

## **APPENDIX 7**

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### **Gnangara Sand Quarry Mine Closure Plan**



## MINE CLOSURE PLAN

**Gnangara Sand Quarries –Tenements  
E70/3279, E70/3275, M70/1306**





## **MINE CLOSURE PLAN**

**Gnangara Sand Quarries –Tenements  
E70/3279, E70/3275, M70/1306**

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## MINING CLOSURE PLAN CHECKLIST

Please cross-reference page numbers from the Mine Closure Plan where appropriate, and provide comments or reasons for No (N) or Not Applicable (NA) answers.

Q No.	Mining Closure Plan Checklist	Y/N NA	Page No.	Comments
1	Has the checklist been endorsed by a senior representative within the tenement holder/operating company? (See bottom of checklist.)	Y	Checklist Signature Below	Signature Below
2	How many copies were submitted to Department of Mines and Petroleum (DMP)?	N/A	N/A	Hard Copies = 2 Electronic = 1
<b>Cover Page, Table of Contents</b>				
3	Does the cover page include: <ul style="list-style-type: none"> <li>▪ project title</li> <li>▪ company name</li> <li>▪ contact details (including telephone numbers and email addresses)</li> <li>▪ document ID and version number</li> <li>▪ date of submission (needs to match the date of this checklist)</li> </ul>	Y	Cover Page	
4	Has a table of contents been provided?	Y	ix	
<b>Scope and Project Summary</b>				
5	State why the Closure Plan is submitted (as part of a Mining Proposal (MP) or a reviewed Closure Plan or to fulfil other legal requirements).	Y	1	
6	Does the project summary include: <ul style="list-style-type: none"> <li>▪ land ownership details</li> <li>▪ location of the project</li> <li>▪ comprehensive site plan(s)</li> <li>▪ background information on the history and status of the project.</li> </ul>	Y	3	
<b>Legal Obligations and Commitments</b>				
7	Has a consolidated summary or register of closure obligations and commitments been included?	Y	6	
<b>Data Collection and Analysis</b>				
8	Has information relevant to mine closure been collected for each domain or feature (including pre-mining baseline studies, environmental and other data)?	Y	12	
9	Has a gap analysis been conducted to determine if further information is required in relation to closure of each domain or feature?	Y	25	
<b>Stakeholder Consultation</b>				
10	Have all stakeholders involved in closure been identified?	Y	27	
11	Has a summary or register of stakeholder consultation been provided, with details as to who has been consulted and the outcomes?	Y	28	
<b>Final Land Use(s) and Closure Objectives</b>				
12	Does the Closure Plan include agreed post-mining land uses(s), closure objectives and conceptual landform design diagram?	Y	31	
13	Does the Closure Plan identify all potential (or pre-existing) environmental legacies, which may restrict the post-mining land use (including contaminated sites)?	Y	35	

Q No.	Mining Closure Plan Checklist	Y/N NA	Page No.	Comments
<b>Identification and Management of Closure Issues</b>				
14	Does the Closure Plan identify all key issues impacting mine closure objectives and outcomes?	Y	37	
15	Does the Closure Plan include proposed management or mitigation options to deal with these issues?	Y	37	
16	Have the process, methodology, and rationale been provided to justify identification and management of the issues?	Y	37	
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17	Does the Closure Plan include an appropriate set of specific closure criteria and closure performance indicators?	Y	39	
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20	Does the reviewed Closure Plan include a summary of closure implementation strategies and activities for the proposed operations or for the whole site?	Y	45	
21	Does the Closure Plan include a closure work program for each domain or feature?	Y	46	
22	Have site layout plans been provided to show each type of disturbance clearly?	Y	Figure 3B	
23	Does the Closure Plan contain a schedule of research and trial activities?	Y	46	
24	Does the Closure Plan contain a schedule of progressive rehabilitation activities?	Y	45	
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28	Does the Closure Plan contain a framework, including methodology, quality control and remedial strategy for closure performance monitoring including post-closure monitoring and maintenance?	Y	49	
<b>Closure Information and Data Management</b>				
29	Does the Closure Plan contain a description of management strategies including systems, and processes for the retention of mine records?	Y	51	
30	Confidentiality	Y	53	

### Corporate Endorsement

I hereby certify that to the best of my knowledge the information within this Mine Closure Plan and checklist is true and correct and addresses all the requirements of the Guidelines for the Preparation of a Mine Closure Plan approved by the Director General of Mines.

Name: Vernon Newton Position: Development Manager

Signature:  Date: 26 August 2016

## SUMMARY

Hanson Construction Materials Pty Ltd (Hanson) is seeking approval to establish three sand quarries in the Gnangara Pine Plantation within the following tenements Smokebush E70/3279 (Two Rocks), Tamega Road E70/3275 (Pinjar), Mulga Road M70/1306 (Gnangara). The proposal would extract over 80 million cubic metres (m<sup>3</sup>) of sand over a 50-year (plus) project life (Figure 1).

The Smokebush E70/3279 (Two Rocks), Tamega Road E70/3275 (Pinjar) and Mulga Road M70/1306 (Gnangara) are located within the Gnangara-Moore River State Forest which is vested in the Conservation Commission and managed, by the Department of Parks and Wildlife (DPaW) for multiple purposes including conservation, recreation, timber production and water catchment protection. The majority of the Gnangara-Moore River State Forest is a pine plantation, which is harvested under agreement by the Forestry Products Commission (FPC). The mining tenement site context is illustrated in Figure 2.

### Post-mining Land Use

The post-mining land use of the area will be directed through the outcomes of the government's draft Green Growth Plan, which is currently in draft form. The draft Green Growth Plan indicates that the area is to remain as State Forest and Parks and Wildlife indicate this is unlikely to change.

After the completion of sand extraction, the land will be rehabilitated by returning native species to the "proposal area" boundaries through broadcast seeding and tubestock planting if pine trees are not replanted. Alternatively, if the state government decides not to initiate the restoration outcomes of the GSS, Hanson proposes to either leave the "proposal area" boundaries (disturbance footprint) in a state suitable for replanting pine trees or development if proposed under the draft Green Growth Plan.

Currently there is a shortage of basic raw materials (sand), required for development in the Perth Metropolitan Region. The key strategic sites outlined in this report will provide an important resource in the region for the next 50–60 years. Silica sand is utilised for use in domestic trade and international export. Extraction of construction sand will be market driven and historically approximately 15 million tonne of material is required annually by the northern Perth market. The sand will be screened on site and then transported off site to customers. Sand extraction is proposed to commence as soon as the required approvals are issued.

This Mine Closure Plan (Closure Plan) has been prepared to meet the Department of Mines and Petroleum (DMP) Guidelines for Preparing Mine Closure Plans (Department of Mines and Petroleum 2015) for the Smokebush E70/3279, Tamega Road E70/3275 and Mulga Road M70/1306 tenements.

It has been developed to provide more certainty to the long-term elements of the mine planning cycle and to provide greater flexibility around the shorter term mine planning. This Closure Plan document will be updated through the life of the mining operation.

The proposed guiding closure principles for the Smokebush E70/3279, Tamega Road E70/3275 and Mulga Road M70/1306 operations are summarised as follows:

- The site will be rehabilitated consistent with the purposes of State Forest and meet the draft Green Growth Plan objectives.
- There should be no significant, physical off-site impacts.
- Landforms remaining after mining should be stable and in keeping with others in the region.
- The established vegetation cover will be sustainable, self-sufficient and minimise erosion.
- The post-mining landform will be geotechnically stabled to respond to erosion agents in a similar manner to naturally occurring landforms.
- There should be no unsafe areas where members of the public could be exposed to health and safety risks resulting from inadequate quarry closure.

Closure data gaps that have been identified through this Closure Plan are outlined in Table I.

