Groundwater	4	4	16	All sewer to be piped and connected to the Water Corporation's regional sewer system.	1	4	4		The existing airport buildings are all on septic tanks and Aerobic treatment units (ATUs)
Spillage of contaminants as part of works (e.g. Petrol Spill)	Poor storage of hydrocarbons. Fuel spill from vehicles	Groundwater pollution / soil contamination	4	4	16	No bulk storage of hydrocarbons within JUWPCA during construction phase. Ensure all vehicles are maintained properly to reduce potential risk of spills.	2	2	4	A construction environmental management plan be undertaken as part of the sub divisional works.	

5 Implementation Framework

5.1 Considerations and requirements for local planning

Detailed information relating to potable and non-potable water use and stormwater and groundwater management is outlined in an IUWMP, which should accompany a cell structure plan for each of the cells in the subject site. The IUWMP should be consistent with the information and objectives stated in this LWMS, and strengthened with additional investigations where necessary. The environmental information and monitoring data will be used to select the most appropriate WSUD BMP for local conditions

5.2 Monitoring

Suitably qualified environmental consultant(s) will be engaged to complete the monitoring exercises and report on the outcomes of the monitoring programs.

5.3 Pre-development monitoring

Pre-development monitoring is to take place to ensure no negative effects on the groundwater levels in the JUWPCA and the dampland areas within Jandakot Airport.

5.3.1 Groundwater monitoring

As identified earlier, pre-development groundwater monitoring is necessary in order to determine accurate groundwater table levels and their possible fluctuations due to seasonal changes, subsequent indications of clearances to ground levels, and the risk to groundwater quality as a result of the proposed development rezoning. It is strongly recommended that this period spans at least two years, and captures two winters of data.

The groundwater quality monitoring program should involve:

- Installation of an adequate number of monitoring bores;
- Monitoring and collection of groundwater samples to meet DEC baseline monitoring requirements;
- Review of water quality data; and
- Completion of hydrogeological and soil determinations, to determine onsite pre-development groundwater levels.

The monitoring parameters (site specific chemicals of concern are to be determined in accordance with site specific land use or industry) should consist of:

- Monthly groundwater levels;
- Physical parameters (conductivity, pH, temperature, dissolved oxygen);
- Hydrocarbons;
- Pesticides and herbicides;
- Total suspended solids (TSS);
- Nutrients – TN, TP, ammonia-N, NOx-N, TKN.

5.4 Post-development monitoring

Following the completion of the baseline pre-development monitoring programs, the ongoing environmental monitoring activities described below will be considered:

- Quarterly monitoring of groundwater and surfce water quality and flows;
- Six monthly reviews of water quality and flows (summer and winter) in subsequent years.

- Six monthly reviews of wetland and vegetation surveys to assess the health and condition of dampland areas.

5.4.1 Groundwater monitoring

Ongoing construction phase and post-development groundwater monitoring will be undertaken to ensure that baseline conditions are not worsened by the proposed development of Jandakot Airport. This is particularly important for this site, due to the nature of proposed end-users. Commercial and light industrial land use may generate additional contaminants in stormwater due to the nature of their activities.

Table 3: Water Quality Monitoring

Issue/Source	Parameter	Location	Frequency	Timeframe	Responsibility
Groundwater Bores	Physical parameters (conductivity, pH, temp, DO) Water Depth TSS Nutrients – TN, TP, ammonia-N, NOx-N, TKN Hydrocarbons Pesticides	Groundwater Sampling from three bores within development area P2	Quarterly monitoring of ground water during pre-development. Quarterly basis of groundwater during construction phase. Quarterly basis of groundwater during post-development.	Sampling post-development.	JAH or as directed
Surface Water Bioretention Swale	Physical parameters (conductivity, pH, temp, DO) TSS Nutrients – TN, TP, ammonia-N, NOx-N, TKN Hydrocarbons Pesticides	At inflow point of bioretention swale	First flush monitoring of surface water quality. Winter monitoring of surface water quality.	Sampling post-development.	JAH or as directed

5.4.2 Data analysis, presentation, reporting and technical review

A suitably qualified engineer and environmental consultant will be engaged to analyse and review the water quality and quantity data collected during the groundwater and surface water monitoring programs. The outcomes of this analysis will be used in the hydrologic modelling and drainage design. The outcomes of these reviews will be used in the selection and design of site specific structural and non-structural BMPs.

5.4.3 Contingency Measures

In the event that observational or analytical deviations are observed, appropriate remedial action will be taken.

The initial response to a change in water quality will entail investigation by means of additional sampling, or other as appropriate to determine:

- Whether the breach is genuine.
- Whether the breach is outside the natural variability of groundwater and surface water quality.
- Whether there were any external events that would affect the wetland area.

- Whether the breach signifies a real decline in the quality of groundwater or is simply an isolated occurrence.

The following contingency measures will address the majority of physical deterioration's that may occur:

- Locate source of water quality deterioration.
- Prevent continuing deterioration with temporary controls.
- Repair existing controls, construct additional controls or modify procedures to prevent future deterioration in water quality.
- If, after new operation commences, there is a significant deterioration in water quality, the management plan and strategies will be reviewed in consultation with the relevant authority.

Contingency measures for water quality indicator exceedance will include:

- Review of Environmental Management Plan and monitoring protocol.
- Consultation with lessees to ensure that they are meeting JAH's Environmental Management Plan and Design Guidelines.
- Review of operational practices (i.e. street-sweeping) to ensure compliance with procedures.
- Consideration to review of water quality criteria to better reflect the variability of the system.

5.5 Funding and ongoing maintenance responsibilities

As the Jandakot Airport site is leased by the Jandakot Airport Holdings, the ultimate responsibility for implementing the IUWMP lies with them.

5.5.1 Maintenance

Given that the Water Corporation has set practices for the maintenance of water and sewer infrastructure, this section deals solely with the maintenance requirements of the stormwater structural BMPs proposed at Jandakot Airport.

Maintenance requirements for the lot level BMPs selected will be identified in the IUWMP for each cell. The main structure plan level BMP that may be essential for flood management for the entire structure plan is the bioretention swales.

One of the primary maintenance requirements for bioretention systems is to inspect and repair the treatment system's components. Generally this involves periodic maintenance of the landscaped area. Plants that are appropriate for the site, climate and watering conditions should be selected. The appropriate selection of plants will aid in the reduction of fertilizer/pesticide usage and irrigation requirements, thereby decreasing the level of nutrients entering the receiving environments. Bioretention system components should blend over time through plant and root growth, organic decomposition, and the development of a natural soil horizon. These biological and physical processes over time will lengthen the BMPs' lifespan and reduce the need for extensive maintenance.

Another critical maintenance consideration is the monitoring of sediment accumulation at the inlet points. Depending on catchment activities, the deposition of sediment can increase internal nutrient loading. Excessive sediment build up may impact on plant health leading to a reduction in their capacity to maintain the infiltration rate of the filter media. Regular sediment removal may therefore be necessary.

Routine maintenance should include inspection for areas of standing water and corrective measures to restore proper infiltration rates as necessary to eliminate mosquito breeding environments. In addition, bioretention systems can be susceptible to invasion by aggressive wees and thereby increase the potential for ponding if not routinely maintained.

In order to maintain the system's appearance, it will be necessary to prune and weed. Furthermore, mulch replacement is suggested when erosion is evident or when the site beings to look unattractive. Specifically, the entire area may require mulch replacement every 2 to 3 years, although spot mulching may be sufficient when there are random void areas. Mulch replacement should be done prior to the start of the wet season.

Timing for inspection and maintenance of bioretention swales is suggested in the typical maintenance program below.

Inspection Activities	Suggested Frequency
Inspect soil and replace eroded areas	Monthly
Inspect for erosion or damage to vegetation, preferable at the end of the wet season to schedule summer maintenance before major autumn runoff to be sure the vegetation strips are established for winter. However, additional inspections after periods of heavy runoff is desirable. Inspect to ensure grass is well established. If not, either prepare soil and reseed or replace with alternative species. Check for debris and litter, and areas of sediment accumulation. Inspect health of trees and shrubs.	Half yearly inspection
Maintenance Activities	**Suggested Frequency**
Water plants daily for 2 weeks (in summer)	At project completion
Remove litter and debris	Monthly
Remove sediment. Re-mulch void areas. Mow turf areas. Repair erosion at inflow points. Repair outflow structures.	Yearly assessment; removal as required.
Remove and replace dead and diseased vegetation.	Half yearly.
Add mulch.	Yearly assessment. Add as required.
Mulch should be replaced every 2 to 3 years or when bare areas appear. Re-mulch prior to the wet season.	Every 2-3 years, or as required.

5.6 Issues to be addressed at Building Application stage

An IUWMP is a requirement to be prepared to accompany all proposed cell structure plans within Jandakot Airport. IUWMPs will be prepared for each cell within Jandakot Airport, and will be consistent with the requirements of this LWMS. An IUWMP is largely an extension of the LWMS, however will provide specific detail on the best management practices to be implemented for each development area.

Specifically, the IUWMP will detail the following:

- Compliance with design objectives in the LWMS. Demonstration of compliance should be achieved through appropriate assessment tools, calculations or assessments.
- Measures to achieve water conservation and efficiencies of use.
- Detailed stormwater management design including the size, location and design of public open space areas, integrating flood management capability.
- Specific structural and non-structural Best Management Practices and treatment trains.
- Management of groundwater levels including dewatering (if applicable).

- Management of groundwater contamination (“hot spots”) and other specific site conditions.
- Protection of wetlands (and their buffers), remnant vegetation and ecological linkages.
- Impact of development on water dependent ecosystems (WDEs), and necessary buffers.
- Management of subdivisional works (to ensure no impact on regional conservation areas and management of any dewatering and soil/sediment including dust).
- Monitoring program.
- Implementation including roles, responsibilities, funding and maintenance agreements.

6. Conclusions

6.1 Stormwater Quality Design Objectives

Water quality objectives can be met by employing the following best management practices:

- **Rainwater Storage Systems:** Rainwater tanks. Treatment will be required on the inlet: a first-flush filter is commonly used to remove litter debris and organic matter. Treatment on the outlet will be based on the intended end use of the water.
- **Soakwells and Pervious Pavement:** Soakwells are widely used for direct infiltration of stormwater. They consist of a vertical perforated liner, with stormwater entering via an inlet pipe at the top of the device. The base of the soakwell is open or perforated and usually covered with geotextile. Alternatively, pervious material, such as gravel or porous pavement, can be used to form the base of the soak well.
- **Bioretention Systems:** Based on a design size of 2% of the total impervious area, the following reductions (assuming no extended detention) in pollutants can be achieved:
  - Total Suspended Solids: 90%
  - Total Phosphorous: 80%
  - Total Nitrogen: 50%
  - Heavy metals: 90%
- **Hydrocarbon Management:** Hydrocarbons can be controlled by means of non-structural measures.
- **Litter and Sediment Management:** Litter, debris and sediment management systems are primary treatment measures that retain gross pollutants by physical screening or rapid sedimentation:
  - Side entry trap pits.
  - Litter control devices.
  - Trash racks.
  - Gross pollutant traps.
  - Floating debris traps.
  - Sedimentation basins.

6.2 Non-Structural Measures

The following non-structural controls should be considered to assist in the management of pollutants:

- **Nutrient control and landscaping:** use of appropriate native species, waterwise gardens and responsible applications of fertilisers and pesticides.
- **Sediment/litter control/construction management:** include in construction management plans detailed waste management, sediment and erosion controls.
- **Street sweeping:** street sweeping removes a large portion of silt and gross pollutants that impacts on the removal effectiveness of best management practices.
- **Community awareness and education programs:** provide owners/tenants with information on water management.

6.3 Water Conservation and Efficiency

Future development should incorporate water conservation and efficiency measures to reduce the demand of potable scheme water. Methods such as the installation of water efficient household appliances, external demand management, macro demand management and supply substitution will provide significant reductions in the demand on and use of potable scheme water.

6.4 Monitoring and Maintenance

Post development monitoring of groundwater is required to ensure that development of the master plan does not impact the groundwater quality. Section 5 details groundwater and surface water monitoring for Jandakot Airport.

6.5 Benefits and Effectiveness

Regular cleaning of the stormwater drainage network can increase dissolved oxygen levels in stormwater, reduce levels of bacteria, reduce the load of common stormwater pollutants entering receiving waters (e.g. sediment, nutrients, litter, organic matter), minimise localised flooding and minimise erosion that is caused by localised flooding.

In regions like Perth, there is evidence to suggest that accumulated sediments in urban areas are enriched with nutrients, heavy metals and hydrocarbons. The flat grades, high infiltration rates, and relatively low rainfall intensity of the region would help sediments to be deposited in the drainage network rather than being flushed through it. Given these circumstances, it would seem likely that a high-quality drain inspection and maintenance program would be effective at removing considerable quantities of contaminants (including nutrients) from the system, thus preventing these contaminants from entering sensitive water bodies. Maintenance plans, such as this one, target areas that are most likely to generate contaminated sediments and potentially discharge the sediments to sensitive receiving water bodies.

