Appendix B:
Restoration Management Plan (Hanson 2017)

Restoration Management Plan

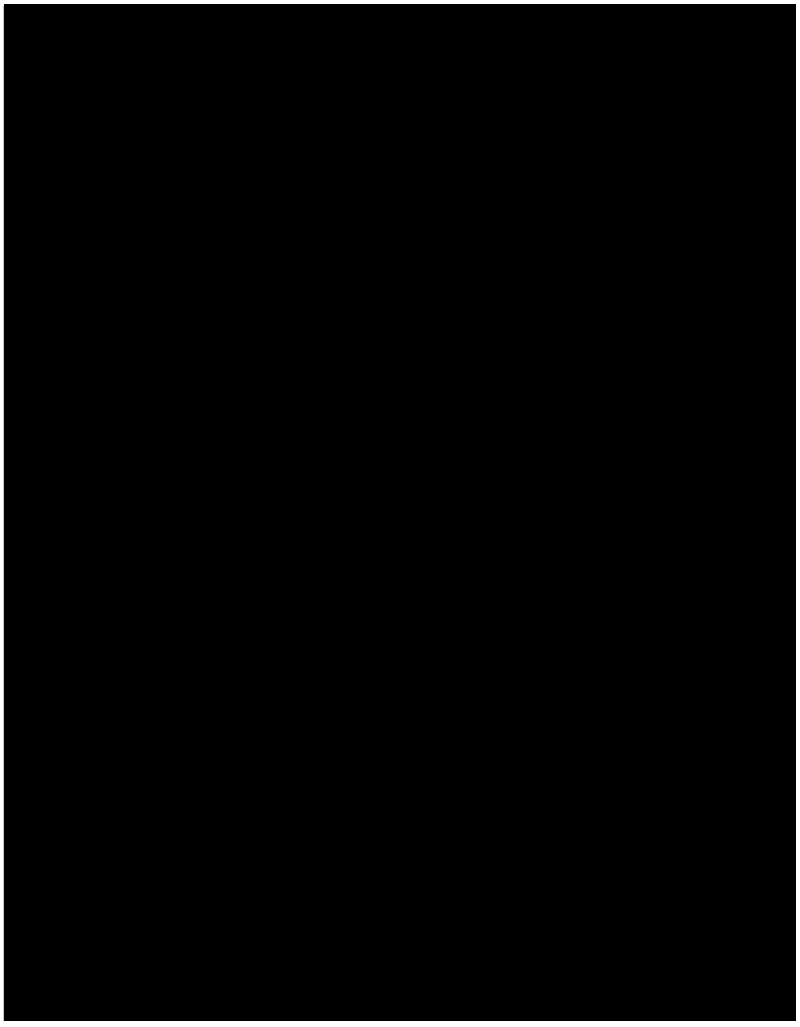
EPBC 2010/5622 – Sand Quarry, Oldbury, Western Australia
Blue Polygon Application Area (15.2 ha)

Contents

1.0 Declaration of Accuracy

In making this declaration, I am aware that Section 491 of the *Environment Protection and Biodiversity Conservation Act 1999* (Cth) (EPBC Act) makes it an offence in certain circumstances to knowingly provide false of misleading information or documnts to specified persons who are known to be performing a duty or carrying out a function under the EPBC Act or the *Environment Protection and Biodiversity Conservation Regulations 2000* (Cth). The Offence is punishable on conviction by impronment or a fine, or both.

I am authorised to bind the approval holder to this declaration and that I have no knowledge of that authorisation being revoked at the time of making this declaration.



2.0 Introduction

The following will be will be implemented for restoration works undertaken in the clearing area (as per Clearing Permit CPS 4935/1 Application **Attachment F**) at the Hanson Boomerang Road Oldbury operation within the BLUE POLYGON application area (see **Attachment A**). The Plan has been prepared for the purpose of setting out Hanson Construction Materials method for site restoration in connection with clearing undertaken pursuant to clearing permit application CPS 4935/1. The target performance indicators within this plan have developed independently by the Botanic Gardens and Parks Authority.