**Table I: Closure Data Gaps**

Area of Closure	Data Gaps	Proposed Actions to Obtain Data
Town Planning Scheme / Metropolitan Regional Scheme	The site is currently zoned under the MRS “Gnangara-Moore River State Forest”.	No further action required. Sand mining is a permitted use under the MRS “Gnangara-Moore River State Forest” zoning.
Infrastructure Decommissioning (or handover to another party)	Full completion of planning for infrastructure decommissioning (or hand over) has not been completed for infrastructure such as: <ul style="list-style-type: none"> <li>▪ plant</li> <li>▪ buildings</li> <li>▪ road infrastructure.</li> </ul>	Decommissioning to be implemented at the completion of each excavation stage within the “proposal area” boundaries
Closure Implementation Schedule	DPaW and FPC to inform Hanson if pine plantation to be reinstated after sand removal.	A schedule of closure implementation is included in Section 10.5 of this Closure Plan.
Monitoring and Maintenance Schedule	DPaW and FPC to inform Hanson if pine plantation to be reinstated after sand removal.	A framework for monitoring and maintenance after closure is included in Section 11.
Closure Monitoring and Maintenance Program	A framework for monitoring and maintenance post-closure is included in Section 11.	A conceptual Closure Monitoring and Maintenance Program will be developed within five years including: <ul style="list-style-type: none"> <li>▪ a schedule of required activities</li> <li>▪ monitoring methodology</li> <li>▪ quality control</li> <li>▪ a remedial strategy should monitoring indicate inadequate performance of closure activities.</li> </ul>



Key closure issues identified and management plans outlined within this Closure Plan are listed in Table 2.

**Table 2: Closure Issues and Management Plans**

Closure Issue	Management Measure
Ensuring final voids do not become a closure legacy	<p>This Closure Plan:</p> <ul style="list-style-type: none"> <li>▪ There will not be large final voids; areas of each stage will be backfilled. Any batters will be one vertical to three horizontal which will enable the landform to be integrated with the surrounding landscape.</li> </ul>
Ensuring oversize and overburden material does not become a legacy	<p>This Closure Plan:</p> <ul style="list-style-type: none"> <li>▪ Any available oversize and overburden will be used to backfill the voids it will not present a closure issue.</li> </ul>
Successful revegetation	<p>This Closure Plan:</p> <ul style="list-style-type: none"> <li>▪ Revegetation processes as outlined in Section 6.3.</li> <li>▪ The site will be rehabilitated with broadcast seeding and with some tubestock and seedling planting out to encourage native vegetation cover establishment if pine trees are not replanted (which is not likely).</li> <li>▪ Alternatively, to leave the “proposal area” boundaries (disturbance footprint) in a state suitable for development if agreed by the stakeholders.</li> </ul>
Prevention of contaminated sites	<p>This Closure Plan:</p> <ul style="list-style-type: none"> <li>▪ Minimal quantities of hydrocarbons and chemicals will be used or stored on site.</li> <li>▪ Hydrocarbon management measures will be implemented to prevent contamination.</li> <li>▪ Monitoring will be implemented to monitor groundwater quality on an ongoing basis.</li> </ul>
Acid Forming Material	<p>This Closure Plan:</p> <ul style="list-style-type: none"> <li>▪ As the proposed activities will not disturb the groundwater table, it is unlikely that any existing ASS will be exposed.</li> </ul>
Disturbance of Groundwater Regime	<p>This Closure Plan:</p> <ul style="list-style-type: none"> <li>▪ Mining will not extend below the groundwater table.</li> <li>▪ Monitoring will be implemented to confirm the depth to the groundwater table on an ongoing basis.</li> </ul>
Ensuring the site does not present a risk to public safety after closure	<p>This Closure Plan:</p> <ul style="list-style-type: none"> <li>▪ Public Access and Safety will be considered as part of detailed closure planning.</li> </ul>

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## 1.0 SCOPE AND PURPOSE

### 1.1 Scope

Hanson Construction Materials Pty Ltd (Hanson) is seeking approval to establish three sand quarries within the following tenements Smokebush E70/3279 (Two Rocks), Tamega Road E70/3275 (Pinjar) and Mulga Road M70/1306 (Gnangara). The proposal would extract over 80 million cubic metres (m<sup>3</sup>) of sand over a 50 year plus project life (Figure 1).

Figure 2 illustrates the mining tenement site context within the Gnangara-Moore River State Forest. The “proposed area” boundaries within the three tenements are focused within the pine plantation areas.

This Mine Closure Plan (Closure Plan) has been prepared to meet the Guidelines for Preparing Mine Closure Plans, June 2015 (Department of Mines and Petroleum 2015). It has been submitted as part of the Section 38(a) referral for the Gnangara Sand Quarries proposal currently under assessment by the Environmental Protection Authority (EPA).

The aim of the mine closure guideline is to ensure that, for every mine in WA, a planning process is in place so the mine can be closed, decommissioned and rehabilitated in an ecologically sustainable manner consistent with agreed post-mining outcomes and land uses without unacceptable liability left to the state (Department of Mines and Petroleum 2015).

### 1.2 Purpose

The closure plan for the Smokebush E70/3279, Tamega Road E70/3275 and Mulga Road M70/1306 excavation within the “proposed area” boundaries follows Hanson’s closure principles and will be updated throughout the life of the mining operation in agreement with Parks and Wildlife and the Department of Mines and Petroleum (DMP).

The mining sequence will be optimised within the constraints of the closure objectives of the plan. This plan proposes closure principles that will guide the management of quarry landforms, water resources, and revegetation, infrastructure and support facilities throughout the life of the operations.

The proposed guiding closure principles for the Smokebush E70/3279, Tamega Road E70/3275, and Mulga Road M70/1306 operations are summarised as follows:

- The site will be rehabilitated consistent with the purposes of State Forest and meet draft Green Growth Plan objectives.
- There should be no significant, physical off-site impacts.

- Landforms remaining after mining should be stable and in keeping with others in the region.
- The established vegetative cover will be sustainable, self-sufficient and minimise erosion.
- Rehabilitation methods will be based on the outcomes of research and development and adaptive management.
- The post-mining landform will be geotechnically stable and respond to erosion agents in a similar manner to naturally occurring landforms.
- There should be no unsafe areas where members of the public could be exposed to health and safety risks resulting from inadequate quarry closure.

## 2.0 PROJECT SUMMARY

### 2.1 Land Tenure

Tenements M70/1306, E70/3275 and E70/3279 are all held by Hanson.

#### 2.1.1 Proponent Contact Details

The contact details for the proponent are listed below:

Vern Newton  
Development Manager  
Hanson Construction Materials Pty Ltd (Hanson)  
Level 1, 35 Great Eastern Highway, Rivervale, WA 6103

### 2.2 Location

Figure 1 shows the regional location of the three mining tenements.

Figure 2 shows the Smokebush E70/3279, Tamega Road E70/3275 and Mulga Road M70/1306 tenements within the context of the Gnangara-Moore River State Forest, Gnangara Pine Plantation and the local government boundaries.

Figures 3a-c illustrates the “proposal area” boundaries (disturbance footprint) and the proposal excludes wetlands, bush forever sites, exclusion areas (‘red’ areas) defined in the draft Green Growth Plan and native vegetation (and their buffers) within the three mining tenements.

### 2.3 Overview of Operations

#### 2.3.1 History

Smokebush E70/3279, Tamega Road E70/3275 and Mulga Road M70/1306 tenements are located within a former Banksia woodland belt of the Swan Coastal Plain (SCP). The Banksia woodland native vegetation was cleared approximately 80 years ago to establish the Gnangara Pine Plantation. There are 22,000 ha of pine plantations within the Gnangara system, 5,000 ha of which have been harvested to date, as part of the Gnangara Sustainability Strategy (GSS). This strategy was a joint project between the Department of Water (DoW), Department of Agriculture, Department of Parks and Wildlife (DPaW), Department of Planning, Forest Products Commission (FPC), Water Corporation and the CSIRO (GSS 2009).

The GSS was a state government initiative that aimed to provide a framework for a whole of government approach to address land use and water planning issues associated with the Gnangara groundwater system. Three pine plantations have been targeted for harvesting by the FPC by 2028, with no new plantations to be established at this stage. Some of this area has been identified to be restored to native woodlands.

The GSS is now largely redundant and the post-mining land use of the area will be directed through the outcomes of the government's draft Green Growth Plan, which is currently in draft form. The draft Green Growth Plan indicates that the area is to remain as State forest and Parks and Wildlife indicate this is unlikely to change.