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Figures

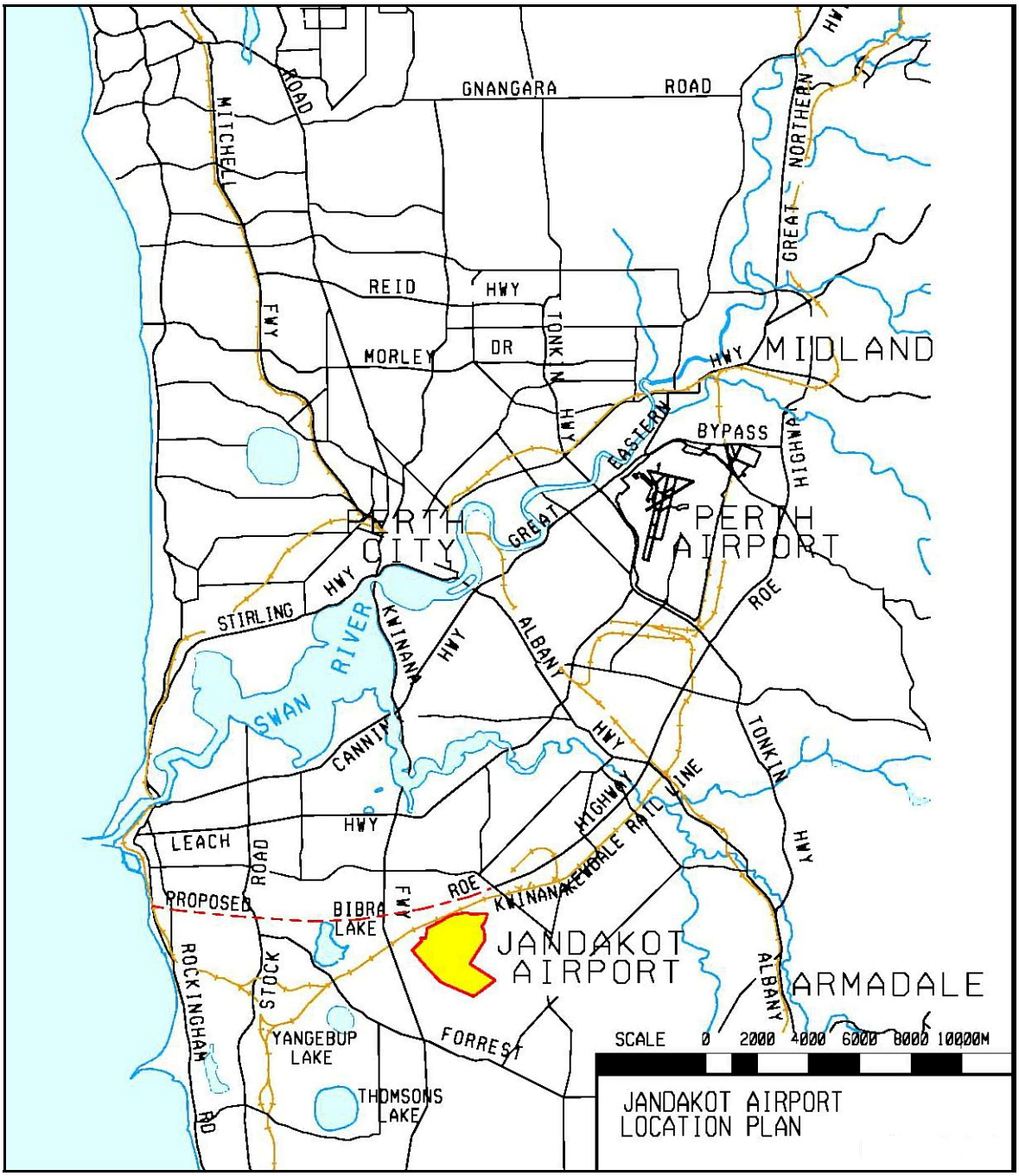


Figure 1: Location of Jandakot Airport (JAH, 2005)

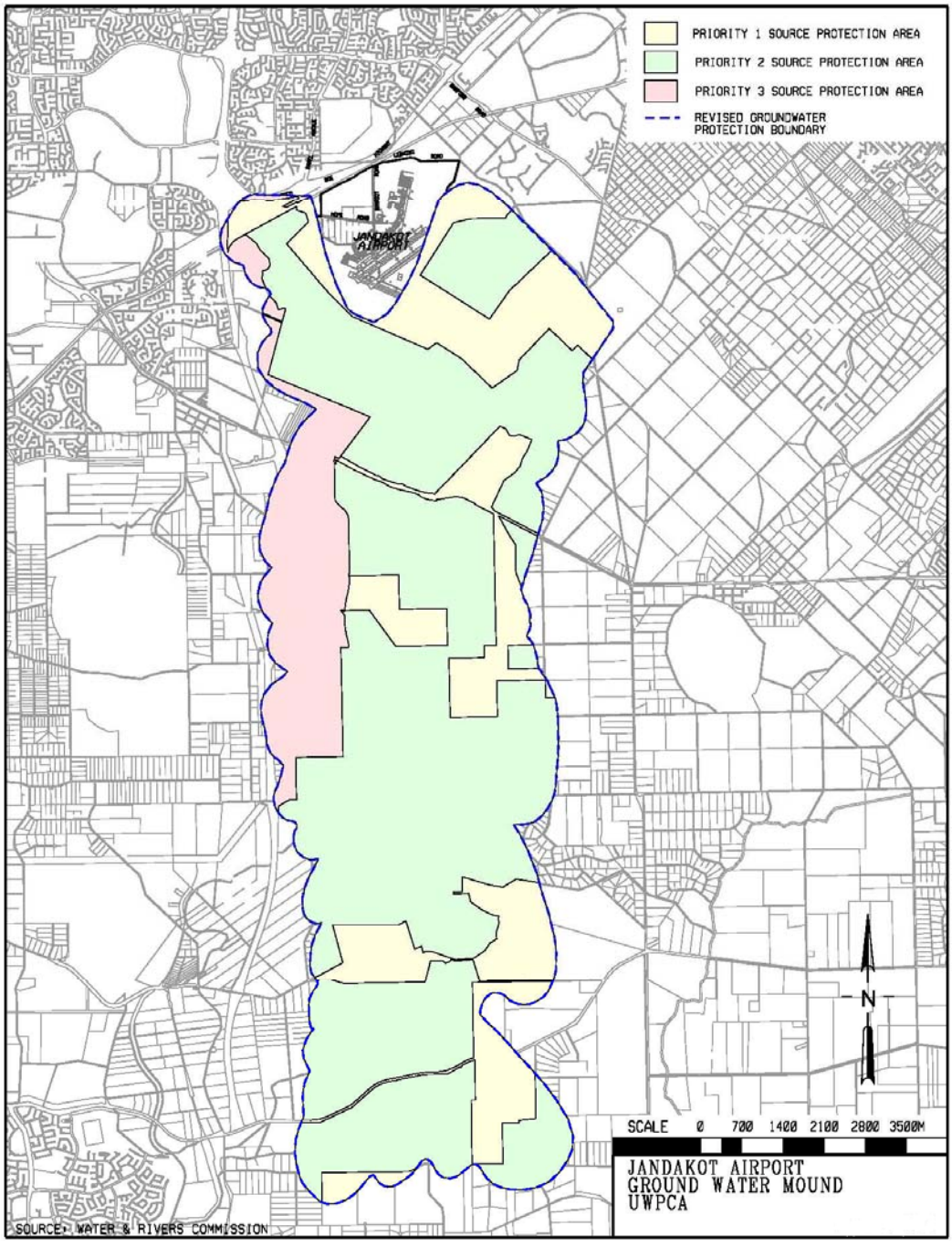


Figure 2: Jandakot Ground Water Mound Underground Water Pollution Control Area (JAH, 2005)

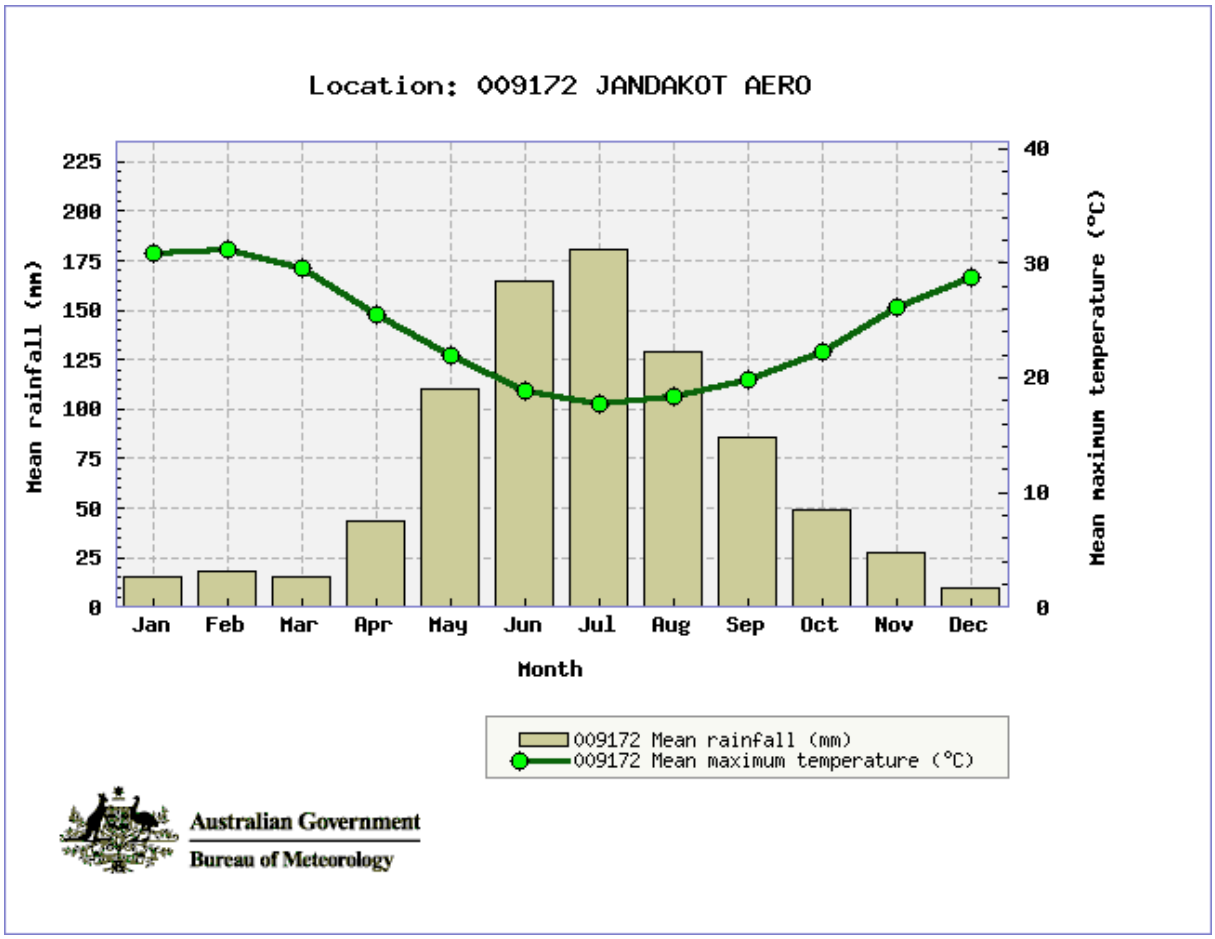


Figure 3: Bureau of Meteorology data for Jandakot Airport site

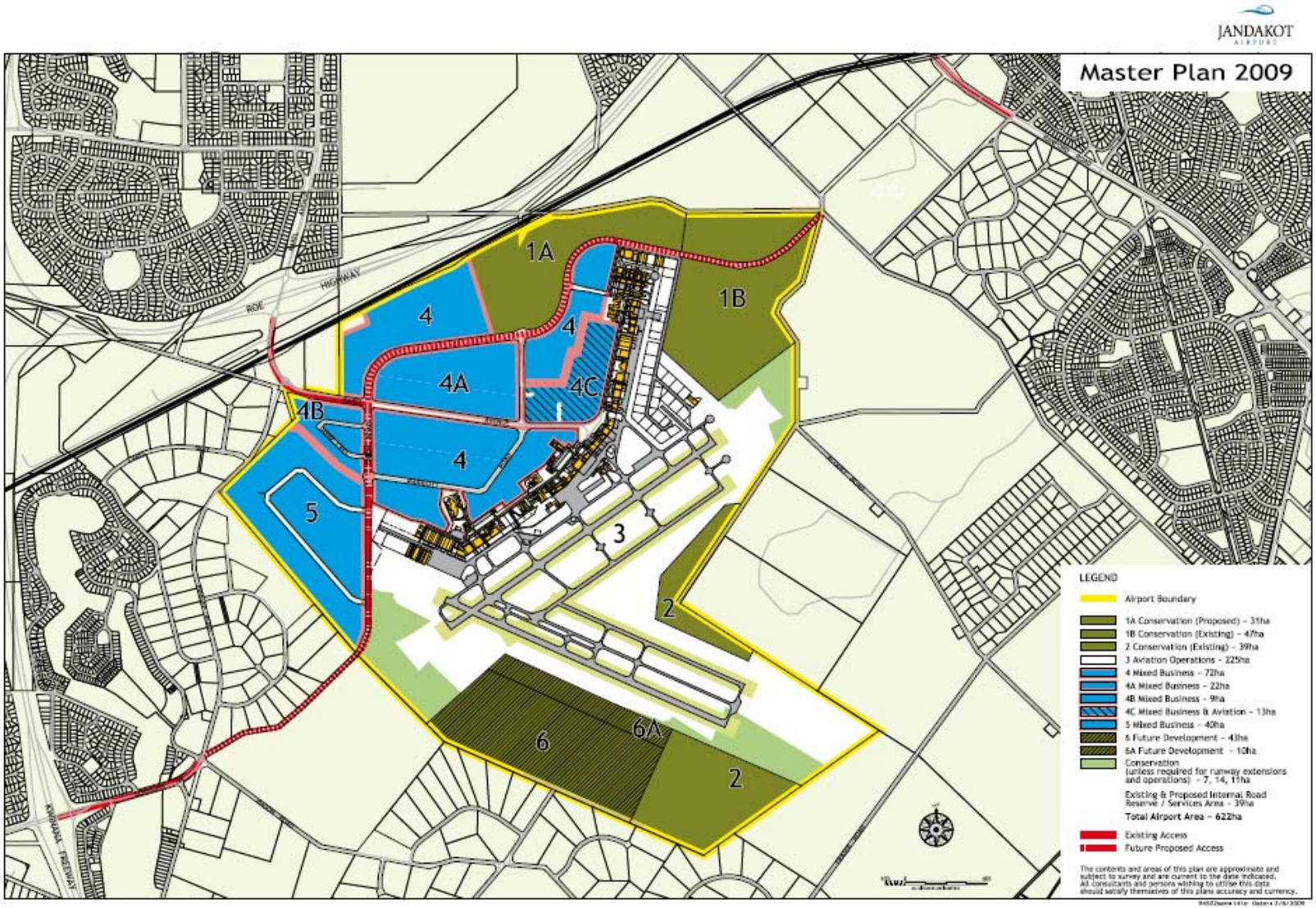


Figure 4: Jandakot Airport Master Plan.