3.0 Rehabilitation Success Criteria

Hanson Construction Materials have monitored rehabilitated sites annually and collected large amounts of data detailing species richness and abundance within rehabilitated areas. This information has been used to develop success criteria (also referred to as completion criteria). These criteria can be applied to rehabilitated sites to determine their success in achieving the restoration of naturally occurring woodland.

The monitoring information used to develop the completion criteria has been collated since 1996. Plant stem and species information from the first spring after rehabilitation was collected and used to determine year 1 data, similarly, this information was collected at year 5 sites. Using this information Key Performance Indicators (KPIs) have been developed for rehabilitated sites in the first and fifth years to determine the ongoing success of the rehabilitation efforts. Table 1 and 2 detail the density and biodiversity KPIs for year 1 and year 5 rehabilitation success.

Table 1: Key Performance Indicators for plant/stem abundance (per 5m^2)

Topsoil / Woodland Quality	Year 1	Year 5
Good	124	15
Medium	69	9
Poor	33	6

Table 2: Key Performance Indications for species richness (per 5m^2)

Topsoil / Woodland Quality	Year 1	Year 5
Good	17	8
Medium	16	7
Poor	16	6

Annual monitoring plots will be located on a site plan (plotted by GPS) and site quadrants established. At least six permanent monitoring plots per rehabilitation stage, each of 5m² will be established for each stage of clearing completed and resultant stage of restoration. The KPI results will be totalled for the six monitoring plots and then divided by 6 to give the result for that stage of restoration. This will be done separately for both plant abundance and species richness. Complementing this will be an annual photo to demonstrate restoration outcomes.

The development of target completion criteria and the application of scientific monitoring on rehabilitation programs have been crucial for Hanson in determining if rehabilitation efforts are producing conservation outcomes. Successful rehabilitation and revegetation activities will be critical to helping protect and recover Carnaby's Black Cockatoo numbers, as it is a primary factor in ensuring that there is no net loss of habitat and it may result in a net gain over time.

3.1 Bushland Regeneration Success Analysis

In order to determine if rehabilitation of Banksia woodland is successful Hanson have committed to measuring all future rehabilitation work against the developed Key Performance Indicators (see Table 1 and Table 2) to determine the success rate. This is a key component of long term monitoring to ensure that there is no net loss of Banksia woodland.

The KPI and regeneration program at Boomerang Road Oldbury will be implemented as follows:

- Vegetation present at the site, prior to clearing, will be assessed for vegetation condition. This will allow determination of the level of the KPI to be applied (i.e. Good, Medium or Poor quality vegetation). This assessment will be undertaken by a qualified Botanist. The quality of the vegetation will determine the quality of the seed load contained with the topsoil, determining the restoration outcome that may be achieved.

- Restoration works will be monitored annually for 5 years (to allow for active management) with KPI assessment undertaken at Year 1 and Year 5.

Five years after each stage restoration is complete the outcome for that stage will be reported to the Department of Water and Environmental Regulation (DWER).

- For example, if Hanson achieves:
  - 120% of the KPI in "Good Topsoil Woodland Quality" for Stage 1-1.8ha rehabilitated (at the Boomerang Road Oldbury site) for plant stem abundance, 'i.e. 18 plants (Benchmark 15) in year 5, and 9.6 species (Benchmark 8) in year 5', then a 120% result against the completion criteria will be reported to DWER (i.e. a no net loss when compared to the completion criteria).
  - 50% of the KPI in "Good Topsoil Woodland Quality" for Stage 2- 2.5ha rehabilitated (at the Boomerang Road Oldbury site) for plant stem abundance, 'i.e. 7.5 plants (Benchmark 15) in year 5, and 4 species (Benchmark 8) in year 5', then a 50% result against the completion criteria will be reported to DWER (i.e. a net loss when compared against the completion criteria).
  - If varying KPI's occurred for Species Richness and Plant/Stem Abundance an average would be calculated between the two and used. For example, for Stage 3 - 3.1ha rehabilitation site at Boomerang Road Oldbury, if Hanson achieves 12 plants (Benchmark 15) in year 5 equating to an 80% outcome, and 9.6 species (Benchmark 8) in year 5 equating to a 120 % outcome, then the average would be 100% of the KPI's being achieved. (i.e. a net loss when compared against the completion criteria).