Smokebush E70/3279, Tamega Road E70/3275 and Mulga Road M70/1306 tenements described in this proposal has not been previously mined or excavated.

The "proposal area" boundaries avoid the exclusion areas designated in the draft Green Growth Plan and focus on the historical pine plantation areas (Figures 4a–4c).

### 2.3.2 Existing Facilities

There are no existing facilities on the tenement. There are some unsealed roads that transect the tenements. These unsealed roads are vested with the DPaW rather than the City of Wanneroo. There are also some unsealed tracks, likely used by logging contractors and recreational four-wheel drive vehicles (4WDs). There is currently no scheme water supply to the site. Potable water will be transported to the site and stored in on-site tanks. There is no power to the site; therefore, power will be supplied by diesel generators. Should mains power become available, the site would avail of this utility over a diesel generator power source option. Existing public road infrastructure will be utilised.

### 2.3.3 Predicted Mine Life

Hanson aims to develop this excavation area within the "proposal area" boundaries for a sustainable long-term operation of 50 years plus, across multiple stages that have all yet been finalised.

The three sand quarries will be generally carried out in accordance to the following process stages:

- removal of any remaining pine stumps once FPC has cleared the pine plantation. Any remaining stumps will be dug up, windrowed and burnt
- overburden stripping and stockpiling
- establishment of supporting infrastructure (roads, buildings, screens, etc.)
- mining of sand from highest to lowest areas

- rehabilitation of each stage to commence when the resource is stripped.
- The “proposal area(s)” within each of the three tenements are illustrated in Figures 3a–3c.

**2.3.4 Proposed Mining Operations Key Components**

The key components of the proposed project area are:

- proposal area boundaries
- internal access and haul routes
- access road
- machinery lay down shed
- portable office with ablutions
- screening plant
- stockpiles for topsoil/overburden, unscreened product, screened product and oversize waste material
- run of mine pad
- water storage tanks.

A summary of the proposed project components is presented in Table 3.

**Table 3: Key Project Characteristics**

<b>Proposal Title: Gnangara Sand Mines</b>			
<b>Proponent:</b> Hanson Construction Materials Pty Ltd (Hanson)			
<b>Short description:</b> The proposal is to develop and operate three sand quarries within tenements M70/1306, E70/3275 and E70/3279 which are located within the Gnangara Pine Plantation approximately 30 km to 50 km north of Perth business district. The proposal includes sand mining infrastructure including: <ul style="list-style-type: none"> <li>internal roads</li> <li>sand screening and washing plant</li> <li>fuel tanks</li> <li>weighbridge</li> <li>wash down facility</li> <li>site office</li> </ul>			
	<b>Gnangara (M70/1306) (Mulga Road)</b>	<b>Pinjar (E70/3275) (Tamega Road)</b>	<b>Two Rocks (E70/3279) (Smokebush)</b>
<b>Excavation</b>			
Quarry life	10+ years	50+ years	50+ years
Total estimated material excavated	5 million metres <sup>3</sup>	25 million metres <sup>3</sup>	25 million metres <sup>3</sup>

<b>Total area of quarry footprint (proposal area)</b>	<b>163.11 ha (proposal area)</b>	<b>3553.86 ha (proposal area)</b>	<b>5037.39 ha (proposal area)</b>
Estimated excavation rate	Each tenement site will produce 3000–4000 tonnes per day		
Maximum pit depth	The excavation level will have an interim depth of 3 m from the historical maximum groundwater level (i.e. the highest ever recorded groundwater level). Once the DoW has agreed with Hanson on the methodology for determining the Likely Future Maximum Winter Water Table (LFMWWT), then the Water Management Plan will be amended and finalised to extract 3 m above this level.		
Screening plant	A screening plant will be used at each site to screen oversized rock and organic material.		
<b>Quarry Site Infrastructure</b>			
<b>Machinery</b>			
Water Cart	18 kL capacity, used for dust suppression of haul road, pit floor and stockpiles.		
Front end loaders	Three Volvo 150E or similar earthmoving equipment as required		
Semi-trailers	Variable. From 10 m <sup>3</sup> to 40 m <sup>3</sup> capacity. Will be provided by customers. Vehicles used will be classified by Main Roads Western Australia		
Grader	One Cat 140G or similar. For maintaining roads, as required		
Dump Trucks	Approximately five articulated dump trucks		
Service truck	Truck with 5000 L fuel capacity and tanks for separate lubricants, including a waste oil tank and evacuation pump.		
Light vehicles	Two for site operators.		
Fuel Tanks	Each sand quarry requires x3 17,500 L above ground self banded tanks		
Diesel generators	Suitably-sized diesel generators		
Mobile screening plant	A washing and screening plant will be used to sort sand material after excavation at each sand quarry site		
<b>Transport</b>			
Truck movements and hours	Approximately 100 to 200 return truck movements per day of operation (depending on truck sizes). Only include noise from within the site. Off-site noise is not included.		
<b>Workforce</b>			
Operation	15-25 personnel during operation		
Hours of Operation	24 hours per day or from 6.00 am to 7 pm if sand extraction stage(s) occurs within 1,000 m of sensitive receptors		

### 2.3.5 Site Layout

The “proposal area” boundaries within the three tenements are focused within the pine plantation areas (Figures 3a–3c).

The proposal has taken into consideration the location of the sand resource, environmental features (e.g. bush forever and wetlands), gradient, drainage lines, noise minimisation, and visibility from the road, cartage distances and the minimal necessary infrastructure. The mine pad will contain the stockpiles and loop road to minimise ground disturbance. The infrastructure (portable office, machinery shed, water tanks and portable toilet) will be located adjacent to the access road.

The infrastructure (office, machinery shed, water tanks and portable toilet) will be located adjacent to the access road. The “proposal area” accommodates the following:

- The three “proposed area” boundaries within the tenements are focused within the pine plantation areas.
- All wetlands are avoided.
- All the designated exclusion (or “red”) areas in the draft Green Growth Plan are avoided.
- All excavation will be at least 100 m from Water Corporation’s abstraction bore. The proposed sand quarry will not store hydrocarbons within 500 m of the wellhead protection zone.
- A 20 m buffer will be maintained from all DoW monitoring bores.
- All high to moderate ASS risk areas are avoided.
- A 50 m buffer will be maintained from all road reserves.
- All bush forever sites and areas of native vegetation are avoided.
- The registered Aboriginal Site - Smokebush Waterhole (Site ID 3574) is avoided (Figure 10)

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### 3.0 IDENTIFICATION OF CLOSURE OBLIGATIONS AND COMMITMENTS

Mine closure planning is an integral part of mine development and operations planning across the various stages of the life cycle of the project (Department of Mines and Petroleum 2015).

In WA, the main legislative obligations and potential liabilities are created under the *Mining Act 1978* (Mining Act), *Mines Regulations Act 1946* and *Mines Safety and Inspection Regulations 1995*, administered by the DMP. The proposed mining operations are also subject to the *Environmental Protection Act 1986* (EP Act). The EP Act overrides all other Acts, including the Mining Act and is administered by the EPA and the Department of Environment Regulation (DER). An approval to mine issued under the Mining Act does not override the requirements to obtain an environmental approval under the EP Act. Consequently, the requirements of both Acts and their regulators must be satisfied.

Hanson's three "proposed area" boundaries (disturbance footprint), Smokebush E70/3279, Tamega Road E70/3275 and Mulga Road M70/1306 will be carried out within their mining tenement and in accordance with the tenement conditions issued under the Mining Act.

#### 3.1 Legal Obligations Register

The conditions of the Mining Leases, along with relevant conditions from other regulatory approvals and proponent commitments, form the current position with regard to rehabilitation and closure obligations.