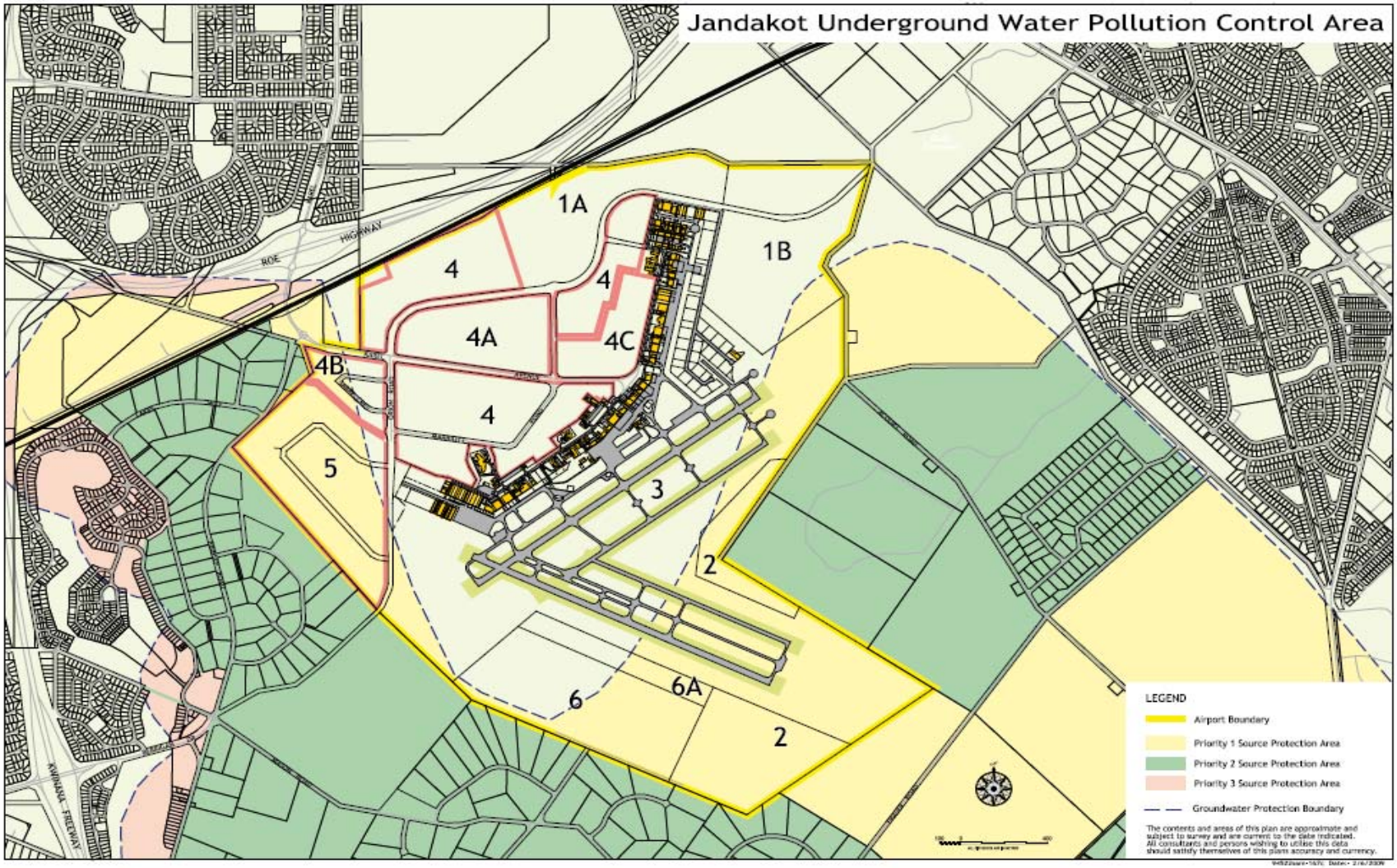


Figure 5: Dampland areas within Jandakot Airport Site (JAH, 2005)

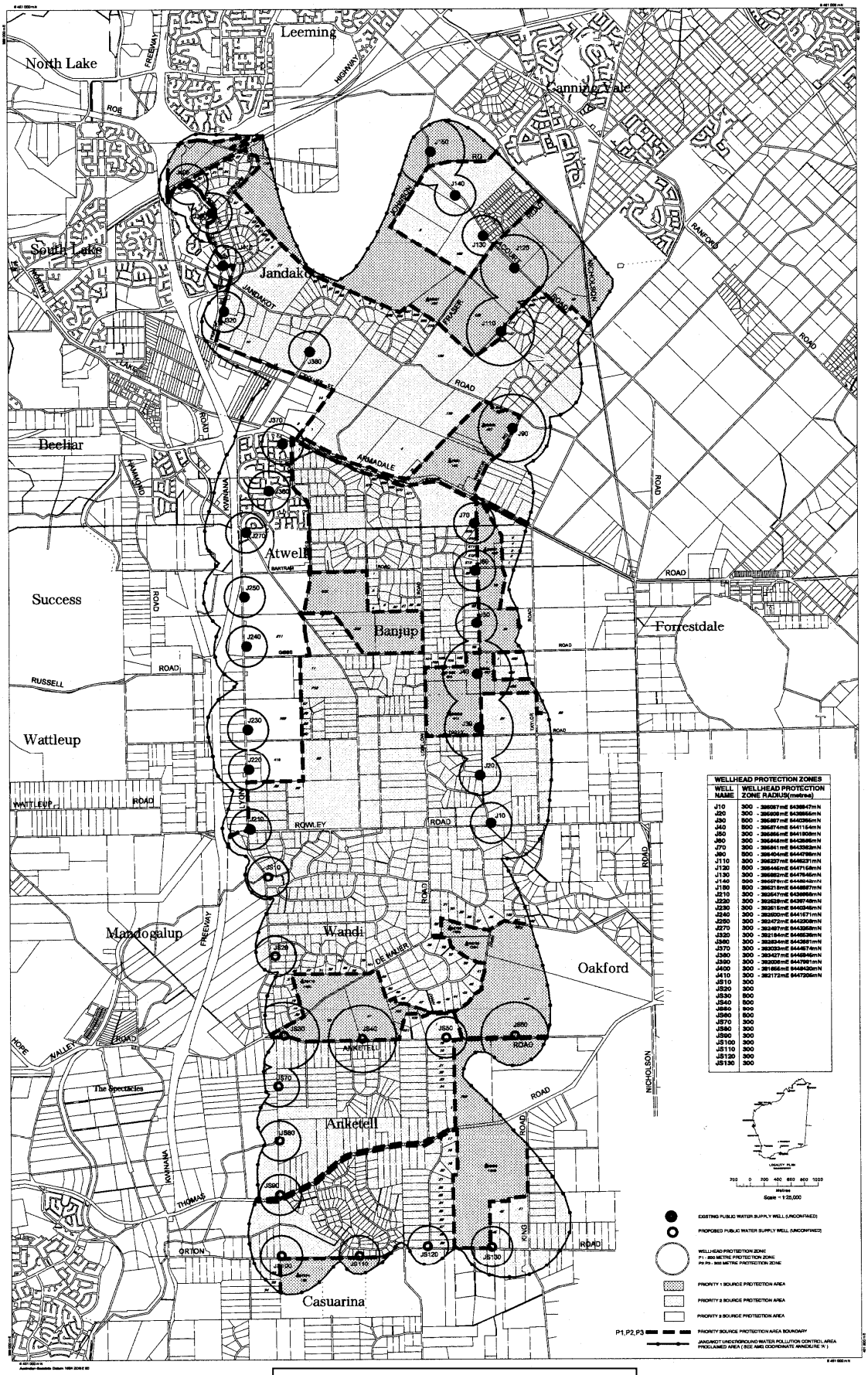


Figure 6: Wellhead Protection Zones

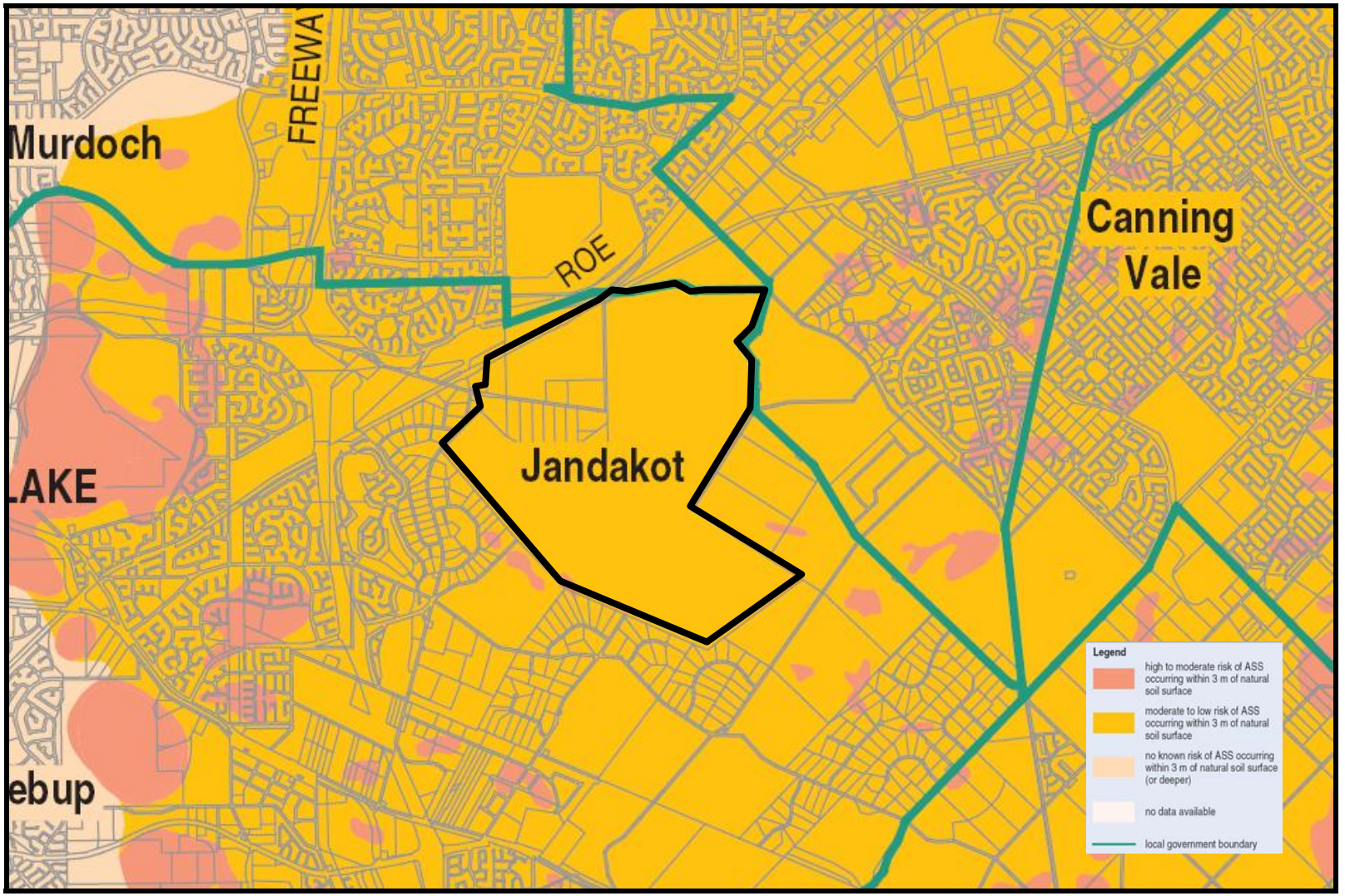
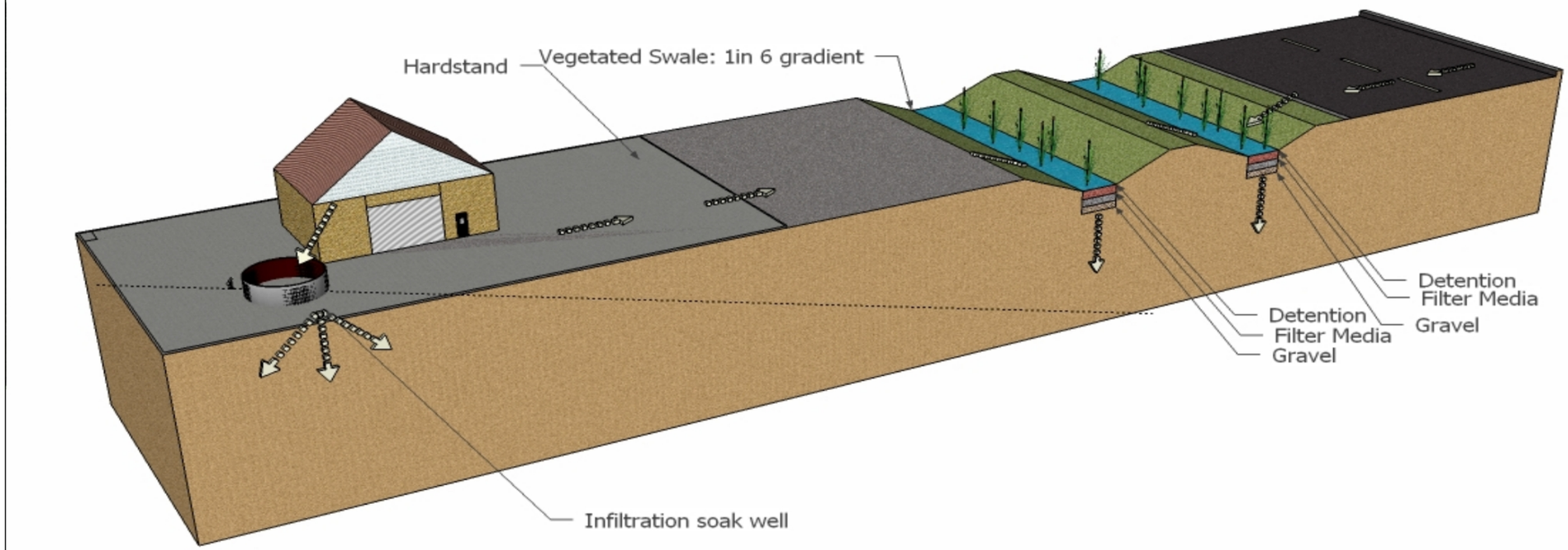


Figure 7: Potential Acid Sulfate Soils Occurrence within Jandakot Airport Site

Figure 8: Stormwater Management Conceptual Layout



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CLIENT: Jandakot Airport

PROJECT: Jandakot Airport

DRAWING TITLE: Stormwater Drainage Concept Plan NOT TO SCALE

SCALE		FILE	80115
HORIZONTAL		DESIGN	MH
VERTICAL		DRAWN	MH
SURVEY DATUM		CHECKED	RH
WAPC No		DATE	4/07/08
CADFILE NAME		DRAWING No.	80803

THIS PLAN IS NOT TO BE USED FOR CONSTRUCTION UNLESS SIGNED BELOW

APPROVED

REV. 1

Appendices

Appendix A: Recommended non-structural BMPs to be considered at Jandakot Airport

BMP	Description	Benefits	Scale of Application	Responsibility for implementation
Xeriscaping	Promote resource sensitive landscape design and maintain on industrial sites/allotments and open space to minimise the need for fertiliser and irrigation.	Reduced nutrient export from the site and reduction in the use of mains water.	Allotment and development scale.	Apply via site-specific development conditions, local guidelines, education, amendment to the town planning scheme and/or local laws.
Soil amendment	Require the use of a loam top-soil in areas where nutrients are likely to be applied (e.g. landscaped areas of industrial sites) and where soil/fill has a low ability to retain phosphorus and moisture.	As above	Allotment and development scale (e.g. in landscaped areas).	Apply via site-specific development conditions, amendment to the town planning scheme and/or local laws.
Provision of sewerage	Provide sewerage to all industrial sites to prevent or minimise the use of septic tanks and the illegal disposal of liquid wastes via infiltration to groundwater.	Reduced loads of nutrient, pathogens and heavy metals being exported to receiving water bodies.	Development scale.	Water Corporation to provide sewerage.
Maintenance of drainage and sewerage infrastructure	Ensure all structural stormwater BMP elements are maintained in accordance with approved maintenance plans that have been developed with input from those people responsible for long-term maintenance. Regularly inspect and maintain nodes in urban stormwater network that may collect pollutants. Ensure that there are no illicit connections of sewer to stormwater by conducting proactive inspections (e.g. dry weather inspections).	Reduced pollutant export to receiving waters (e.g. nitrogen, phosphorus, sediment, gross pollutants, heavy metals, hydrocarbons, etc).	Allotment and Development scale. Development scale. Development scale.	For local stormwater drainage: apply via development conditions and its own maintenance activities. For major drainage and sewerage: Water Corporation to apply via its own inspections and maintenance activities.
Intensive estate scale education	Promote awareness of the need to minimise stormwater and shallow ground pollution, the reason why and the ways this can be achieved. Specific programs may be developed (e.g. audit programs with an amnesty against prosecution, incentive based educational events, provision of spill cleanup kits etc).	Reduced loads of pollutants being explored to receiving waters (e.g. nitrogen, phosphorus, sediment, gross pollutant, heavy metals, hydrocarbons, etc).	Development scale.	Awareness programs in cooperation with the Department of Environment and Conservation and Department of Water.