- The size and timing of each stage will be determined by sand market requirements though the sequence of staging will be as per the **Attachment D** unless for operational reasons this needs to change.

- EXAMPLE

Stage	Area (Ha)	5 years Later	Plant Stem	Species	Average Outcome	Habitat Outcome
1	1.8	→	120%	120%	120%	No Net Loss
2	2.5	→	50%	50%	50%	Net Loss
3	3.1	→	80%	120%	100%	No Net Loss

- Any shortfall/ benefit when comparing to the completion criteria has been encapsulated in the calculation completed by DWER utilising the Commonwealth Calculator where 5.6 hectares were affected by the clearing. This resulted in Hanson funding the purchase of 30 hectares as a direct offset valued at $301,410 in the Southern Corridor of Perth in October 2016.

This methodology will ensure that 100% of the Banksia woodland is rehabilitated/conserved, provide for no net loss.

The above KPI's have been developed independently by the Botanic Gardens and Parks Authority (Kings Park). Their advice is contained in **Attachment B1**, including monitoring plot information. The target completion criterion requires the quality of the vegetation and the associated seed load within the topsoil to be assessed prior to clearing so that restoration can be benchmarked and the success analysed. Botanic Gardens and Parks Authority (Kings Park) completed this assessment of Oldbury in March 2015 and they have determined in the recommendations section of the report that "overall the site represents a variable quality soil seedbank topsoil that provides a moderate resource for reinstatement of soil seed banked (geosporous) species (see **Attachment B2**). Therefore a Medium outcome for plant/stem abundance and species richness is the target completion criteria benchmark for the site.

The completion criteria will therefore be benchmarked against the below.

Table 3: Key Performance Indicators for plant/stem abundance (per 5m^2)

Topsoil / Woodland Quality	Year 1	Year 5
Medium	69	9

Table 4: Key Performance Indications for species richness (per 5m^2)

Topsoil / Woodland Quality	Year 1	Year 5
Medium	16	7

The intention is to have a restored structure representing the mapped vegetation consisting of approximately:

- 7% overstorey
- 27% midstorey
- 66% understorey

The BLUE POLYGON extractive industry application area is 15.2 Ha within which 11.6 ha will be cleared and 3.95 ha is already cleared. The rehabilitation target completion criteria will apply to the entire Blue Polygon area.

3.2 Rehabilitation Staging

Attached is a map (**Attachment D**) showing six cells. This is where the sequence clearing will occur, unless operation requirements necessitate a change. There will be potentially many stages of clearing within each cell. This will be driven by the market requirements for the sand. As each stage is cleared the previous stage will be rehabilitated by directly transferring the topsoil into the previously mined area. The general sequence for this to occur will be from cell 1 to 6 as per the attached Plan (**Attachment D**) and having consideration of the recommendations in the Bushland Condition Report (**Attachment B2**). This staged approach will provide time to monitor changes in groundwater levels whilst also enabling native vegetation to be reinstated in areas that are currently completely degraded. This methodology will provide the best overall net environmental outcome and minimise potential impacts to the L120 Wetland.

3.3 Restoration Methodology

Restoration techniques and timing of works will be undertaken in accordance with Table 5 - Restoration Project Schedule (example), with site activities to occur at specific times of the year. Items not applicable to the site will not occur. Further information is available in *Banksia*

Woodlands - A restoration guide for the Swan Coastal Plain (Stevens et al. 2016), presented in **Attachment E**.