Table 4 and Table 5 identify indicative conditions and commitments relevant to the rehabilitation and closure of the three "proposed area" boundaries (disturbance footprint) within Smokebush E70/3279, Tamega Road E70/3275 and Mulga Road M70/1306 tenements. The indicative conditions are premised upon draft conditions from other Hanson sand quarries within the Gnangara Pine Plantation. Hanson will also implement any additional closure requirements related to regulatory approvals for the operation of sand mining activities, such as Works Approval(s) and Licence(s) to Take Water. The Minister for the Environment on advice from Parks and Wildlife also provides the regulatory approval and will set conditions with regard to rehabilitation and closure obligations.

**Table 4: Closure Commitments – Indicative Draft Conditions**

Condition No.	Aspect	Description of Condition / Commitment
2	Rehabilitation	All surface holes drilled for the purpose of exploration are to be capped, filled or otherwise made safe immediately after completion.
3	Rehabilitation	All disturbances to the surface of the land made as a result of exploration, including costeans, drill pads, grid lines and access tracks, being backfilled and rehabilitated to the satisfaction of the Environmental Officer, DMP. Backfilling and rehabilitation being required no later than six months after excavation unless otherwise approved in writing by the Environmental Officer, DMP.
4	Closure	All waste materials, rubbish, plastic sample bags, abandoned equipment and temporary buildings being removed from the mining tenement prior to or at the termination of exploration program.
5	Closure	Unless the written approval of the Environmental Officer, DMP is first obtained, the use of drilling rigs, scrapers, graders, bulldozers, backhoes or other mechanised equipment for surface disturbance or the excavation of costeans is prohibited. Following approval, all topsoil being removed ahead of mining operations and separately stockpiled for replacement after backfilling and/or completion of operations.
<b>Consent to Mine on State Forest Reserve No. 65 Granted Subject to the Following Conditions</b>		
8 10	Rehabilitation and Closure	The lessee preparing and implementing a rehabilitation and closure plan to the satisfaction of the DMP Director Environment, and areas within the lease being rehabilitated to the standard and condition agreed by the DMP Director Environment.
9 11	Rehabilitation	The lessee submitting an Annual Environmental Report to DMP's Director Environment and to DPaW's Director General outlining operations and rehabilitation conducted in the previous 12 months and the proposed operations and rehabilitation programs for the next 12 months. This report being provided in September of each year.
13 16 23 43	Timing of Operations and Closure	In preparation of a mining proposal, the lessee ensuring that the timing of sand extraction meets the requirements of any land use development schedules as determined by the Minister for Mines and Petroleum.

**Table 5: Mining Proposal Closure Commitments**

Page No.	Section No.	Closure Commitment
<b>Mining Proposal</b>		
Pg. 37	5.7.1	<ul style="list-style-type: none"> <li>▪ Only certified Phytophthora dieback-free materials (e.g. soil, mulch and compost) will be brought to the site for use in rehabilitation.</li> <li>▪ Plants will be purchased from accredited nurseries and direct seeding would be considered, rather than planting seedlings.</li> </ul>
Pg. 49	7.1	<ul style="list-style-type: none"> <li>▪ After the completion of sand extraction, the land will be rehabilitated by returning native species to the excavation areas within the "proposal area" boundaries through broadcast seeding and tubestock planting if pine trees are not replanted.</li> <li>▪ Alternatively, to leave the excavation areas in a state suitable for development as proposed the PPSR if agreed by the stakeholders.</li> </ul>

Page No.	Section No.	Closure Commitment
	7.2.1	<ul style="list-style-type: none"> <li>▪ Once quarrying of each stage is complete, the excavation area within the “proposal area” boundaries will be backfilled with oversize screened material and reshaped.</li> <li>▪ Overburden will be spread evenly over backfilled material and other areas where waste has been picked up.</li> <li>▪ Surfaces will be ripped or ploughed along the contour to minimise erosion from water run-off and relieve compaction.</li> <li>▪ Surface drainage lines will be established to control surface run-off and minimise potential erosion.</li> </ul>
Pg. 50	7.2.2	Topsoil and overburden will be stockpiled for use in rehabilitation.
	7.2.4	<ul style="list-style-type: none"> <li>▪ All buildings and infrastructure will be removed.</li> <li>▪ Any hard stand surfaces will be removed and used to backfill the pit.</li> <li>▪ Overburden and scalps (oversize screened material) will be used as backfill.</li> <li>▪ Area will have the slopes and soils contoured to allow for regeneration of native vegetation that can be returned via seed and tubestock at rates commercially acceptable to Hanson and Kings Park to complete the works, or alternatively pine plantation or an alternative use if agreed by all stakeholders in the future.</li> <li>▪ Broadcast seeding and tubestock planting will likely be used or native vegetation topsoil if available. Alternatively, the excavation areas within the “proposal area” boundaries will be left in a state suitable for development.</li> </ul>
Pg. 53	9.0	At the completion of operations, adequate rehabilitation will occur across the Smokebush E70/3279, Tamega Road E70/3275 and Mulga Road M70/1306 quarry areas. A rehabilitation plan will be devised and implemented to the satisfaction of DPaW and DMP.
<b>Water Management Plan</b>		
Pg. 15	4.2.3	The excavation level will have an interim depth of 3 m from the historical maximum groundwater level (i.e. the highest ever recorded groundwater level). Once the DoW has agreed with Hanson on the methodology for determining the LFMWWT, then the Water Management Plan will be amended and finalised to extract 3 m above this level.

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## 4.0 COLLECTION AND ANALYSIS OF CLOSURE DATA

Collection and analysis of closure data must meet the following minimum requirements (Department of Mines and Petroleum 2015):

- use of recognised or acceptable methodologies and standards
- incorporate appropriate quality management systems and procedures (e.g. ISO 9000)
- consideration of the wider receiving environment, receptors and exposure pathways
- provide a base on which to develop criteria or indicators for closure monitoring and performance.

Information from baseline studies undertaken prior to the commencement of mining operations and ongoing monitoring is essential to establish achievable closure outcomes and goals, as well as to identify issues requiring management through the mine closure process (Department of Mines and Petroleum 2015).

Hanson have gathered (and will continue to gather) environmental and rehabilitation data to enable planning and monitoring of effective rehabilitation and closure of the three “proposed area” boundaries for the Smokebush E70/3279, Tamega Road E70/3275, Mulga Road M70/1306 operations.

The following documents include studies of baseline environmental conditions specific to the Smokebush E70/3279, Tamega Road E70/3275 and Mulga Road M70/1306 operations, undertaken for the mining proposal application by Hanson include:

- Environmental Assessment, Sand Quarries, Gnangara (RPS 2016).

The following subsections describe the available baseline data.

### 4.1 Regional Setting

The following discusses the overall region, including all tenement areas.

The Interim Biogeographic Regionalisation for Australia (IBRA) classification system divides Australia into 85 bioregions and 403 subregions. The bioregions and subregions are the reporting unit for assessing the status of native ecosystems, their protection in the national reserve system and for use in the monitoring and evaluation framework in the Australian Government’s current Natural Resource Management initiatives (DSEWPC 2012a).

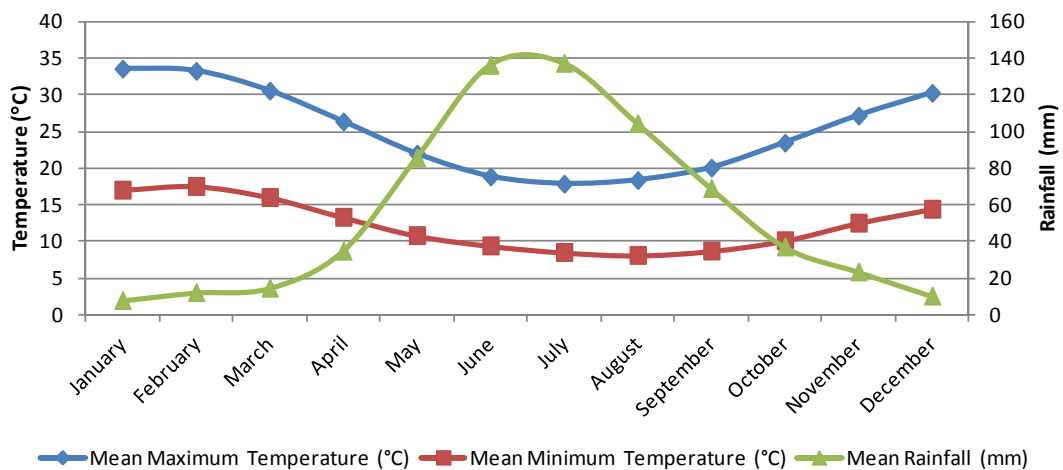
The proposed sand quarries are located within the Swan Coastal Plain 2 (SWA2) subregion, which lies within the Swan Coastal Plain Bioregion.