Point source regulation of industrial premises	Licensing under the Commonwealth legislation, and/or local laws, frequent and regular site inspections/audits, education and strict enforcement of environmental laws (including those related to dangerous and hazardous goods).	Reduced loads of pollutants being exported to receiving waters.	Development scale.	High risk sites – Department of Environment and Conservation. Low to medium risk sites – Council
Erosion and sedimentation control during development	Require best practice erosion and sediment control during development. This would involve requiring an erosion and sediment control program/plan as part of the development assessment process, as well as inspection and enforcement activities by local council/and or DEC. High-quality erosion and sediment control is also needed during construction of structural BMPs for stormwater management such as bioretention systems, or their infiltration media will need immediate replacement.	Reduced sediment and nutrient export to receiving waters.	Allotment and Development scale.	Apply via development/building conditions and through its own inspection and enforcement activities.
Solid waste management activities	Ensure that the subject site is well serviced by the best practice solid waste management and recycling services that minimises the potential for littering and the spillage of waste/recyclable items including kerbside collection. These activities should also include hazardous waste collection days, used oil collection programs and composting programs. Note that in industrial estates with sandy soils with shallow groundwater, there is a significant risk of illegal dumping and groundwater contamination.	Reduced export of a range of pollutants to receiving waters (e.g. litter, hydrocarbons)	Development scale.	Apply its own solid waste management and recycling initiatives for the municipality.
Choice of street trees	Restrict the use of street trees that are deciduous. Street trees with large canopies can also be used to locally lower groundwater tables and allow increased stormwater infiltration (e.g. via roadside grass swales).	Reduced BOD, carbon and nutrient export to receiving waters.	Development scale.	Apply via development conditions and/or local laws.

Promote the use of environmental management systems (EMSs) or industrial premises	Ensure environmental management systems exist to minimise the risk of stormwater or shallow groundwater pollution as a result of the operation of industrial premises. EMSs include risk assessment mechanisms, procedures/plans, training, audits, reporting systems, etc. The JAH EMS should extend to all future developments and businesses should be encouraged to adopt the JAH EMS.	Reduced loads of pollutants being exported to receiving bodies.	Development scale.	Regulated under Commonwealth laws.
Environmental incident and response procedure	Ensure the adequate resources (e.g. staff, procedures, training and equipment) exist to manage environmental incident and emergencies such as the spillage of hazardous chemicals as a result of an accident on the estate.	Reduced loads of pollutants being exported to receiving waters.	Development and estate scale.	Site operators to be prepared for emergency response (e.g. as a part of site's EMS). Council and the state emergency services to provide a coordinated 24 hour service.
Limiting the allowable site area that is unsealed and used for industrial purposes (e.g. unloading materials, washing vehicles, re-fuelling stations etc)	Prevent activities on each industrial site from occurring on unsealed areas that could contaminate groundwater. Sealed areas would need stormwater treatment structures and possibly provisions to fully contain accidental spills	As above.	Development scale.	Apply via development conditions and/pr the town planning scheme.
Encourage strategic sweeping	Encourage industrial site operators to use sweeping strategically to capture pollutants (e.g. litter, organic matter, and course sediments) if these pollutants accumulate on sealed surfaces within the site (e.g. after unloading raw materials). Note that street sweeping is generally not a higly effective BMP for nutrient removal in urban environments.	Reduced litter, organic matter and course sediment export to receiving water bodies.	Allotment scale.	Encourage via development conditions, regulation and or education

16.0

APPENDIX C
REHABILITATION PLAN

Jandakot Airport Environment Strategy

Jandakot Airport Holdings (Pty) Ltd

Bushland Rehabilitation Proposal and Success Criteria

July, 2009

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Bushland Rehabilitation Proposal and Success Criteria

July, 2009

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Executive Summary

This Bushland Rehabilitation Proposal (BRP) provides a project plan with supporting analysis, methodology, timelines and budgets for Jandakot Airport Holdings Pty Ltd (JAH) to undertake high level rehabilitation works over a 7 year period for a 90 hectare portion of Precincts 7 and 8, as shown in figure 1.

This BRP is intended to assist JAH in meeting its obligations under a provisional agreement for the rehabilitation and management of Precincts 7 and 8 with the City of Canning. It is intended that this BRP, when initiated will also assist JAH in meeting its environmental obligations under the Master Plan for management of the airport.

The principal issues for future management consideration are seen as:

- Irrigation water supply;
- The rate at which fencing is established and therefore JAH's responsibility for Precincts 7 and 8;
- Traffic control and public access of the land; and
- Waste management.

The agreement with City of Canning requires JAH to also prepare a Management Plan for Precincts 7 and 8.

This BRP has been designed with the intention of ensuring that the Bushland Rehabilitation Success Criteria that accompanies this proposal can be met and within a projected budget maximum of $6.65 million plus gst. The budget calls for expenditure for the first three calendar years as follows:

Year 1 - $575 K + gst
Year 2 - $838 K + gst
Year 3 - $1,245 K + gst

The budget allows for cost escalation of 3% per annum compounded from 2009 base and incorporates an allowance of 10% for project management. The opportunity presents for JAH to provide appropriate incentives to the Project Manager to deliver on success targets and achieve under budget operational performance.

It needs to be recognised that the subject site is at the highest scale of rehabilitation difficulty and significant operational risks exist, principally arising from:

- Public disturbance/vandalism to site works, the area having being long used for motorised recreation;
- Erosion and achieving stabilisation essential for plant rehabilitation;
- Predation of plants and seed; and
- Scale of works i.e. water availability and quality, endemic plant and seed availability etc.

These risks are compounded by the inescapable forces of nature that are unleashed on rehabilitation areas that are sensitive in the early stages. This BRP looks to manage these risks by proposing commencement of works at a challenging but realistic level and up scaling operations as site experience improves.

The budget allowances to meet the potential costs of managing these risks are robust and good management may result in substantial cost savings. This BRP provides a schedule of necessary items for action upon acceptance. The issue of best irrigation water source and nature of system/cost to install is a planning priority as is the appointment of a Project Manager.

July, 2009

Appointment

Natural Area Management and Services (NAMS) were appointed on Friday 17th October, 2008 by Jandakot Airport Holdings Pty Ltd. (JAH) to the tasks described below:

- Research and develop revegetation success criteria that is specifically related to the proposed clearance and revegetation sites;
    - this criteria would be specific to the mission statement of the Jandakot Airport Holdings Master Plan 2006 and seek to meet the requirements of Commonwealth and State legislation (namely the *Airports Act 1996*, *Airport Environmental Regulations 1997* and the *Environment and Biodiversity Conservation Act 1999)*;
    - this criteria would be supported by a combination of current and relevant supporting literature plus evidence from our own revegetation projects and case studies; and
    - the criteria would be credible and sustain critical third party analysis to underpin the efficacy of the revegetation project.
- Construct a broad strategy for on-ground activities and to focus particularly on the major and practical components of a revegetation action plan;
- Provide recommendations on early actions;
- Provide a broad timeline for each action; and
- Provide an indicative costing for each action and an overall indicative project cost.

Part 2 of this document, Bushland Rehabilitation Success Criteria was completed and submitted by email on Friday 21st November and has been reproduced here for completeness of the document.

Minor amendments were made to Part 1 and Part 2 in July, 2009.

Disclaimer

Natural Area Management & Services has prepared this report for the sole use of the Client and for the purposes as stated in the agreement between the Client and NAMS under which this work was completed. This report may not be relied upon by any other party without the express written agreement of NAMS.

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Any recommendations, opinions or findings stated in this report are based on circumstances and facts as they existed at the time NAMS performed the work. Any changes in such circumstances and facts upon which this document is based may adversely affect any recommendations, opinions or findings contained in this document.

Contents

Part 1 Bushland Rehabilitation Proposal (BRP)

1. Rehabilitation Site Description

Jandakot Airport is located 18 km south of Perth in the City of Cockburn. The City of Melville borders the Airport to the north and the City of Canning lies to the north-east (Figure 2). Jandakot Airport and surrounds are divided into nine precincts for planning purposes (Figure 1).

The proposed rehabilitation area is the majority of the land which makes up Precincts 7 and 8. Precinct 7 is recognised as Jandakot AA zone 166 (Reserve 33289, total area 67 ha) which is held as a Crown Reserve vested in the City of Canning. It is proposed that 50 hectares of Precinct 7 be regenerated and that another 12 hectares be re-contoured for the City of Canning to establish community facilities. The balance of approximately 5 hectares constitutes a lease to the Canning Smallbore Rifle and Pistol Club. This lease area is excluded from this BRP. This rehabilitation area adjoins Precinct 8 which is recognised as Lot 167, owned freehold by the City of Canning (total area 54 ha). The southern portion of Precinct 8 is zoned to provide for a future special rural sub division and is not included in this BRP (approximately 10 ha). The total area available for rehabilitation over both precincts is approximately 90 ha.

Precinct 7 falls within a Priority 1 Groundwater Protection Reserve and Precinct 8 within the Rural Water Protection Zone as identified in the Jandakot Groundwater Protection Policy (WAPC, 1998). Both precincts were previously subjected to sand mining and are in a highly degraded state. The land is a combination of bare sand, sparse and mainly juvenile natural plant regeneration with infestations of introduced weeds. There are some healthy remnant patches of intact native vegetation, particularly along Johnston Road and at the interface between the two precincts.

As a consequence of sand mining, some parts of the proposed rehabilitation area are steeply contoured with acute undulations and are subject to substantial wind erosion. There is evidence of a long period of inappropriate activity, e.g. recreational vehicle use, vandalism and rubbish dumping.

2. Strategic Overview

This BRP is a significant initiative by JAH as part of the Jandakot Airport Master Plan currently under revision, for the development and environmental management of the Jandakot Airport area and surrounds.

This BRP details plans to create an ecological corridor through Precincts 7 and 8 to link Ken Hurst Park (Bush Forever site no. 245, vested with the City of Melville) with the Jandakot Regional Park (DEC) and to compliment the substantial nearby remnant bushland within the Jandakot Airport area.

A preliminary understanding between JAH and the City of Canning with respect to the future use of Precincts 7 and 8 has been reached and JAH has the following key obligations:

- To lease the precincts from the City of Canning for 10 years at a nominal annual rent;
- To prepare a rehabilitation plan (this BRP) and management plan for the proposed leased area;
- To regenerate the proposed lease area including topsoil replacement to enhance connectivity between Ken Hurst Park, Jandakot Regional Park and conservation areas within the Jandakot Airport;
- To recontour the proposed lease area including a designated 'City of Canning Recreational Facility' zone ; and
- To install fencing to the proposed lease area.

If approved, JAH will clear bushland within its lease area on a staged basis, in terms of the Master Plan, for the following reasons:

1. There are obvious environmental benefits arising from progressive clearing including maximum time retention of habitat for regionally significant fauna that exist in the area, most notably the Carnaby's Cockatoo.
2. The proposed rehabilitation project will result in staged replacement of habitat that can be aligned to the progressive clearing and development of land at Jandakot Airport.
3. Progressive clearing will allow for the orderly and manageable salvage of topsoil, mulch, plant material and seed collection to align with the rehabilitation project.
4. To negate the requirement of constant watering of and fire risks associated with large mulch stockpiles.

2.1 Broad Rehabilitation Plan

It is proposed that the land area within Precincts 7 and 8 available for rehabilitation be divided into five zones ranging from 15 -25 ha (Table 1, Figure 3).

Table 1
Indicative area for rehabilitation zones over Precincts 7 and 8.

Zone	Area
1	10
2	15
3	20
4	20
5	25

The zones are to be worked in annual and overlapping stages and aligned where possible with the progressive clearing works. The rehabilitation program is scheduled over a 7 year period.

It is proposed that the rehabilitation zones run in a north-south direction to establish the connectivity between Ken Hurst Park and Jandakot Regional Park and to mitigate the effects of erosion from prevailing winds. The success of the rehabilitation works will be determined by the set of success criteria (see Part 2). The success criteria benchmarks should ensure that a high level rehabilitation outcome be achieved however it is not feasible nor is it proposed to completely reconstruct a Banksia woodland complex with all of its botanical and ecological components within the timeframe.

3. Proposed Bushland Rehabilitation Activities

The following activities are incorporated into the budget of this BRP (See Section 5).

3.1 Baseline Surveys

Baseline surveys will be carried out on the remnant site vegetation and immediately connecting areas of similar landform prior to any on-ground works to address the following:

- Vegetation – species diversity, species cover, condition and health;
- Fauna – feral and natives;
- Presence of *Phytophthora cinnamomi* (Dieback);
- Extent of erosion;
- Level of disturbance;
- Presence of weeds; and
- Activity of feral animals.

Timing is important, initial surveys will occur in late spring/early summer with follow up surveys as necessary. The results of these surveys will form baseline data for the success criteria (see Part 2). Specific outcomes of these surveys will include:

- A reconstructed species list for native flora which will provide the plant production and direct seeding species lists;
- Establishing species richness and abundance of native and exotic flora;
- Determining the ratio of bare soil to vegetation in a comparable mature Banksia woodland;
- Calculating the evenness of spread and percentage cover of flora species in a comparable mature Banksia woodland;
- Assessing the vegetation condition based on the Keighery vegetation condition scale;
- Assessing the vegetation health to Nursery and Gardening Industry Association horticultural standards; and
- Assessing acceptable levels of erosion and disturbance in comparable mature Banksia woodlands.

3.2 Seed Collection

For rehabilitation programs it is important to obtain local provenance seed; this is established best practice. Sustainable seed collection should occur as soon as possible in all JAH precincts. Given the substantial seed requirements of this project, collection from relevant adjoining bushland, where permission can be obtained, should be undertaken. Support for the project from Cities of Cockburn, Melville, Canning and the DEC should be sought. All seed collection needs to be

undertaken by suitably licensed operators and statutory returns recording all seed collected are to be submitted to DEC on a quarterly basis.