In summary, if Cell 2 was being cleared (Donor site) and Cell 1 was being rehabilitated (Receptor site), the following will occur:

Year 1

- Seed collection will precede clearing of the bushland from the Donor site. (between October and March)
- The Receptor site is prepared and shaped, by ripping the ground and spraying for weeds, ready for rehabilitation (December – February)
- Clearing of the Donor site (between February –March)
- Direct transfer of topsoil from the Donor site to the Receptor site (between February- April)
- Compaction reduction works on the Receptor site (March – April)
- Broadcast canopy species seeding of Receptor site (June-August).
  - Broadcast seeding rates from the research undertaken by Hanson will be at rate of approximately 1.5kg/ hectare and include canopy, mid storey and under storey species that are expected to be missing from the topsoil germination. Seeding rate developed from previous work undertaken.
- Monitoring of rehabilitation in Receptor site to determine initial seedling emergence patterns against target KPIs (Table 3 & 4) and monitoring for weed emergence (October)

Year 2

- Weed management in the Receptor site (June – August)
- Monitoring of rehabilitation in Receptor site to determine if rehabilitation is on track to meet the year 5 target KPI, including canopy species survival monitoring, and monitoring for weed emergence (October)

Year 3

- Weed management in the Receptor site (June – August)
- Monitoring of rehabilitation in Receptor site to determine if rehabilitation is on track to meet the year 5 target KPI, including canopy species survival monitoring, and monitoring for weed emergence (October)

Year 4

- Tubestock planting (as required June to August)
- The tubestock planting of canopy species will be as per Table 6 (eg Banksia and Eucalyptus species)
- Weed management in the Receptor site (June – August)
- Monitoring of rehabilitation in Receptor site to determine if rehabilitation is on track to meet the year 5 target KPI, including tube stock survival monitoring, and monitoring for weed emergence (October)

Year 5

- Weed management in the Receptor site (June – August)
- Monitoring of rehabilitation in Receptor site to determine if rehabilitation is on track to meet the year 5 target KPI, including tube stock survival monitoring, and monitoring for weed emergence (October)
- Complete analysis of restoration outcome (including seedling survival patterns, and biodiversity and density outcomes) and compare to the completion criteria (Table 3 & 4) and report the results to DWER.

4.0 Site Specific Background

4.1 Engineering and Mechanical Design

4.1.1 Batter Angles

To assist the restoration, Receptor sites with excessive slopes will need those slopes battered to a flatter grade to minimise erosion and assist with plant survival. Grades approximately 1:3 will be designed as a minimum.

Depending on the scale of the works required loaders or dozers should be used.

If a dozer is to be used the size of the machine will be dependent on the size of the project and the "boggyness" of the sand. Often a smaller dozer (a "Swampy" with wider tracks and lower ground pressure) will be more efficient as it does not become bogged in hungry sand, resulting in the need for reworking of the site by other machinery to ensure a clean neat finished profile.

4.1.2 Donor Site Preperation

To enable effective translocation of the topsoil seedbank from the Donor site to the Receptor site, the Donor site needs to be prepared utilising the correct machinery to ensure disturbance to the topsoil (top 100mm) is minimal.

For the topsoil to be in a state ready for transfer, the Donor site needs to be cleared of the native vegetation in the drier months of the year, preferably early summer, to allow enough time for other activities to occur before the break of season. Clearing can be achieved utilising a variety of machinery including loaders and dozers. To minimise the disturbance to the topsoil, a small to medium sized Traxcavator with flat wide tracks and "rake bucket", should be used for clearing works and stockpiling of vegetation.

When clearing with the Traxcavator, small areas should be worked and a stockpile of trees left in each area ready for mulching. A light rake may be required to remove stumps and stakes, so that machinery subsequently picking up the topsoil does not incur damage to rubber tyres. Again minimal disturbance to the top 100mm of topsoil should be the objective.

The vegetation may also be used as barriers to entry. If the cleared vegetation is utilised in these ways often all material will be required and no mulching is necessary.

4.1.3 Donor Site Topsoil Removal

To enable effective translocation of the topsoil seedbank from the Donor site to the Receptor site, the Donor site needs the top 100mm of topsoil to be collected from the soil profile and ideally directly transferred to the Receptor site.

The effective collection of the topsoil is a very important step in the restoration programme.

Loaders and Scrapers are options for collecting the topsoil, dependent on the size of the project, but where possible, to maximise the benefit of the topsoil seedbank, minimising dilution and wasting seed, a landplane towed behind an agricultural tractor should be utilised.