The Swan Coastal Plain (SCP) is a low-lying coastal plain, mainly covered with woodlands. It is dominated by Banksia or tuart on sandy soils, *Casuarina obesa* on outwash plains, and paperbark in swampy areas. In the east, the plain rises to discredited Mesozoic sediments dominated by jarrah woodland. The climate is warm Mediterranean. Three phases of marine sand dune development provide relief. The outwash plains, once dominated by *C. obesa*–marri woodlands and *Melaleuca* shrublands, are extensive only in the south. (Mitchell et al. 2002)

The Perth subregion is composed of colluvial and Aeolian sands, alluvial river flats and coastal limestone. Heath and/or tuart woodlands are present on the limestone, Banksia and jarrah – Banksia woodlands on Quaternary marine dunes of various ages, and marri on colluvial and alluvials. The region includes a complex series of seasonal wetlands and also includes Rottnest, Carnac and Garden islands. Rainfall ranges between 600 and 1000 mm annually. The subregional area is 1,333,901 ha. (Mitchell et al. 2002).

## 4.2 Climate

The proposed three proposed quarries are located just north of the Perth metropolitan area. The climate is classified as Mediterranean. The closest open climate station is located at the Royal Australian Air Force (RAAF) Base Pearce. This area experiences hot, dry summers and cool, wet winters. Graph A below displays the average annual climate data for RAAF Base Pearce, Station No. 09053 (BOM 2012).



**Graph A: Climatic Means from RAAF Base Pearce Station from 1940 to 2012**  
 Physical Environment (BOM 2012)

## 4.3 Geology

The following is an overall explanation of the geology and soils of the entire Gnangara region, including all tenements, and then will focus on each individual tenement.

The SCP consists of Pliocene to Quaternary sediments (collectively termed “superficial formations” which comprise Aeolian, alluvial, swamp, estuarine and shoreline sediments) that were deposited on a gently seaward-sloping unconformity surface on top of Mesozoic sedimentary rocks (Bettany et al. 1960). The latter rocks include the Leederville Formation (Cretaceous) and the Yarragadee Formation (Jurassic). The major dune systems, oriented in a north–south direction, transect the SCP. The Bassendean dunes are the oldest (Pleistocene), lowest and most leached of the series. To the west of the Bassendean dune system are the calcareous Quindalup dunes, the youngest unit (Bettany et al. 1960). The superficial formations (i.e. sands, sandstone and limestone) support Perth’s two major aquifers: the Gnangara mound north of the Swan River, and the Jandakot mound south of the river.

### 4.3.1 Resource Statement

It is estimated that approximately 80 million tonnes will be extracted over the 50 year plus mine life. The sand will be used in the construction industry.

### 4.3.2 Waste Rock and Tailings

There will be no tailings, as no processing of the product is proposed. Waste material will be mostly organic material left over from pine stumps, and rocky oversize material. The sand will be screened and the oversize fraction will be stockpiled. This will be returned to the pit during rehabilitation of each stage, prior to overburden return.

## 4.4 Soils

### 4.4.1 Smokebush (E70/3279) Two Rocks

Regional geology mapping indicates that the site is predominantly Tamala limestone through the central and west portion of the site and Bassendean sand in the east. The far south-western portion of the site consists of S7 sand (pale and olive yellow, medium to coarse-grained, sub-angular quartz with a trace of feldspar, moderately sorted, of residual origin) with very minor stands of LS1 limestone (light yellowish brown, fine to coarse-grained, sub-angular to well-rounded quartz, trace of feldspar, shell debris, variably lithified, surface kankar, of eolian origin) and LS2 limestone (light yellowish brown, fine to coarse-grained, sub-angular to well-rounded quartz, trace of feldspar, shell debris, variably lithified, surface kankar, or eolian origin, abundant karstic). There are also two swamp deposits in the west and a small portion of Alluvium in the north-east (Figure 5a).

#### 4.4.2 Tamega Road (E70/3275) Pinjar

Regional geology mapping indicates that the site is predominantly S8 sand (very light grey at surface, yellow at depth, fine to medium-grained, sub-rounded quartz, moderately well sorted of eolian origin) (Figure 5b).

The northern portion of the site is Bassendean sand and the south-western portion is S7 sand (pale and olive yellow, medium to coarse-grained, sub-angular quartz with a trace of feldspar, moderately sorted, of residual origin) with a small stand of LSI limestone (light yellowish brown, fine to coarse-grained, sub-angular to well-rounded quartz, trace of feldspar, shell debris, variably lithified, surface kankar, of eolian origin). There is also a swamp deposit in the north-east corner.

#### 4.4.3 Mulga Road (M70/1306) Gnangara

Regional geology mapping indicates that this site is predominantly S8 sand (very light grey at surface, yellow at depth, fine to medium-grained, sub-rounded quartz, moderately well sorted of eolian origin) and S10 sand (as S8 sand) with some small portions of peaty clay (dark grey and black with variable sand content of lacustrine origin) in the north-west and east of the tenement (Figure 5c).

#### 4.4.4 Acid Sulfate Soils

Acid Sulfate Soils (ASS) are naturally occurring soils and sediments containing iron sulfides, most commonly pyrite. When ASS are exposed to air, the iron sulfides in the soil react with oxygen and water to produce a variety of iron compounds and sulfuric acid. The resulting acid can release other substances, including heavy metals, from the soil and into the surrounding environment. These materials are characterised by bright yellow or straw-coloured mottles of the mineral jarosite and often contain dark reddish coloured streaks. Actual ASS have a soil pH of 4 or less (DoE 2003).

The DER compiled ASS risk maps for several regions of Western Australia that provide broad-scale indication of the areas where ASS is most likely to exist. ASS categories surrounding the project area are displayed in Figures 6a–6c.

The three tenements consists predominantly of “moderate to low risk of ASS within 3 m of the natural soil surface (or deeper)”, with a small portion of high to moderate risk of ASS within 3 m of the natural soil surface (or deeper).

As the proposed activities will not disturb the ground below the water table and the mine footprint will not disturb wetland areas, it is unlikely that any existing ASS will be exposed. Excavation works avoids “high to moderate” risk ASS polygon areas.



#### 4.4.5 Contaminated Sites

A search of the DER Contaminated Sites database did not identify any registered contaminated sites within the three mining tenements.

### 4.5 Topography

#### 4.5.1 Smokebush (E70/3279) Two Rocks

The site varies in height from 15 m Australian Height Datum (m AHD) to 95 m AHD, with the lowest lying land in the south-west and the highest peak in the south-east (Figure 7a).

#### 4.5.2 Tamega Road (E70/3275) Pinjar

The site varies in height from 50 m AHD to 100 m AHD, with the majority of the highest land in the south-east portion of the site. The northern portion of the site consists of far more gradual sloping land, in comparison to the greatly undulating land throughout the centre and south (Figure 7b).

#### 4.5.3 Mulga Road (M70/1306) Gnangara

The site varies in height from 50 m AHD to 75 m AHD. The highest point is within the northern section of the tenement, which consists of a central point at 75 m AHD, decreasing gradually to 55 m AHD. The southern portion of the tenement is comprised of much flatter land, with two central points at 60 m AHD, decreasing gradually to 50 m AHD in the outer areas of the site (Figure 7c).

### 4.6 Hydrology

The tenements are located within the Swan–Avon catchment, in the sub-catchment of Lower Swan. The Swan–Avon river has a total catchment area of 125,000 km<sup>2</sup>, extending from Dalwallinu in the north, Southern Cross in the north-east and Lake King in the south-east, down to the river mouth at Fremantle.