When decisions about clearing and the rehabilitation program are finalised it would be appropriate to maximise seed collection ahead of clearing. This BRP provides for the collection, recording, administration and storage of seed to a reasonable level with some of the anticipated seed requirements likely to have to be purchased from local licensed seed collectors. It is intended that outside purchases would be kept to a minimum and collection maximised by the rehabilitation project team.

3.3 Plant Salvage

Plant salvage involves retaining species that are difficult to propagate by seed, by removing the whole plant (root and shoots) from the ground. The benefit from propagation by salvage is enhanced species diversity. This process is generally only successful with small, understory plant species. It is possible to divide some plants to increase their yield. Sites of possible plant salvage include areas within Jandakot Airport immediately ahead of clearing and areas in the rehabilitation site that may be subject to disturbance from earthworks. Salvaged plants should be transplanted into pots, stored in a nursery and managed until planted out. Plant salvage would generally be more successful if carried out between autumn and spring. It would be recommended that the JAH nursery be utilised to house the salvaged plants. It is proposed that 3,000 plants be salvaged for every 10 hectare of rehabilitation area.

The larger, slow growing iconic species such as *Xanthorrhoea preissii*, (Grass tree) *Macrozamia reidlei* (Zamia) and *Nuytsia floribunda* (Western Australian Christmas Tree) are salvageable with specialised equipment. This BRP incorporates salvage of up to thirty individuals of these larger species for each 10 ha of rehabilitation area.

3.4 Plant Propagation

As soon as approval for seed collection is granted, plant propagation could begin to provide stock for planting in Zone 1 in 2011 and continue annually thereafter. Plant production should only take place in nurseries certified as accredited under the Nursery Industry Accreditation Scheme Australia (NIASA) guidelines. This BRP provides for the propagation and subsequent direct planting of upper storey Banksia woodland species (*Banksia*, *Allocasuarina* and *Eucalyptus* spp.) with the majority of understorey species to be derived from direct seeding, natural regeneration and salvaged plant return.

3.5 Clearing

This BRP assumes that the clearing site at Jandakot Airport is to be cleared progressively in approximately 10 ha portions. The vegetation should be knocked down, the surface ripped to remove large stumps and the vegetative matter mulched and stockpiled or transported to the rehabilitation site. In addition it is proposed that topsoil be removed and respread on the rehabilitation site.

The progressive clearing and the re-use of mulch and topsoil will be aligned where possible with the timing of works on the rehabilitation zones. In addition the risk/cost associated with constant watering of large mulch stockpiles to avoid spontaneous combustion/large fire fuel load risk can be avoided.

Clearing activities are best carried out in summer to minimise fauna impact and dieback transfer risk.

3.6 Rehabilitation Site Preparation

Waste management

There is a substantial amount of rubbish, including hazardous waste (e.g. asbestos) presenting on the rehabilitation site that has implications for public liability. It is proposed that requirements for waste management on each rehabilitation zone be assessed and dealt with annually, ahead of any activities in the respective zones. All the bulky rubbish (E.g. tyres, old fencing, empty drums, wire etc) should be removed and hazardous waste disposed of as regulated.

A budget allowance has been made for waste management on an annual basis for the rehabilitation zones, based upon current presentation. No allowance for additional dumping has been made and we believe that the City of Canning is best equipped to maintain responsibility for waste management outside of the established rehabilitation zones.

Surface re-contouring

It is not proposed that entire rehabilitation zones be re-contoured as this is not necessary and will only serve to increase costs, destroy valuable natural regeneration and increase erosion, dust and disturbance. Re-contouring involves assessing and surveying individual areas and determining which areas require attention. This assessment would also be based on the extent and value or otherwise of the native vegetation presenting. The earthmoving equipment would be used to bury the larger weed infestations and non contaminated rubble. At the same time, the acute undulations would be removed and deep depressions filled.

It is proposed that re-contouring, spreading of topsoil and spreading of available mulch be carried out in conjunction with each other, commencing in December 2010 and according to table 2.

Table 2
Timing of re-contouring topsoil and mulch re-spreading.

Year	Re-contour	Spread topsoil	Spread mulch
1	Zone 1 and Zone 2	Zone 1	Zone 2
2	-	Zone 2	Zone 3
3	Zone 3	Zone 3	Zone 4
4	Zone 4	Zone 4	Zone 5
5	Zone 5 and Canning Rec. Zone	Zone 5	
6	Canning Rec. Zone		

An agreed timing of re-contouring of the proposed City of Canning Recreation Facility area needs to be determined. The likely pace of the recreation area establishment and priority work locations needs to be agreed as a landscape and amenity plan is developed in conjunction with the eastward rollout of this BRP.

As a considerable amount of native flora has regenerated since the cessation of sand mining, Permits to Clear will be required from the Department of Environment and Conservation. Applications for the required amounts of clearing will need to be made at the appropriate times. Clearing permits should be readily granted on the basis that the outcomes of this BRP will provide a more than adequate offset for the small amounts of vegetation to be cleared.

Fencing

Whilst JAH has an obligation to fence the rehabilitation site, we do not consider it wise or viable to fence the entire site in one operation. The site has been used by recreational vehicles for many years and any attempt to restrict total access would result in frequent incursions and a very high maintenance cost. This recommendation is based on our experience in working with the City of Melville at nearby Ken Hurst Park and other similar situations. We believe that JAH's obligation should be fulfilled progressively and fencing undertaken progressively and prioritised to protect the rehabilitation zones.

This BRP provides for the installation of long term conservation style fencing (treated pine and mesh) in stages, in conjunction with temporary revegetation fencing (star picket, strainer wire, ring-lock and shade cloth) which will enclose the rehabilitation zones that are the subject of works. The temporary revegetation fencing can be re-used to progressively encompass the future rehabilitation zones according to table 3. Figure 4 outlines this proposed fencing program.

Table 3
Indicative fencing program.

Year	Conservation fencing	Revegetation fencing
1	Install to north, south and west boundary of rehabilitation site to enclose Zones 1 & 2	Eastern boundary of Zone 2
3	Extend northern and southern boundary to enclose Zone 3	Relocate to eastern boundary of Zone 3
4	Extend northern and southern boundary to enclose zone 4	Relocate to eastern boundary of Zone 4
5	Extend northern and southern boundary to meet at the eastern corner of the rehabilitation site	Not required as entire rehabilitation site will be enclosed by conservation fencing

The budget allows for the establishment and periodic relocation of the temporary revegetation fencing, its removal cost can be offset by the scrap value of the metal.

3.7 Topsoil Removal and Re-spreading

The topsoil from Jandakot Airport has the potential to provide a rich source of seeds for the rehabilitation site. The topsoil also contains beneficial fungi and micro-organisms that enhance seed growth. Details of research by the Botanic Gardens and Parks Authority on topsoil transfer are detailed in Attachment 2.

It is important to consider the risks of spreading dieback and weeds with topsoil replacement. Most of Jandakot Airport was mapped as dieback free by Glevan Dieback Consults in 2006; however some areas within the Airport have been mapped as dieback infected and others as uninterpretable. Closer to the timing of clearing activities, indicator species should be inspected for signs of dieback stress. Any areas deemed to be possibly infected with dieback should be excised from the topsoil removal process to negate the risk of spreading dieback into the rehabilitation site. Dieback transfer could seriously impact achievement of the success criteria.

There is currently a low level presence of perennial veldt grass, *Ehrharta calycina* at Jandakot Airport and a very low level presence of priority weed species. On balance the risks associated with dieback and weed transfer are outweighed by the potential benefit to the rehabilitation site.

The gentle sloping topography of the clearing site at Jandakot Airport lends itself well to even topsoil removal. Topsoil should be stripped to a depth of approximately 150 mm following clearing, transported and re-spread immediately to the relevant re-contoured rehabilitation zones.

3.8 Site Stabilisation

The practical issues of stabilising the site are as follows:

1. Minimal re-contouring and maximum retention of native vegetation will assist in maintaining stabilisation of the site. The vegetation that exists at the interface between Precincts 7 and 8 provides a buffer to the prevailing winds from the south and west. No such protection exists for winds from the north-east to the south-east.
2. The re-use of topsoil and spreading of mulch will assist stabilisation.
3. Following re-contouring it may prove necessary to install a series of wind control fences to avoid large scale sand movement, plant inundation and seed loss. A provision for this cost has been made.
4. Ahead of distribution of seed to the rehabilitation zones, it will be necessary to decide the extent of spray on soil stabiliser (polymer based product) that will be required to overcome soil instability in particular areas (Refer to Attachment 4 for examples of spray on soil stabiliser). The use of Hydra mulch type stabilisers is not recommended on native seed sites. Decisions on areas to be treated will be based upon accumulated site knowledge and conditions presenting on respective rehabilitation zones at the time. A substantial allowance for this cost has been made.

This BRP provides for the attachment of shade cloth to the temporary revegetation fencing on the eastern boundaries of the rehabilitation zones which will mitigate seasonal easterly winds.

3.9 Environmental Weed Control

Weed control will initially focus on controlling the weeds presenting in the remnant vegetation on the western and southern boundary of Zones 1 and 2 and also at the interface between Precincts 7 and 8. Weeds within each rehabilitation zone will be controlled according to a distinct annual program for each zone. However, weeds that are acting to stabilise areas in the eastern rehabilitation zones will not be targeted until closer to the time of rehabilitation works applicable to that zone. Environmental weed control involves herbicide spraying and or physical removal of weeds in accordance with industry best practice i.e. *Bushland Weeds* by Brown and Brooks (2002). The types of herbicides used will comply with the regulations pertaining to Groundwater Protection Reserves.

Selective herbicide is required for control of grasses where growing in close proximity to remnant vegetation (e.g. Quizalofop, Fluazifop). In all other cases, surgical application of appropriate non-selective herbicides will apply (e.g. Glyphosate, Metsulphuron and Chlorsulphuron). Appropriate additives (e.g. wetting agents, surfactants and marker dye) are to be used in all cases.

Most of the rehabilitation zones contain large and significant infestations of Giant Reed (*Arundo donax*) which will require physical removal of the plant material and rhizome to a tip site for deep burial. The budget allows for the cost of machine removal and tipping costs. It may be that the City of Canning would assist in these disposal costs.

The general strategy for herbicide treatment for each zone is detailed below and shown in table 4.

First year: Initial spray
This includes three non-selective herbicide treatments to the majority of the site with two selective treatments to the remnant vegetation persisting on the fringes. This spray year corresponds to re-contouring in each zone which will provide for the removal of large infestations of Veldt Grass and Giant Reed by burying with earthmoving machinery.

Second Year: Pre-planting spray
This includes one non-selective treatment prior to direct planting and two selective treatments following planting.

Third Year: Pre-seed spray
This includes one application of non-selective herbicide prior to direct seeding followed by two applications of selective herbicide following direct seeding.

Fourth Year: Final spray
This includes one application each of selective and non-selective herbicide. Rehabilitation from direct seeding and direct planting should be occurring at this stage of the project, the application of herbicide therefore requires great care.

Table 4
Indicative herbicide treatment program.

Year	Zone	Number of non-selective herbicide treatments	Number of selective herbicide treatments	Spray type	Other
1	1	3	2	Initial	Burying
	2	3	2	Initial	Burying
2	1	1	2	Pre-planting	
	2	2	2	Initial	
3	1	1	2	Pre-seed	Hand weed
	2	1	2	Pre-planting	
	3	3	2	Initial	Burying
4	1	1	1	Final	
	2	1	2	Pre-seed	Hand weed
	3	1	2	Pre-planting	
	4	3	2	Initial	Burying
5	1	Finished	Finished		
	2	1	2	Final	
	3	1	2	Pre-seed	Hand weed
	4	1	2	Pre-planting	
	5	3	2	Initial	Burying
6	1	Finished	Finished		
	2	Finished	Finished		
	3	1	2	Final	
	4	1	2	Pre-seed	Hand weed
	5	1	2	Pre-planting	
7	1	Finished	Finished		
	2	Finished	Finished		
	3	Finished	Finished		
	4	1	2	Final	
	5	1	2	Pre-Seed	Hand weed

3.10 Feral Animal Control

Feral rabbits

There is a significant feral rabbit presence and early commencement of a treatment program is recommended. Treatment should commence in early winter with a follow up program in spring. The treatment program would involve the acclimatisation of the rabbits to oats followed by baiting warrens with oats laced with Pindone pesticide. Best practice is for the Pindone to be administered directly to active warrens to avoid impacts to non-target species. The general broadcasting of Pindone is not recommended. Only licensed operators should be used for this work and communication with the City of Canning may be necessary.

Feral cats & foxes

It may be necessary to extend the current JAH program to the rehabilitation site and to work in concert with adjoining land managers for widespread control. No budget allowance has been made.

3.11 Rehabilitation

Rehabilitation will be based on a modest level of direct planting and a high level of seed broadcasting to compliment topsoil transfer and natural rehabilitation. The species to be planted will be the predominant Banksia species of the area together with the appropriate Eucalyptus and Allocasuarina species. The strategy is to establish these upper storey species quickly, with reticulation support, continue intensive weed control ahead of direct seeding and then allow a season of germination without non-selective weed control. This will allow the native germinants time to establish and become prominent before non-selective weed control is re-commenced. Selective control of grasses will be ongoing.

Banksia species are to be grown in 70 x 70 x 100 mm containers (squat pots), Eucalypts to be grown in 50 x 50 x 125 mm tubes and Allocasuarina species to be grown in 90 x 90 x 180 mm olive pots.

Slow release/low phosphorus fertiliser suitable for Banksia species will be broadcast across the rehabilitation zones to counter the nutrient deficient soils. Seed to be broadcast on the rehabilitation zones will receive proven treatments to promote germination, e.g. smoking, boiling, heat variation and scarification.

Direct planting

To allow time to propagate endemic species, it is proposed that rehabilitation works commence in year two and be planted prior to winter rains in late autumn 2011. Remedial planting may be required depending on seedling survival and or damage caused by predation or vandals. No direct provision for remedial planting costs has been made.

The proposed planting density is 1 plant per 10 square metres for upper storey plants. This will be complimented by planting 3 salvaged plants per 100 square metres.

The budget for planting costs includes the transport of plants to site, installation, watering on planting, application of fertiliser, supply and fitting plant guards and removal of guards at end of growing season. The plant guards would be supported by 4 bamboo stakes for additional stability.

Direct seeding

Following collection and appropriate treatment of seed, direct seeding will first occur in Year 3 in rehabilitation Zone 1 and annually in each of the remaining zones. Distributing

seed over large areas involves the blending of the seed with a distribution medium and controlled broadcasting to achieve even coverage of the entire area. It will be necessary to minimise surface soil movement and site disturbance post seed distribution. The measures to achieve this are outlined in Section 3.8.

Watering

Achievement of the success criteria is predicated on the installation of a substantial reticulation system to establish the essential Banksia species in each rehabilitation zone in the initial season. It is intended that this system will be designed to be extended progressively to successive rehabilitation zones.