When the Landplane is fully loaded the soil is transported directly to the Receptor site for spreading.

4.1.4 Receptor Site Topsoil Placement

4.1.4.1 Direct Transfer to an Adjacent Site

The ideal scenario is where the topsoil is moved from the Donor site directly to the Receptor site, which is easiest when the two sites are in close proximity to each other. This will occur at Boomerang Road Oldbury. In this scenario, the landplane travels from the Donor site to the Receptor site and begins spreading the topsoil 100 mm thick across the prepared Receptor site systematically, ideally not traversing the area where the topsoil has already been spread.

4.1.5 Receptor Site Ground Pressure Reduction

To maximise the restoration outcome the Receptor site needs to be profile contoured to minimise erosion, and ripped to minimise ground pressure / compaction to give the plants the best chance of penetrating the subsoil in the first year to gain access to water.

A smaller dozer or Traxcavator (with wider tracks and lower ground pressure), are ideal as they are less likely to become bogged in hungry sand, which results in the spread topsoil becoming buried and subsequently sterilised as the seed cannot germinate.

When ripping it is ideal to contour rip at right angles to the grade of the terrain to reduce runoff in winter time. Ripping should occur in a planned manner so that the once ripped, the Receptor site is not traversed unnecessarily causing further disturbance.

4.2 List of Species Return from Topsoil

A list of species from the local area that have the capacity to return from restoration which includes topsoil, seed and tubestock are listed in Table 6.

4.3 Potential Weed Species

A list of potential weed species is included in Table 6. If weed control is required then Hanson will use chemical control by (1) broad application of grass specific herbicides (e.g. Fusilade) and (2) more targeted application of broad spectrum herbicides (e.g. Roundup). Hanson will commit to eradication of woody weeds and approximate removal of weeds to 10 per cent ground cover.

4.4 Tubestock to be Planted

The species to be planted will be identified by (1) determining the species composition of the reference area (2) identifying the outcomes of restoration efforts and (3) if required, supplementary planting with species that differ in the restoration site in comparison to the species list and completion criteria. From experience in achieving KPI's, this usually involves planting species that have canopy stored seeds (Banksia and Eucalyptus species). The tubestock planting of canopy species will be as per Table 6 (eg Banksia and Eucalyptus species). Planting will occur by hand (poti-putki) within gaps in restoration.

Tree guards will not be used as the site will be fenced (thus removing predation threats). Research by Kings Park has demonstrated that tree guards may be detrimental to seedling establishment (Close et al., 2007 - Ecophysiology of Species with Distinct Leaf Morphologies: Effects of Plastic and Shadecloth Tree Guards. Restoration Ecology).

4.5 Water Balance

From reports produced from a plant prospective and a hydrological point aspect, it is unlikely that there will be an effect on the watertable as a result of Hanson's activities at Oldbury.

Detailed groundwater modelling undertaken at the request of and in consultation with the Department of Parks and Wildlife (now Department of Biodiversity Conservation and Attractions, DBCA) indicates that groundwater levels after revegetation are predicted to decrease by a maximum 2 cm at the downgradient site boundary. Similarly, ecophysiologist technical advice shows Banksia water use changes associated with the mining operations are expected to be minimal.

Further details of these conclusions are provided in:

- **Attachment C1** - RPS Groundwater Profiling Modelling Report (March 2016) - which has been updated in line with letter from DER (now DWER) dated 15 03 16.
- **Attachment C2** - Ecophysiological advice on potential changes to groundwater access by plants resulting from mining operations at Oldbury (Jason Stevens).

With ongoing monitoring of existing bores at the Oldbury site, if there is a dramatic change then the relevant trigger values will identify this change and a management response will occur as outlined in Section 6.0 of the Groundwater Profile Modelling Report provided in **Attachment C1**, and in consultation with a hydrologist and ecophysiologist.

4.6 Commitment

Hanson confirms they are committed to meeting the recording and reporting requirements as outlined in this Rehabilitation Management Plan.

Attachments