Over a quarter of the SCP subregional land area from Wedge Island to Dunsborough is wetland (Mitchell et al. 2002). Most of the wetlands on the SCP occur in inter-dunal swales and are hence also orientated in the north–south direction. Although some are perched, the majority of the SCP wetlands are hydraulically connected to the underlying superficial aquifers. At low points in the landscape, the water table frequently intersects the land surface to form lakes and swamps (Salama et al. 2005).

Surface water quality of the wetlands largely reflects groundwater quality, with the Bassendean wetlands historically tending to be coloured, base-poor and slightly acidic, while wetlands on the Spearwood and Quindalup dunes tend to be richer in calcium carbonate with relatively high to very high pH.

#### **4.6.1 Surface Water**

##### **4.6.1.1 Smokebush (E70/3279) Two Rocks**

The Loch McNess System, a nationally important wetland, is located approximately 5 km south of the site.

There are six CCW within the site; one in the west and five in the east. These CCWs have been excluded from the “proposal area” boundary (Figure 8a).

##### **4.6.1.2 Tamega Road (E70/3275) Pinjar**

There are no nationally important, or internationally significant, wetlands within a 10 km radius of this site.

There is one CCW within the northern portion of the site. This CCW has been excluded from the “proposal area” boundary (Figure 8b).

##### **4.6.1.3 Mulga Road (M70/1306) Gnangara**

Joondalup Lake, a nationally important wetland, is located approximately 7 km west of the site.

There is a CCW located wholly within the northern section of the tenement and a large REW spanning across the central section of the tenement. There are no CCWs or REWs within the “proposal area” boundary (Figure 8c).

#### **4.6.2 Groundwater**

##### **4.6.2.1 Smokebush (E70/3279) Two Rocks**

Groundwater contours indicate that the groundwater flow direction is west towards the Indian Ocean. The minimum groundwater contours across the site range from 0 m AHD in the south-west to 50 m AHD in the north-east. The average annual maximum groundwater mapping does not reach this site (Figure 7a).

Perth Groundwater Atlas indicates that the site lies within the Gnangara Underground Water Pollution Control Area (Priority I Zone).

#### 4.6.2.2 Tamega Road (E70/3275) Pinjar

Groundwater contours indicate that the groundwater flow direction is south-west towards the Indian Ocean. The minimum groundwater contours across the site range from 35 m AHD in the south-west to 50 m AHD in the north-east. The maximum groundwater contour mapping reaches only the southern portion of the site and ranges from 35 m AHD in the south-west to 55 m AHD in the south-east (Figure 7b).

Perth Groundwater Atlas indicates that the site lies within the Gnangara Underground Water Pollution Control Area (Priority I Zone).

#### 4.6.2.3 Mulga Road (M70/1306) Gnangara

Groundwater contours indicate that the groundwater flow direction is south-west towards the Indian Ocean. The maximum groundwater contours range from 53 m AHD in the north-east to 47 m AHD in the south. The average annual maximum groundwater level in the vicinity of the site is 51 m AHD (Figure 7c).

Perth Groundwater Atlas indicates that a portion of the three tenements are within the Gnangara Underground Water Pollution Control Area (Priority I Zone) (Figure 8c). The remainder of the tenements are outside the Gnangara Water Pollution Area.

## 4.7 **Vegetation and Flora**

### 4.7.1 **Vegetation and Flora**

Hanson's three proposed "proposal area" boundaries (within each tenement) avoids wetlands, bush forever sites, exclusion areas defined (or "red" areas) in the draft Green Growth Plan and native vegetation. The "proposal area" boundaries are focused within areas of pine plantation after clearing is undertaken by the FPC and the "green" area defined in the draft Green Growth Plan.

Acknowledging the proposal development timeframes being 50 years plus, Hanson will need to clear any areas of regrowth within the sand quarry disturbance area that may occurred after the pines trees are harvested. Acknowledging this Hanson will seek approval to clear any regrowth vegetation through a Part V Division 2 of the EP Act - Clearing Permit.

#### 4.7.1.1 Smokebush (E70/3279) Two Rocks

A search of the EPBC Protected Matters Search Tool with a 10 km radius returned two TECs; Aquatic Root Mat Community in Caves of the SCP and Sedgelands in Holocene dune swales of the southern SCP. The search also returned seven species of Threatened plants and 13 species of weeds that are likely to occur in the area.

A NatureMap search with a 10 km radius revealed seven species of Bryopsid, 417 species of Dicotyledon (including one Threatened, two Priority 1, one Priority 2, eight Priority 3 and one Priority 4 species), one species of fungus (Priority Two), two species of fungus (including one Priority 2 species), three species of Gymnosperm, 11 species of Lichen (including two Priority 2 and one Priority 3 species), 165 species of Monocotyledon (including one Threatened and one Priority 4 species) and one species of Pteridophyte.

The site wholly encompasses Bush Forever Site 127. The site also intersects Bush Forever Sites 128, 284, 381, 396 and 406 along the southern and western boundaries (Figure 9a).

The vegetation complex present within Bush Forever sites 127 128 and 396 is:

- Spearwood Dunes
  - Cottesloe Complex – North.

The vegetation complexes present within Bush Forever site 284 are:

- Spearwood Dunes
  - Cottesloe Complex – North
- Quindalup Dunes
  - Quindalup Complex.

The vegetation complex present within Bush Forever site 381 is:

- Spearwood Dunes
  - Karrakatta Complex – North
  - Karrakatta Complex – North (one of two most northern occurrences)
  - Karrakatta Complex – Central and South (most northern occurrence).

The vegetation complexes present within Bush Forever site 406 are:

- Spearwood Dunes
  - Cottesloe Complex – North
- Quindalup Dunes
  - Quindalup Complex.

(Government of Western Australia 2000)

#### 4.7.1.2 Tamega Road (E70/3275) Pinjar

A search of the EPBC Protected Matters Search Tool with a 10 km radius returned two TECs; Aquatic Root Mat Community in Caves of the SCP and Sedgelands in Holocene dune swales of the southern SCP. The search also returned 10 species of Threatened plants and 13 species of weeds that are likely to occur in the area.

A NatureMap search with a 10 km radius revealed one species of alga, 291 species of Dicotyledon (including one Threatened and six Priority 3 species), one species of fungus (Priority 2), two species of Gymnosperm, 106 species of Monocotyledon (including one Threatened and one Priority 4 species), one species of Pteridophyte and one species of water mould.

The site wholly encompasses three Bush Forever sites (94, 285 and 286). In addition, site 380 is intersected on the eastern boundary and sites 410 and 381 in the south-west (Figure 9b).

The vegetation complex present within Bush Forever sites 94, 285 and 286 is:

- Spearwood Dunes
  - Karrakatta Complex – North.

The vegetation complexes present within Bush Forever site 380 are:

- Bassendean Dunes
  - Bassendean Complex – North
  - Bassendean Complex – North Transition (restricted complex, contains significant area)
  - Bassendean Complex – Central and South Transition (restricted complex, contains significant area, most southern occurrence).
- Spearwood Dunes
  - Karrakatta Complex – North (most southern occurrence)
  - Karrakatta Complex – North Transition (restricted complex, contains significant area, most northern occurrence)
  - Karrakatta Complex – Central and South (restricted complex, contains significant area).

The vegetation complex present within Bush Forever site 381 is:

- Spearwood Dunes
  - Karrakatta Complex – North
  - Karrakatta Complex – North (one of two most northern occurrences)
  - Karrakatta Complex – Central and South (most northern occurrence).

The vegetation complex present within Bush Forever site 410 is:

- Spearwood Dunes
  - Karrakatta Complex – Central and South (most northern occurrence)
  - Cottesloe Complex – North
  - Cottesloe Complex – Central and South.

(Government of Western Australia 2000)

#### 4.7.1.3 Mulga Road (M70/1306) Gnangara

A search of the EPBC Protected Matters Search Tool with a 10 km radius returned one Threatened Ecological Community (TEC); assemblages of plants and invertebrate animals of tumulus (organic mound) springs of the SCP. The search also returned 12 species of Threatened plants and 13 species of weeds that are likely to occur in the area.