The budget contains an allowance based upon our experience and an indicative costing by a large commercial irrigation company.

It will be necessary to undertake a specific investigation of irrigation options, proposed water consumption and requirements for water licence/consumption within approved allowances.

A dry rehabilitation site, whilst an option, is considered unviable as it is unlikely that the success criteria can be achieved on this site without a temporary reticulation system. Preferably the system should operate over two seasons for each rehabilitation zone to assist in the second year with enhanced planting growth rate. Manual, hose and tanker watering is not a viable alternative for a site of this size and soil type.

NAMS has been involved for the last 4 years in extensive rehabilitation project works for Telstra Corporation at its 220 hectare Gnangara Bush Forever site. The Telstra site is a similar landform to the Jandakot area. This has given us significant experience in comparing dry and reticulated growth performance of Banksia planting sites. The anecdotal evidence supports approximately 35% improvement in plant survival and approximately 40% growth advantage in the initial season with the use of reticulation. Whilst there is some evidence of mortality following discontinuation of reticulation this is low and not general in occurrence.

3.12 Monitoring

Rehabilitation zones will be monitored on a bi-annual basis each April and October to ascertain the effectiveness of the methods and to gauge the success of rehabilitation works against the Bushland Rehabilitation Success Criteria.

Monitoring reports should be completed and submitted by 15th of each June and December.

3.13 Community Participation

Community participation is important in raising awareness and support for this BRP. This is especially important given the history of the site and its location. Community groups should be identified and contacted to develop a level of respect and understanding for the project. This type of contact will foster good will and positive personal relations between JAH and the community. Table 5 identifies some potential individuals and organisations for community involvement.

Table 5
Potential individuals and organisations for community involvement

Community Group	Example Organisations
Schools	Melville PS Beeliar PS Jandakot PS
Universities	Murdoch University
Local community groups	Canning Vale Scout Group Canning Smallbore and Rifle Club Armadale 4WD Club, Foothills 4WD Club WA
Local government	City of Canning City of Cockburn City of Melville
Scientists/naturalists	Birds Australia WA Dieback Action Groups

Potential avenues for community participation include:

- Planning planting, eco-education, weeding and clean up days;
- Creating an Adopt-a-bushland project and/or a Friends-of group, where groups are able to take 'ownership' of sections of the rehabilitation site and provide assistance in rehabilitation activities;
- Involving local scientists and naturalists who can provide local knowledge on the site; and
- Gaining support of local four wheel drive groups for the purpose of engaging in responsible use of the site.

4. Action Plan

On approval of this BRP, the following is a suggested list of action items required to progress the plan. The list is generally in the required order of attention.

The timing of some items will be affected by other approvals processes.

Item	Recommended completion date
Authorise seed collection from sites within the JAH area	End December 2009
Seek approval from Cities of Canning, Cockburn and Melville for seed collection in relevant areas	End December 2009
Confirm appointment of BRP Project Manager	January 2010
Finalise contractual undertakings with City of Canning	March 2010
Appoint weed control and feral rabbit control contractors for early 2010 works	March 2010
Establish contacts with stakeholders	April 2010
Seek quotes from irrigation contractors for water supply system	May 2010
Seek quotes for contractors for conservation fencing	May 2010
Survey rehabilitation site for earthwork requirements	May 2010
Seek quotes from contractors for earthworks	May 2010
Update project budget and seek formal approval	Early June 2010
Finalise clearing program for land at Jandakot Airport	September 2010
Review the progress of BRP and schedule actions for year ahead	September 2010

5. Budget

5.1 Costs Summary

Description		Timing	Cost	Requirement
3.1 Baseline Surveys	Flora survey team	Year 1 only	$900/day	For a 10 ha area/year: 4 x field days 2 x processing days
	Fauna survey team	Year 1 only	$130/hr	For a 10 ha area/year: 3 x field days 1 x processing day
3.2 Seed Collection	Collection, processing and administration	Year 1-6	$850/day	For 10 hectares of rehabilitation area/year: 6 x field days 3 x processing days
3.3 Plant Salvage	Plant salvage – understorey	Year 1-5	$950/day	For a 10 ha area/year: 4 x field days 2 x processing day
	Plant salvage – large species	Year 1-5	$4,000/day	For a 10 ha area/year: 1 day
3.4 Plant Propagation	Nursery propagation, sowing and maintenance of seedlings	Year 1-5	$3/plant	For 10 ha of rehabilitation area: 10,000 plants from seed 3,000 salvaged plants
3.5 Clearing	Clearing	Year 1 – 5	$7,000/10 ha	10 ha each year.
	Mulching, transportation and spreading	Year 1 - 5	$19,000/10 ha	10 ha each year.
3.6 Rehabilitation Site Preparation	Waste removal	Year 1 - 5	$5,000/yr	Each zone will be assessed annually, Zone 1 and Zone 2 assessed initially in Year 1
	Recontouring rehabilitation zones	Year 1, 3-5	$7,200/10 ha	Year 1 - 25 ha (Zone 1 & 2) Year 3 – 20 ha (Zone 3) Year 4 – 20 ha (Zone 4) Year 5 – 25 ha (Zone 5)
	Recontouring Canning Recreation Zone	Year 5 -6	$7,200/10 ha	12 ha in total.
	Temporary revegetation fencing	Year 1, 3, 4	$25/m for initial installation then $20/m for remaining years	Approximately: Year 1 – 1000 m Year 3 – 1050 m Year 4 – 800 m

Description		Timing	Cost	Requirement
	Conservation fencing	Year 1, 3-5	$35/m	Approximately: Year 1 – 2500 m Year 3 – 520 m Year 4 – 700 m Year 5 – 1050 m
3.7 Topsoil Removal and Re-spreading	Topsoil removal	Year 1 – 5	$10,000/10 ha	Clearing site will be stripped of topsoil annually (10ha/year). Topsoil will be re-spread on rehabilitation zones Immediately following stripping.
	Transporting from clearing site to rehabilitation zones	Year 1 – 5	$12,500/10 ha	
	Re-spreading	Year 1 - 5	$10,800/10 ha	
3.8 Site Stabilisation	Erosion control – sand/wind trap fencing	Year 2 - 6	$15/m	Approximately 125 m required for each hectare of rehabilitation area.
	Erosion control – spray on stabiliser	Year 3 -7	$17,000/ha	To approximately 40% of each rehabilitation zone.
3.9 Environmental Weed Control	Weed control program	Year 1 - 7	First year: $5,000/ha Second year: $3,000/ha Third year: $2,000/ha Fourth year: $1,500/ha	Each rehabilitation zone requires a four year spray program.
3.10 Feral Control	Baiting	Year 1-5	$6,820/year	5 year program
3.11 Rehabilitation	Direct planting	Year 2 – 6	$8/plant	10,000 plants/10 ha, from seed and 3,000 salvaged plants/10 ha.
	Seed purchases	Year 2-6	$900/kg	Year 2 - 35 kg Year 3 – 55 kg Year 4 – 70 kg Year 5 – 80 kg Year 6 – 90 kg
	Seed treatment	Year 3-7	$1,000/day	For a 10 ha area: 2 days/year
	Irrigation	Year 2-6	$160,000 (installation) $60,000/yr (relocation)	Installation over Year 2 & 3 then relocated in years 3-6 to relevant area.
3.12 Monitoring	Bi-annual surveys	Year 2 – 7	$4500/yr	Bi-annually: 4 x field days 1 x processing days

5.2 Costs Spreadsheet

	Base Costs	One 2009	Two 2010	Three 2011	Four 2012	Five 2013	Six 2014	Seven 2015	Total
Baseline surveys		10,080							**10,080**
Seed collection	765 /ha	11,475	15,759	16,232	16,719	21,525	22,171		**103,881**
Plant propagation	3,900 /ha	58,500	80,340	82,750	85,233	109,737			**416,560**
Plant salvage	970 /ha	9,700	9,991	10,291	10,599	10,917			**51,499**
Clearing	700 /ha	7,000	7,210	7,426	7,649	7,879			**37,164**
Mulching	800 /ha	8,000	8,240	8,487	8,742				**33,469**
Mulch transporting	300 /ha	3,000	3,090	3,183	3,278	3,377			**15,927**
Mulch spreading	800 /ha	8,000	8,240	8,487	8,742	9,004			**42,473**
Waste removal	500 /ha	17,500		10,609	10,927	14,069			**53,105**
Recontouring	720 /ha	25,200		15,277	15,735	25,121	5,008		**86,342**
Conservation fencing	35 /m	25,000		22,279	17,484				**64,763**
Topsoil stripping	1,000 /ha	87,500		19,308	26,772	41,362			**174,943**
Topsoil transporting	1,250 /ha	10,000	10,300	10,609	10,927	11,255			**53,091**
Topsoil spreading	1,080 /ha	12,500	12,875	13,261	13,659	14,069			**66,364**
Erosion Control - sand/wind trap fencing	15 /m	10,800	11,124	11,458	11,801	12,155			**57,339**
Erosion Control - spray on stabiliser	17,000 /ha		28,969	39,784	40,977	42,207	54,341		**206,277**
Revegetation fencing	20 /m			108,212	148,611	153,069	157,661	202,989	**770,542**
First year weed control	5,000 /ha	175,000	103,000	106,090	109,273	140,689			**634,051**
Second year weed control	3,000 /ha		46,350	63,654	65,564	67,531	86,946		**330,044**
Third year weed control	2,000 /ha			31,827	43,709	45,020	46,371	59,703	**226,630**
Fourth year weed control	1,500 /ha				24,586	33,765	34,778	35,822	**128,951**
Feral control	6,820 /yr	6,820	7,025	7,235	7,452	7,676			**36,208**
Irrigation - installation	160,000		115,360	50,923					**166,283**
Irrigation - reloaction	3,000 /ha			63,654	81,955	67,531	86,946		**300,085**
Direct planting	10,400 / ha		214,240	275,834	227,287	234,106	301,411		**1,252,878**
Direct seeding - labour broadcasting	160 /ha			2,546	3,497	3,602	3,710	4,776	**18,130**
Seed purchases	900 /kg		32,445	52,515	68,842	81,037	93,901		**328,739**
Seed treatment	200 /ha			3,183	4,371	4,502	4,637	5,970	**22,663**
Monitoring	4,500 /yr		4,635	4,774	4,917	5,065	5,217	5,373	**29,981**
Sundry	25,000 /yr	25,000	25,750	26,523	27,318	28,138	28,982	29,851	**191,562**
	Sub Total	**511,075**	**744,942**	**1,076,410**	**1,106,626**	**1,194,407**	**932,080**	**344,484**	
	Contingency	**12,777**	**18,624**	**26,910**	**27,666**	**29,860**	**23,302**	**8,612**	
	Project Management	**51,108**	**74,494**	**107,641**	**110,663**	**119,441**	**93,208**	**34,448**	
	Yearly Total	**574,959**	**838,060**	**1,210,962**	**1,244,955**	**1,343,708**	**1,048,589**	**387,545**	

Total $6,648,777.74 + GST

Cost per hectare $66,487.78 + GST

Note: This budget has a 3% per annum inflation price built in, contingency is 2.5% of sub- total and project management is 10% of sub-total. Sundry includes repairs and maintenance, signage, fees and charges, remedial costs, BRP preliminaries and wildlife rescue. Explanatory notes are available on request.

Part 2 Bushland Rehabilitation Success Criteria

1. Background

Natural Area Management & Services has been appointed by Jandakot Airport Holdings Pty. Ltd. (JAH) to prepare a BRP for:

1. A broad strategy and costing for the on ground activity and related matters required to regenerate up to 90 hectares of heavily disturbed ex sand mining land adjacent to the JAH managed Jandakot Airport site; and
2. The development of criteria by which the success of the rehabilitation would be measured.

This preliminary report is to form part of early submissions to Federal Government by JAH as the company seeks support for its master plan for the Jandakot Airport.

1.1 Objectives of the Rehabilitation Plan

The purpose of the proposed bushland rehabilitation is to commence the creation of an ecological corridor to link the Ken Hurst Park Bush Forever site (City of Melville) with the remnant bushland that forms part of the Jandakot Regional Park (DEC) and to compliment the substantial remnant bushland within the Jandakot Airport precinct.

1.2 Methodology

The methodology implemented will reflect current knowledge based on local site experience of Banksia woodland rehabilitation. The exact course of action is yet to be determined but may involve recontouring of the site, relocation of topsoil, direct seeding and planting, low water use irrigation, addition of slow release fertilizer, weed and feral animal control, waste control, erosion control and vehicle access control. It is intended that rehabilitation will occur in successive 10ha stages.

1.3 Indicative Budget

The strategy is expected to outline the requirement for a high quality outcome and to utilise best practice within a high level but justifiable budget. Whilst accurate estimates are yet to be completed, the budget for discussion purposes is up to $6 million over a 7 year project life.

2. Vegetation

Objectives	Baseline	Methods	Target/Success
Species Diversity			
- Species composition to reflect surrounding remnant vegetation and indicator species on similar landforms.	- Surveys to calculate species richness and abundance.	- Reconstruct species list and have it independently assessed by a qualified restoration ecologist. - Bi-annual monitoring to measure species richness and abundance in rehabilitation sites.	- Species richness and abundance will increase as rehabilitation progresses. - Return of at least 80% species identified in the reconstructed species list by year five. - Year on year targets to be agreed and established.
Species Cover			
- Ratio of bare soil to vegetation, evenness of spread and percentage cover of each species to reflect surrounding remnant vegetation and indicator species on similar landforms.	- Surveys to calculate ratio of bare soil to vegetation, evenness of spread and percentage cover of each species in mature Banksia woodland/	- Bi-annual monitoring to measure ratio of bare soil to vegetation, evenness of spread and percentage cover of each species in rehabilitation sites.	- Ratio of bare soil to vegetation will decrease as rehabilitation progresses; a target level for improvement will be set for each year. - Early success will be based on establishment of dominant Banksia woodland species (E.g. B. *menziesii*, B. *ilicifolia*, B. *attenuata*, B. *grandis*, *Eucalyptus marginata* & *Allocasuarina fraseriana*); success will be based on progression to baseline data. - Yearly targets will be set for evenness of spread; successful rehabilitation will reflect these targets.

Objectives	Baseline	Methods	Target/Success
Vegetation Condition			
- Vegetation condition in regenerated sites will reflect the condition of surrounding remnant vegetation and on similar landforms.	- Vegetation in the Jandakot Airport area ranges from poor to excellent; with the majority in very good condition (Mattiske, 2001). - The condition of comparable surrounding sites will also be assessed and based on the Keighery (1994) vegetation condition scale.	- Yearly monitoring to qualitatively assess the condition of regenerated vegetation.	- Successful rehabilitation will be in good to very good condition by year 7.
Vegetation Health			
- Vegetation health in regenerated areas should be similar to surrounding remnant vegetation and indicator species on similar landforms.	- Assess surrounding remnant vegetation to NGIA horticulture standard. E.g. exhibiting sound growth, free of debilitating disease, low mortality, development of propagules.	- Monitored and reported yearly.	- Vegetation health will meet NGIA standards.