A NatureMap search with an 10 km radius revealed 14 species of Bryopsid, 447 species of Dicotyledon (including two Threatened, three Priority 1, one Priority 2, two Priority 3 and one Priority 4 species), six species of fungus, three species of Gymnosperm, 224 species of Monocotyledon (including two Threatened, one Priority 1, one Priority 2, three Priority 3 and one Priority 4 species), one species of Pteridophyte, one species of slime mould and one species of water mould.

The western portion of the tenement intersects Bush Forever Site 326 (Figure 9c). The vegetation complexes present within this site are:

- Bassendean Dunes
  - Bassendean Complex – North
  - Bassendean Complex – Central and South (most northern occurrence)
  - Bassendean Complex – North Transition
- Wetlands
  - Pinjar Complex.

(Government of Western Australia 2000)

#### 4.7.2 **Post-pine Plantation Clearing Vegetation Assessment**

A flora and vegetation survey post-pine tree removal was undertaken in the Gnangara Pine Plantation area in 2014 by PGV Environmental. This survey was undertaken to provide information on the patterns of natural regeneration of the previously cleared pine plantation within the project area.

The flora and vegetation survey identified the project area comprises a combination of existing pine plantations (of variable age). Native vegetation that has regenerated within the previously cleared areas is mainly degraded condition with poor structural integrity as summarised below.

- low shrubs and herbs dominated by *Acacia pulchella*, *Xanthorrhoea preissii*, *Stirlingia latifolia*, *Jacksonia densiflora* and *Anigozanthos humilis*
- low woodland of *Corymbia calophylla* with an open understory of *Gastrolobium capitatum*, *Acacia pulchella*, *Xanthorrhoea preissii*, *Gompholobium tomentosum*, *Hibbertia hypericoides* and *Hardenbergia comptoniana*

- scattered small *Eucalyptus marginata* trees over an open heath understorey and scattered *Stirlingia latifolia*, *Gastrolobium capitatum* and *Daviesia triflora* and abundant weed species
- low open woodland of *Corymbia calophylla* over a weedy understorey dominated by lupins and veldt grass
- cleared and open areas dominated by weed species with scattered, small shrubs and trees.

The structure, complexity and condition of the vegetation identified on the site were dependent on the time since the pine plantation had been cleared. With those areas of only one year's worth of regrowth being the most degraded areas of vegetation.

## 4.8 Fauna

A list of key species compiled from NatureMap and EPBC Act search is shown in Table 6.

**Table 6: Key Species List**

Species	Common Name	Wildlife Conservation Act 1956 Status	EPBC Act Status
<b>Birds</b>			
<i>Botaurus poiciloptilus</i>	Australasian bittern	Threatened	Endangered
<i>Calyptorhynchus banksii naso</i>	Forest red-tailed black cockatoo	Threatened	Vulnerable
<i>Calyptorhynchus latirostris</i>	Carnaby's Black-Cockatoo, short-billed black cockatoo	Threatened	Endangered
<i>Leipoa ocellata</i>	Malleefowl	Threatened	Vulnerable
<i>Rostratula australis</i>	Australian painted snipe	Threatened	Endangered
<i>Sternula nereis nereis</i>	Fairy tern (Australian)	Threatened	Vulnerable
<i>Merops ornatus</i>	Rainbow bee-eater	Migratory	Migratory
<i>Haliaeetus leucogaster</i>	White-bellied sea-eagle	Migratory	Migratory
<i>Ardea alba</i>	Great egret, white egret	Migratory	Migratory
<i>Ardea ibis</i>	Cattle egret	Migratory	Migratory
<b>Mammals</b>			
<i>Dasyurus geoffroii</i>	Chuditch, western quoll	Threatened	Vulnerable

## 4.9 Dieback

Dieback refers to the introduced plant disease caused by *Phytophthora cinnamomi*. Although there are many species of *Phytophthora*, this is the species that causes the most severe and widespread damage to native plants in Western Australia. Up to 25% of native Western Australian plants are susceptible to *Phytophthora cinnamomi* (Komerek, Shearer, Smith and Fairman 1994).

Dieback is mapped by the presence of dead and dying indicator species that are known to be susceptible to the disease. The three mining tenement areas are considered Un-interpretible. As native vegetation has not been present since the 1920s, there is a lack of indicator species to map the pathogen. Therefore the site will be managed using the precautionary principle in regard to dieback.

## 4.10 Aboriginal Heritage

Hanson has been working with the South West Aboriginal Land and Sea Council (SWALSC) (representing the Whadjuk and Yued people) regarding the three sand quarries in the Gnangara Pine Plantation area. Hanson has been in formal discussions with SWALSC since 2008 regarding the sand quarries (Appendix 4); the formalising of these discussions is at different points for each tenement. However, the following summaries the status of the engagement with SWALSC:

- Native Title Agreement and associated State Deed (e.g. McKinley and Mulga Roads)
- Heritage survey completed (e.g. Smokebush)
- Consultation regarding the Temega and Smokebush mining tenements in the Gnangara Pine Plantations noting, the individual sand quarries will step through the assessment process as required, under the DMP's approval process for Mining Proposals.

A search of the Aboriginal Heritage Enquiry System returned one “other heritage place”; “Smokebush Waterhole”, which is located within the western portion of the site (Figure 10a).

The outcome from this engagement with the Traditional Owners was that permission was granted to drill over 900 holes throughout this tenement.

No known Indigenous sites within a 10 km radius of the site were identified at either the Tamega Road (E70/3275) or Mulga Road (M70/1306) tenements (Appendix 4a).



## 4.11 Land Use and Planning

The three mining tenements are located within the Gngangara-Moore River State Forest, which is vested in the Conservation Commission and managed by DPaW. The majority of the Gngangara-Moore River State Forest is a pine plantation that is harvested under agreement by the FPC. Some of the pines within the tenements have been, or will be, cleared as part of the GSS. Only areas of pine plantation / areas previously under pine plantation are the focus of the “proposal area” boundaries.

The draft GSS (Department of Water 2009), released for public comment in July 2009, considers the impact of declining groundwater resources in the Gngangara Mound and the associated implications for land use.

The GSS acknowledges modifications to current land uses as one form of response to groundwater decline and includes a land use concept for the East Wanneroo area. The study’s Land Use Plan indicates the mining tenement areas has been designated for:

post-pine banksia rehabilitation and post-pine parkland

(Department of Water 2009)

### 4.11.1 Separation Distances

The three mining tenement are located within the Gngangara pine plantation. There is significant distance (300 m) between existing dwellings and the proposed sand quarry, which will have screening bunds in place. Hanson will use specific management measures to ensure sufficient buffer distances are maintained, and the quarry operations do not adversely impact residents.

The separation distances between the proposed quarry operations and are illustrated in Figures 11a-11c. The minimum separation distance to sensitive dwellings is 300 m, which is at the Mulga Road M70/1306 sand quarry. There is a 460 m buffer to sensitive dwellings at the Smokebush E70/3279 sand quarry. There are no sensitive premises within 500 m from the Tamega Road E70/3275 sand quarry.

## 4.12 Data Gap Analysis

Hanson has performed a closure data gap analysis to determine additional data required to enable full planning for decommissioning and closure as outlined in Table 7.