3. *Phytophthora cinnamomi* Dieback Control

Objectives	Baseline	Methods	Target/Success
- Adoption of best practice *Phytophthora* hygiene procedures. - Avoiding dieback transfer. - Plants stock supplied from accredited dieback free nurseries.	- Dieback has been mapped in some sections of Jandakot Airport; however precinct 5, from where topsoil will be likely be transferred is mapped as dieback free.	- Bi-annual monitoring of indicator species to assess any presence of dieback in the regenerated area.	- Dieback not detected.

4. Fauna

Objectives	Baseline	Methods	Target/Success
- The regenerated site should provide food and habitat for native species of birds, mammals and reptiles as a consequence of rehabilitation. - High level complex habitat will continue to develop after the 7 year project life span.	- Baseline species composition to be established from existing species lists pertaining to JAH and from comparable surrounding landforms.	- Field surveys will measure species richness and abundance of certain species of birds, mammals and reptiles.	- Species composition to reflect baseline.

5. Feral Animal Control

Objectives	Baseline	Methods	Target/Success
- Introduction of an effective treatment regime for feral rabbit control and establish successful treatment partnerships with adjoining land owners/managers.	- Survey of rehabilitation area prior to any works to determine the level of activity of feral rabbits.	- Bi-annual survey to check presence of feral rabbits by assessing droppings and grazing in rehabilitation areas.	- Progressive reduction in presence and activity of feral rabbits within rehabilitation areas. - By year 7 elimination of feral rabbits

6. Stakeholder and Community Participation

Objectives	Baseline	Methods	Target/Success
- Establish active partnerships at state and local government level, community land care and resident groups. - Actively encourage and achieve direct community participation and develop respect and understanding for the project.	- Establish a list of stakeholders and community groups currently affiliated with the project and the area.	- Qualitatively asses the level of stakeholder and community participation.	- Establish yearly targets for amount of stakeholder and community participation. - Increase the amount of stakeholder and community participation over the project life.

7. Disturbance Control

Objectives	Baseline	Methods	Target/Success
Erosion			
- To control and reduce the effects of erosion on regenerated sites by using stabilisation strategies such as sand and wind traps and soil stabilisers.	- Surveys of surrounding remnant vegetation on similar landforms will determine the acceptable level of erosion in Banksia woodland.	- Rate the functionality of sand and wind traps every 3 months	- Sand and wind traps will increase in function as rehabilitation progresses. - Target rates will be established and met.
Disturbance			
- To control and reduce the amount of disturbance to the rehabilitation sites from unauthorised access (vehicles and people).	- Surveys of surrounding Banksia woodlands will determine the acceptable level of disturbance.	- Inspect perimeter fence every 3 months for damages and score the level of damage (1: no damage, 5: high damage). - Inspect rehabilitation site for unauthorised tracks.	- Damage scores will be low.

8. Weed Control

Objectives	Baseline	Methods	Success
- Weed control includes broad scale herbicide application and manual removal according to well established bushland rehabilitation principles. - Weed control will not occur at the expense of site stabilisation. - Preventing seed set in every year for progressive rehabilitation sites will be an essential criterion. - All new weed species to be controlled.	- A weed list will be constructed based on composition of weeds currently growing in the rehabilitation site and from weeds growing in surrounding remnant vegetation.	- Field surveys will determine the percentage cover and species composition of weeds that are persisting on the rehab site. - Persisting weeds will be rated on a scale of relative invasiveness.	- Successful weed control will be achievement of a target of a minimum 30% reduction of weed cover annually until reduced to <1% of baseline.

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Attachment 1 - Background Information

1. Background – Jandakot Airport and Surrounds

1.1 Regional Context

Jandakot Airport is located 18 km south of Perth in the City of Cockburn. The City of Melville borders the Airport to the north and the City of Canning lies to the north-east (Figure 1). The Jandakot airport and surrounds is divided into nine precincts (Figure 2).

The Airport is located in the South-West Botanical Province of Western Australia, in the Darling Botanical District and the Bassendean System of the Drummond Botanical Subdistrict (Beard, 1981).

1.2 Statutory Setting

Jandakot Airport is leased and operated by Jandakot Airport Holdings Pty Ltd. (JAH) in accordance with the *Airports Act 1996* (the Act) and *Airport Environmental Regulations 1997* (the Regulations). Under the Act and the Regulations, JAH have several environmental obligations. This includes, but is not limited to setting standards in relation to environmental management, pollution, monitoring and remediating breaches of environmental standards. Development proposals and approvals need to meet Commonwealth legislative requirements outlined in the *Environmental and Biodiversity Conservation Act 1999, Aboriginal and Torres Strait Islander Heritage Protection Act 1984, Australian Heritage Council Act 2003 and Native Title Act 1993.*

The Jandakot Airport Master Plan 2005 is a statutory requirement which provides a framework for the planning and use of the Airport over a 20 year period. The Master Plan is currently under review together with a review of the Environmental Strategy 2004 which forms a companion document to the Master Plan and provides a framework for environmental management. JAH's mission statement, incorporated into the Master Plan includes environmentally sustainable development.

1.3 Surrounding Environment

Climate

The Jandakot area experiences a Mediterranean climate with cool wet winters and hot dry summers. Average maximum and minimum temperatures in the dry season (October – March) range from 22°C to 31°C and 9°C to 18°C respectively. In the wetter winter months, maximum and minimum temperatures range from 18°C to 25°C and 7°C to 12°C respectively (BOM, 2008).

Landforms

The Jandakot area is underlain by Bassendean Sands derived from the Bassendean Dune System. The Jandakot Airport is situated on the northern margin of the Jandakot Groundwater Mound and some of the area considered for rehabilitation in this BRP sits on a Priority 1 Groundwater Protection Reserve (WAPC, 1998).

Land use

Current land uses surrounding the Jandakot Airport include urban, rural, industrial and parks and recreation. Major residential developments occur in the suburbs of Jandakot, South Lake and North Lake all within the City of Cockburn. Areas to the east, south and west of the Airport are designated as special rural, including kennels, plant nurseries and stables.

In the past, sand-mining activities occurred on land to the area north-east of the Airport (JAH, 2006), this land is vested with the City of Canning, is largely devoid of vegetation and is the focus of this BRP.

Conservation Areas

The Jandakot Regional Park is situated to the south-east of the Airport and includes Acourt Road Bushland (Bush Forever site no. 389). Ken Hurst Park, Bush Forever site no. 245, vested with the City of Melville is 57 ha and borders the north-eastern boundary of the Airport.

Vegetation

The condition of bushland in the Jandakot Airport area was assessed and mapped by Mattiske Consulting in 2001. Their analysis was based on the Keighery vegetation condition scale and found the majority of the area was either in good, very good or excellent condition. The areas that were mapped as 'poor' were areas subject to human disturbance and airport operations. The condition of bushland in Ken Hurst Park has been mapped as in very good condition (CoM, 2003).

The Jandakot Airport area supports five vegetation communities (Mattiske, 2001a). These communities are similar to the communities described by Gibson et al. (1994) for the Swan Coastal Plain:

H1 Woodland of *Eucalyptus marginata* with *Banksia* spp
H2 Open woodland of *Banksia attenuata* and *Banksia menziesii*
J1 Woodland of *Banksia ilicifolia* with *Banksia* spp
K1 Disturbed Open Forest of *Eucalyptus rudis* with *Melaleuca preissiana*
K2 Woodland of *Melaleuca preissiana*
J2 Heathland of *Beaufortia elegans* and *Hypocalymma sp*.

A total of 317 vascular plant species have been identified in the Jandakot Airport (JAH, 2006); 291 of which are native.

The vegetation types represented in the Airport area are well represented in conservation estates on the Swan Coastal Plain however the Australian Heritage Commission has listed some areas on the Register of the National Estate (Mattiske, 2006).

Declared Rare Flora

The Declared Rare Flora species (pursuant to Subsection 2 of Section 23F of the *Wildlife Conservation Act 1950), Caladenia huegelii* has been recorded in the Jandakot Airport area (JAH, 2006). This species is also present in the adjacent Ken Hurst Park (CoM, 2003). Several other Declared Rare Flora and Priority Flora have been recorded in the vicinity of the Jandakot area (Table 2.1) (CoM, 2003).

Table 2.1
Declared Rare Flora and Priority Flora in the Jandakot vicinity.

Species	Location
Acacia lasiocarpa* var. *Bracteolate	Gosnells, Jandakot, Mundijong
Byblis lindleyana	Yule Brook, Cannington, Jandakot
Microtis media ssp. Quadrata	Pinjarra, Jandakot
Stylidium longitubum	Midland, Bussleton, Jandakot
Tripteroccus paniculatus	Canning Vale
Dodonara hackettiana	Wattleup, Thompson Lake, Jandakot, Kings Park

Weeds

Thirteen introduced (weed) species have been identified in the Jandakot Airport area (JAH, 2006). None of these introduced species are listed by the Department of Agriculture as a Declared Plant or a Pest Plant.

Fauna

A total of 117 fauna species have been identified in the Jandakot Airport area (JAH, 2006). This includes amphibians, reptiles, birds and mammals. Of national conservation significance is the Carnaby's Cockatoo (*Calyptorhynchus latirostris*), Quenda (*Isoodon obesulus*), the Brush Wallaby (*Macropus Irma*) and the Black-striped Snake (*Neelaps (Vericella) calonotus*) (JAH, 2006). All of these species, except the snake have been recorded in Ken Hurst Park (CoM, 2003).

Dieback

The Jandakot Airport area was mapped for dieback in 2006 by Glevan Dieback Consultants. Most of the area is Dieback free but large portions of Precincts 1B, 2 and 6 has been mapped as Dieback infected. Glevan surveyed Ken Hurst Park in 1999 and 2002 for Dieback and concluded that approximately 50% of the Park was infected.

Attachment 2 - Topsoil Processing & Direct Seeding

Topsoil Processing

The return of the topsoil seed bank is the most practical means of plant replacement in a post-mined/sand-extracted situation for seed storing species (Rokich & Dixon, 2007). For 60-80 % of Banksia woodland species, the topsoil is the sole source of germinable seeds (Rokich & Dixon, 2007).

There are several factors to consider when processing topsoil:

1) The depth of stripped topsoil and depth of re-spread;
2) Topsoil handling methods; and
3) The timing of topsoil removal and re-spreading.

The seedbank from Banksia woodlands are concentrated in upper topsoil profile (92% seeds in top 10 cm) (Rokich et al, 2000). The depth of topsoil removed should be 10-20cm where reasonably practicable. The re-spread topsoil should also be kept to a minimum as seedlings cannot emerge from great depths (Rokich et al, 2000). Topsoil should be re-spread immediately following stripping. Where this is not practicable topsoil needs to be stockpiled. Stockpiling reduces seedling recruitment and the stockpile is susceptible to 'catching' wind dispersed weed seeds (Rokich et al, 2000) so the period of stockpiling needs to be kept to a minimum. Topsoil is best stripped in dry summer months after summer seed fall, this is also the time when dieback is least active (Dieback Working Group, 1999). Stripping in winter reduces seedling recruitment (Rokich et al, 2000) and increases the risk of spreading dieback (Dieback Working Group, 1999). Likewise, re-spreading in winter also reduces seedling recruitment.

Direct Seeding (broadcasting)

There are three factors to consider when direct seeding:

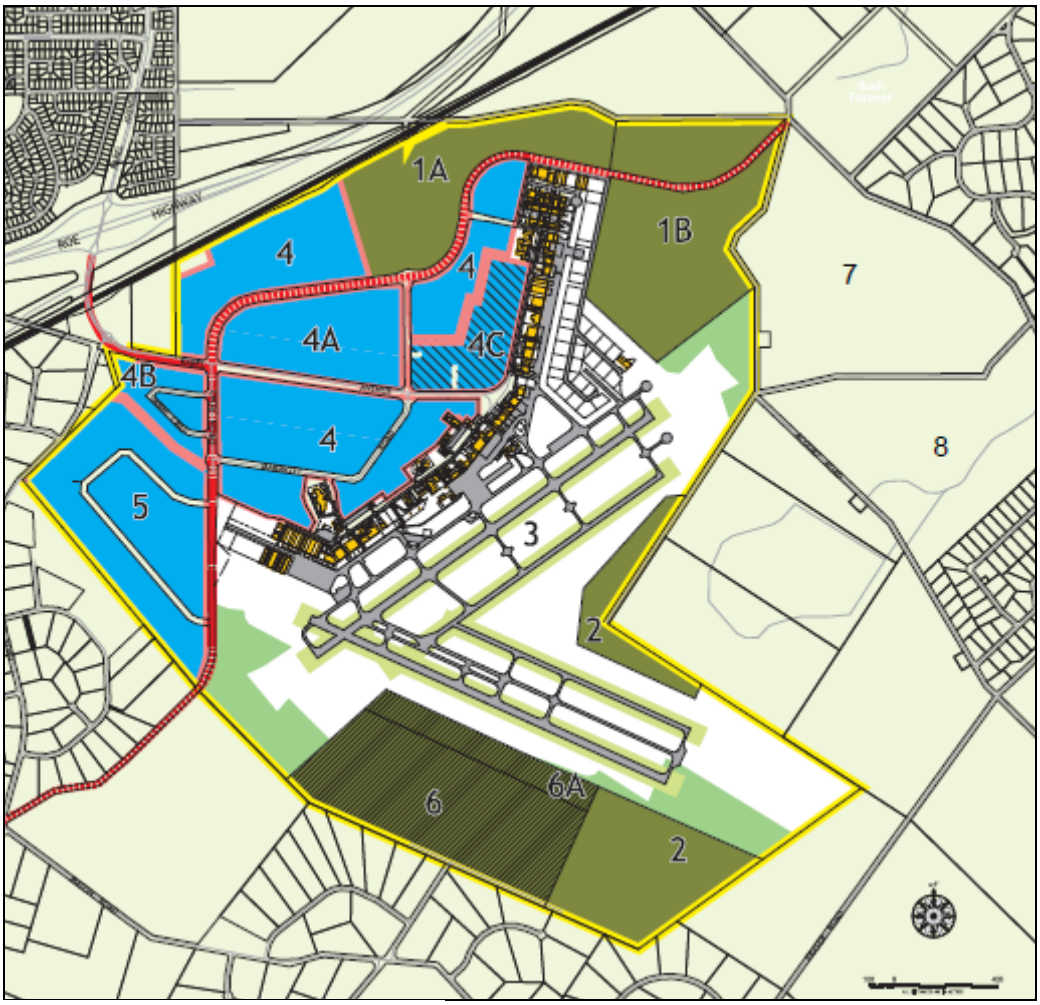
1) Treatment;
2) Timing; and
3) Raking.

At post extracted sand mining sites smoke treatment has proven to increase seedling recruitment (Rokich & Dixon, 2007). Applying smoke water to broadcasted seeds is a more practical method compared to applying aerosol smoke, however it is not as effective (Rokich et al, 2002). Another option is to smoke the seeds prior to broadcasting. Seed should be broadcast in late autumn rather that mid winter as seedling recruitment levels are generally higher (Rokich & Dixon, 2007). The exact timing of broadcasting will depend on the weather at the time. Raking is a means of burying the seeds into the soil and should occur immediately after broadcasting. Seeds are less prone to wind or water erosion and predation when buried. Also seeds left on the soil surface are subject to higher soil temperatures. When seeds are buried

there is a more consistent level of soil moisture availability which improves chances of seedling survival, particularly in areas where rainfall and water availability is limited. Turner et al. (2006) report a 90-fold increase in seedling recruitment under raking treatments at post–sand extracted Banksia woodland restoration sites. However the practicality of raking needs consideration over large areas.

Attachment 3 - Figures

Figure 1 Precinct map



LEGEND

- Airport Boundary
- 1A Conservation (Proposed) - 31ha
- 1B Conservation (Existing) - 47ha
- 2 Conservation (Existing) - 39ha
- 3 Aviation Operations - 225ha
- 4 Mixed Business - 72ha
- 4A Mixed Business - 22ha
- 4B Mixed Business - 9ha
- 4C Mixed Business & Aviation - 13ha
- 5 Mixed Business - 40ha
- 6 Future Development - 43ha
- 6A Future Development - 16ha
- Conservation (unless required for runway extensions and operations) - 7, 14, 11ha
- Existing & Proposed Internal Road Reserve / Services Area - 39ha
- Total Airport Area - 622ha
- Existing Access
- Future Proposed Access

Figure 2 Location map

(Source: JAH, 2006)

Figure 3

Key

Zone 1
Zone 2
Zone 3
Zone 4
Zone 5

Indicative only
Not to scale

Map Title:	Rehabilitation Zones
Author:	Kimberly Harmsworth
Client:	JAH
Project:	Bushland Rehabilitation Proposal
Date:	July, 2009

N

Natural Area Management & Services
99C Lord St,
Whiteman, WA, 6063
naturalarea.com.au

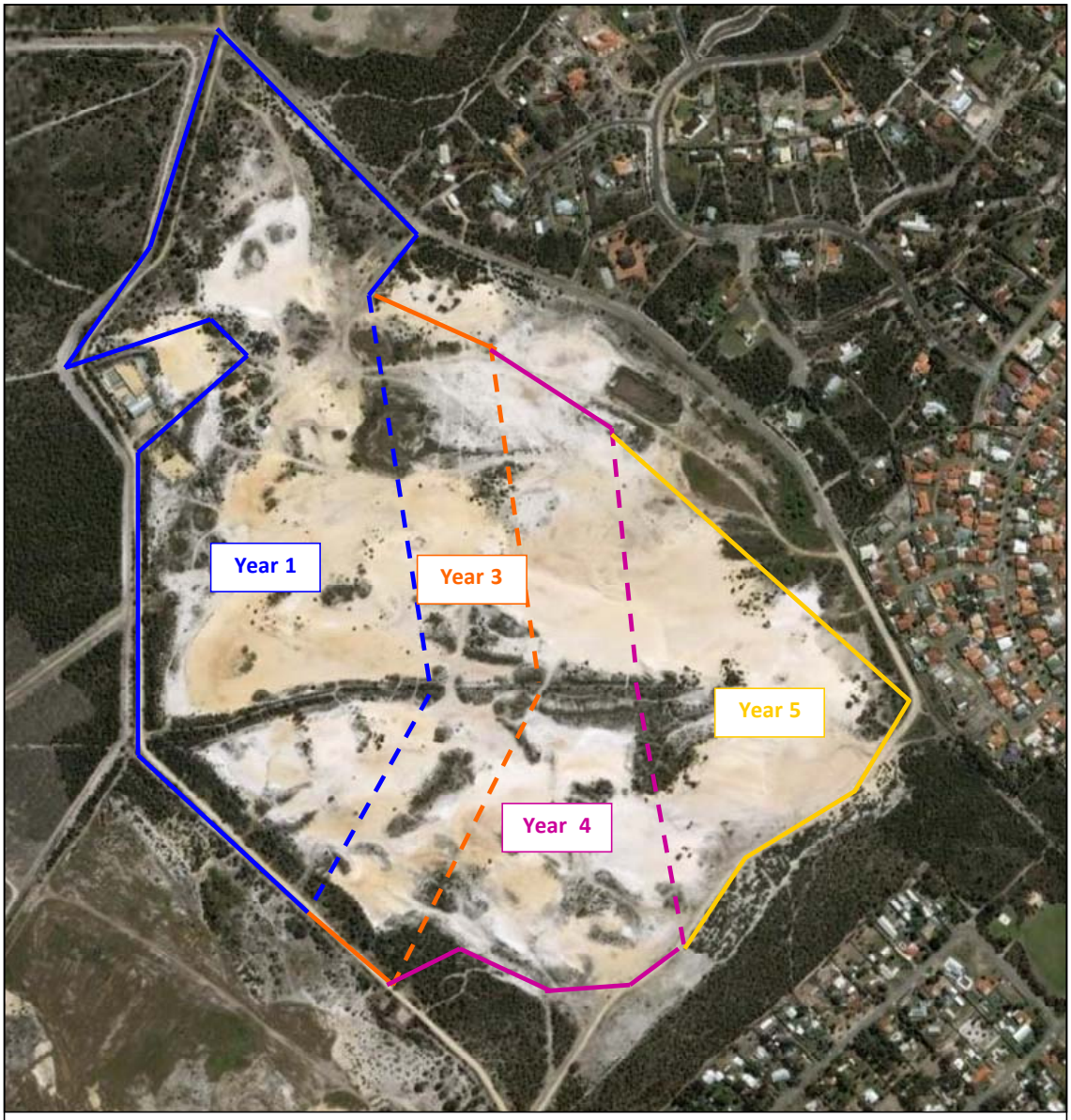


Figure 4

Key
Revegetation Fencing—dotted lines
Conservation Fencing—solid lines

Indicative only
Not to scale

Map Title:	Rehabilitation Zones
Author:	Kimberly Harmsworth
Client:	JAH
Project:	Bushland Rehabilitation Proposal
Date:	July, 2009

N

Natural Area Management & Services
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Attachment 4 - Supporting Photos

Comparable Rehabilitation Projects

1. Natural Rehabilitation on Bassendean sands

Natural rehabilitation following sand mining. The low typography and surrounding remnant bush has aided natural rehabilitation. Note that vegetation is absent on the crest in the background due to its susceptibility to wind erosion

This is natural rehabilitation approximately 7 years after cessation of sand mining.

2. Direct Seeding on Bassendean sands

Rehabilitation 3 years following direct seeding

Rehabilitation 3 years following direct seeding, lack of rehabilitation due to loss of seed by wind erosion.

Soil Stabilisation

1. Direct Seeding with Soil Stabilisation

Batter banks before soil stabilisation with spray on Erosionex.

Germination of seeds on batter banks after application of Erosionex stabiliser.

Rehabilitation Site

1. Proposed Rehabilitation Zone 1

Zone 1 looking north onto Precinct 7 from interface with Precinct 8.

Approximate eastern boundary of Zone 1 looking north onto Precinct 7 from interface with Precinct 8.

2. Proposed Rehabilitation Zone 2

Zone 2 looking north onto Precinct 7 from interface with Precinct 8.

Zone 2 looking north onto Precinct 7 from approximately 100 m north of interface with Precinct 8.

3. Remnant Vegetation

View looking east along the interface between Precincts 7 and 8 of the remnant vegetation.

Remnant vegetation that will provide some guide to the original vegetation composition of the site and benchmarks for success of rehabilitation.

17.0

APPENDIX D
MONITORING PLAN

Jandakot Airport Environment Strategy

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June 30, 2009

Response to Scoping Documents

1. Undertaking additional work on *Drakaea elastica* through additional targeted searching within bushland areas on Jandakot Airport following discussions with Kings Park orchid specialists. This additional work to be undertaken in July/August 2009 and will include weekly checking of sites that may support the species (based on habitat preference information from Kings Park orchid specialists). In addition, a report will be prepared outlining methodology of survey and any findings (including data, tabulations and maps).

   No response necessary at this time.

2. Prepare a summary of survey effort to date including timing of field work and reporting.

   Mattiske Consulting Pty Ltd has been involved in Botanical Studies at Jandakot Airport for Jandakot Airport Corporation since 2001. The table below stipulates the time, effort , objective and Report Title.

   As indicated in the summary below the main field programs have been related to the original gridding with recordings on a 100m x 100m grid (with tree species recorded on a 20m radius from each site and understorey recorded on a 5m radius from each site). This work covered all remnant vegetation areas on the Jandakot lease area and at the time exceeded the standards as accepted in government circles.

   The more recent searching for both the *Caladenia huegelii* and *Drakaea elastica* plants was undertaken by teams of botanists traversing the remnant vegetation areas on a fine scale (keeping each other in site). The coverage was very comprehensive as indicated by the additional finds of the occasional orchid in the areas of remnant vegetation. Whilst it recognized that not every inch of ground could ever be covered, the survey effort highlighted the species in a range of additional areas not known previously and the latter reflected the survey effort.

Table 1: Botanical Studies Completed for Jandakot Airport Corporation

Survey Times	Effort	Objective	Report containing Findings
24th -26th September 2001	4 Botanists using 100x 100m grid pattern	Search for the 3 known Priority Flora in the area	"Declared Rare And Priority Flora Survey of Jandakot Airport"
		Assess the condition of the vegetation on the Jandakot Airport lease area	"Bushland Condition Survey of Jandakot Airport Lease Area"
		Map the vegetation on the Jandakot lease area utilising the Havel (1968) approach.	"Vegetation Mapping of Jandakot Lease Area"
18th July 2006	4 Botanists	Confirmation of Vegetation and Condition Values	"Review of flora, vegetation and fauna values in the Proposed Industrial Area at Jandakot Airport"
August/September 2006	4 to 6 Botanists	Search for *Caladenia huegelii* and *Drakaea elastica* in the remnant areas of bushland on Jandakot Airport. Searches were undertaken for the two Rare orchids on the area with fine gridding and searching by a team of botanists.	"Review of flora, vegetation and fauna values in the Proposed Industrial Area at Jandakot Airport"
January 2007 (one Day)	Two Botanists	Demarcation of Buffers for 4 *Caladenia huegelii* populations	Short Communication to Jandakot Airport Holdings
5th September 2008	Five Botanists	Search for *Drakaea elastica*	Short Communication to Jandakot Airport Holdings

3. Prepare a summary of effort to date on the *Caladenia huegelii* and prepare a monitoring program for future assessments, including undertaking an assessment of plants in the Spring months of 2009 (when the species is flowering).

Table 2: Studies completed in order to establish values associated with *Caladenia huegelii*

Dates	Effort	Area
24th August 2006	Reconnaissance by an Experienced Botanist	
13th September 2006	One Experienced Botanist and one Botanist	Area to the South of Hope Road
19th September 2006	One Experienced Botanist and one Botanist	Area South of Hope Road
21st September 2006	Two Experienced Botanists	Area North of Hope road
25th,26th,28th September 2006	Four Botanists	Airside areas and areas North of Hope Road
Time in Total	*5 Days by an Experienced Botanist* *14 Days by a Botanist*	

These studies for the most part consisted of the people involved walking 5 m apart in a straight line search pattern, in habitat suitable for *Caladenia huegelii.* On the 21st September 2006, this methodology was changed to checking known DEC sites for this species' status. Attachment A is a map of the results of this work.

4. Proposed Studies on the *Caladenia huegelii* and *Drakaea elastica*

Following consultation with orchid specialists from Kings Park (Dr Kingsley Dixon) the following proposed follow up work will be undertaken for the ongoing monitoring of the orchids at the site.

Caladenia huegelii – a series of permanent monitoring sites will be established in the spring of 2009 to capture approximately a third of the population (as currently known) in representative areas in different sections of the Jandakot Airport. The timing of the field work will align with the peak of flowering. The peak of flowering may vary each year as rainfall events are not consistent. Therefore inspections of current populations will be undertaken prior to the work each year to assess and determine the optimum time for the field assessments to be undertaken. These monitoring sites will be assessed on an annual basis for three years. The monitoring will include re-assessing individual plants in permanent quadrats. Every three years an audit of all plants will be undertaken. Reporting will be supplied on an annual basis.

After three years the monitoring program will be reviewed in consultation with orchid specialists and

Drakaea elastica – additional targeted searching will be undertaken in consultation with orchid specialists from Kings Park in potentially preferred habitats. This approach is based on the current detailed knowledge of this species habitat preference (which is unlikely or restricted within the Airport area). This work will be undertaken on a regular basis (fortnightly in early spring to late spring). As the basal leaf if quite distinctive this work does not need to align totally with the flowering period of this species. If any plants are located then a detailed monitoring program (along similar lines to that for *Caladenia huegelii*) will be determined in consultation with Kings Park orchid specialists.

5. Review the occurrence of other Western Australian Rare and Priority species that have been recorded in or near the Jandakot Airport. This will include an updated search of DEC databases and DEWHA databases and the preparation of a brief report with associated tables, maps and text.

A DEWHA Protected matters search was conducted for Jandakot Airport with a 5 km buffer (Attachment B). Three Endangered plant species have been recorded in this area. The first two *Caladenia huegelii* and *Drakaea elastica* , have already been addressed previously. The third,

Lepidosperma rostratum is a Cyperaceae that occurs further east on the Swan Coastal Plain in winter wet flats. This type of habitat is not present at Jandakot Airport.

A search of DEC databases is still in progress.

6. Review the previous data to access whether *Lomandra hermaphrodita* is present on the Airport or likely to be present on the Airport (in view of the sun moth).

   This species has been found in Banksia woodlands to the east of the Jandakot Airport (Mattiske Consulting Pty Ltd 1995). The habitat for this species is described in Flora of Australia (Lee and Macfarlane 1986) as "Grows in laterite in eucalypt forest or sand in eucalypt or Banksia woodland or in heath". This type of habitat occurs at Jandakot Airport, therefore this species may occur in the Jandakot area and further searches for this species are recommended at the time of the *Drakaea elastica* work in coming months.

   This species is widespread in the southwest and therefore its presence in Jandakot Mound is less significant in a local and regional context (Department of Environment and Conservation 2009).

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Mattiske Consulting Pty Ltd (2001b)
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Mattiske Consulting Pty Ltd (2001c)
Vegetation Mapping of Jandakot Airport Lease Area. Unpublished Report prepared for Jandakot Airport Holdings Pty Ltd.

Mattiske Consulting Pty Ltd (2007a)
Review of flora, vegetation and fauna values in the Stage 1 of the Proposed Industrial Area at Jandakot Airport. Unpublished Report prepared for Jandakot Airport Holdings Pty Ltd.