**Table 7: Closure Data Gap Analysis**

<b>Area of Closure</b>	<b>Data Gaps</b>	<b>Proposed Actions to Obtain Data</b>
Town Planning Scheme/ Metropolitan Regional Scheme	The site is currently zoned under the MRS “Gnangara-Moore River State Forest”.	No further action required. Sand mining is a permitted use under the MRS “Gnangara-Moore River State Forest” zoning.
Infrastructure Decommissioning (or hand over to another party)	Full completion of planning for infrastructure decommissioning (or handover) has not been completed for infrastructure such as: <ul style="list-style-type: none"> <li>▪ plant</li> <li>▪ buildings</li> <li>▪ road infrastructure.</li> </ul>	Decommissioning to be implemented at the completion of each excavation stage.
Closure Implementation Schedule	DPaW and FPC to inform Hanson if pine plantation to be reinstated after sand removal.	A schedule of closure implementation is included in Section 10.5 of this Closure Plan.
Monitoring and Maintenance Schedule	DPaW and FPC to inform Hanson if pine plantation to be reinstated after sand removal.	A framework for monitoring and maintenance after closure is included in Section 11.
Closure Monitoring and Maintenance Program	A framework for monitoring and maintenance after closure is included in Section 11.	A conceptual Closure Monitoring and Maintenance Program will be developed within five years including: <ul style="list-style-type: none"> <li>▪ a schedule of required activities</li> <li>▪ monitoring methodology</li> <li>▪ quality control</li> <li>▪ a remedial strategy should monitoring indicate inadequate performance of closure activities.</li> </ul>

## 5.0 STAKEHOLDER CONSULTATION

### 5.1 Stakeholder Identification

Key stakeholders relevant to the approval and closure planning of the Smokebush E70/3279, Tamega Road E70/3275 and Mulga Road M70/1306 sand quarries have been identified as follows:

- Department of Mines and Petroleum
- Department of Parks and Wildlife
- Department of Water
- Office of the Environmental Protection Authority (OEPA)
- City of Wanneroo
- Water Corporation.

### 5.2 Record of Stakeholder Consultation to Date

To date, Hanson and RPS have made a number of contacts within the community and plan to build on this platform of communication through ongoing consultation. Hanson has also undertaken extensive consultation across the past four years in particular with regulatory agencies and the Traditional Owners.

In consultation with the FPC (Russell Warnes and Michael Lobb pers. comm. late 2011) it was discussed that Hanson would manage and plan their operations to align with FPC forestry management and planning; Hanson will extract from recently harvested pine plantation areas. When extraction activities are completed, the FPC will replant pine though this is unlikely with current information available from the GSS and draft Green Growth Plan. It has now been confirmed by DPaW that the pine within the mining tenement will be harvested and will not be replaced by the FPC for the majority of the tenement area.

The details of stakeholder consultation undertaken to date is outlined in Table 8.

**Table 8: Consultation Register**

Stakeholder/ Organisation	Contact	Comment/Outcome
DPaW	Kieran McNamara Director General	Various letter correspondence (2010–2012) regarding approvals for access to site for drilling program
	Daniel Coffey Owen Donovan Grant Lamb Michael Roberts Jacqui McGuire Nicholas Woolfrey	Written correspondence (2010–2015) regarding gaining approval from Minister for Environment (exploratory drilling program) and future sand extraction operations and subsequent rehabilitation works in the Gnangara pine plantations as part of the mine closure.
		Correspondence outlining the commitment and support of the development and progression of the mining application to the EPA / Minister for Environment (2010–2015).
DER	Sarah McEnvoy Sarah Chapman	Hanson coordinated a site visit with DER and Appeals Convenors office as part of the EPA's assessment of the environmental factors and as part of the Perth Peel Strategic Review (September 2014).
DMP	Mike Freeman Warren Ormsby Colin Strickland Ivor Roberts Demelza Dravniers Neil Spencer Eugene Bowhuis Tyler Sujdovic	Numerous meetings (2010 – 2015) to discuss the mining extraction proposal and closure approach and requirement for the sand resource in to meet the looming shortage (e.g. building sand) as a result of market demand.
Minister for Mines	Ben Allen Collin Edwardes	Hanson provided an overview of Gnangara Sand Quarry project and assessment process and status to the Minister for Mines and Petroleum
DSD	Brian Wood (General Manager of Strategic Projects) Peter Baldwin (Director of Strategic Approvals)	Meeting and then a site visit 15 September 2014.
DoP	Geoff Findlay	Discussions regarding proposal and the site's importance to the long-term sand supply of Perth in late 2010 and again in 2014.
DoW	James Mackintosh Carlie Slodecki	Discussions and correspondence (2010–2015) regarding exploration works, and future mining groundwater / separation levels for future mining operations in the Gnangara pine plantations. Met with DoW to finalise the Water Management Plan requirements (October 2015).
EPA	Dr. Paul Vogel Anthony Sutton Darren Foster Kaylene Carter Mark Jefferies	Assessment of the proposal, referral approach and likely outcomes discussed at meetings from 2011 to 2016.
Commonwealth Department of the Environment	Con Voutas	Phone meeting Hanson and the Commonwealth Department of the Environment to outline/provide background to the project and the state assessment process.
FPC	Michael Lobb Russell Warnes John Tredinnick	Various meeting from 2011 to 2015. Excavation activities will be planned and managed to coincide with forestry management and planning.
Yued & Whadjuk People (SWLASC)	Carolyn Fennelle	Discussions on the Gnangara Pine Plantation project (2008-2010). Discussion and agreement on the Negotiation Protocol for Native Title Agreement 2012–2013 and in 2014 a signed NTA for some of the tenements.

The Smokebush E70/3279, Tamega Road E70/3275, Mulga Road M70/1306 project was referred under section 38 of the *Environmental Protection Act 1986* to the EPA as part of the Environmental Assessment Sand Quarries, Gnangara (RPS 2012).

### **5.3 Future Consultation**

Hanson commits to future liaison with DPaW on an annual basis and making the annual audit reports available to DPaW.

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## 6.0 FINAL LAND USE AND CLOSURE OBJECTIVES

### 6.1 Post-mining Land Use

The post-mining land use of the area will be directed through the outcomes of the government's Green Growth Plan, which is currently in draft form. The draft Green Growth Plan indicates that the area is to remain as State Forest and Parks and Wildlife indicate this is unlikely to change. Current key objectives to in the draft Green Growth Plan relevant to Hanson's rehabilitation include groundwater protection and conservation of black cockatoo.

After the completion of sand extraction, the land will be rehabilitated utilising low water use native vegetation comprised of species native to the Swan Coastal Plain 2 (SWA2) IBRA subregion, that facilitates ease of ongoing management by Parks and Wildlife and provides benefits to conservation of Carnaby's Black-Cockatoo. Hanson will utilise its best practice restoration knowledge gained from Banksia woodland restoration research in partnership with Kings Park Botanical Garden (Kings Park). Alternatively, the excavation areas within the "proposal area" boundaries will be left in a state otherwise directed by the draft Green Growth Plan.

The proposed sand extraction cycle for the Smokebush E70/3279, Tamega Road E70/3275 and Mulga Road M70/1306 sand quarries is illustrated in Figure 12.

### 6.2 Banksia Woodland Restoration Overview

Hanson has focused on restoration standards considered to be the highest in Australia. This has been achieved by strategic long-term investment in research and development into species and ecosystem restoration by utilising leading science from Kings Park and the University of Western Australia, and innovating engineering solutions in the field. The tangible benefits (present and future) from Hanson's research investment and partnership with Kings Park include:

- approximately 300 ha of Banksia Woodland successfully restored (post-sand extraction operations) across the Swan Coastal Plain
- Hanson has been involved with the development of a Banksia Woodland restoration guideline that details the techniques and requirements for successful Banksia Woodland regeneration. This is currently being published by the University of Western Australia after five years of work
- Banksia Woodland restoration success rates have been benchmarked every hectare of topsoil that is preserved and utilised correctly will result in additional Banksia Woodland habitat for black cockatoos

- restoration completion criteria (success targets) can be set with scientific certainty and confidence allowing proper auditing and monitoring
- results are measurable, resulting in certain and real outcomes for the black cockatoo habitat
- ongoing research that will facilitate improved outcomes for restoration works.

### 6.3 Closure Objectives

Closure objectives for the Smokebush E70/3279, Tamega Road E70/3275 and Mulga Road M70/1306 “proposal area” boundaries (disturbance footprint) and the broader tenement areas have been developed and are documented in Table 9.

**Table 9: Closure Objective for the Smokebush E70/3279, Tamega Road E70/3275 and Mulga Road M70/1306 Tenements**

Area	Objective
Compliance	<ul style="list-style-type: none"> <li>▪ All legally binding conditions and commitments relevant to rehabilitation and closure will be met.</li> </ul>
Landforms	<ul style="list-style-type: none"> <li>▪ The sand quarry stages will be backfilled in areas, there will not be large final voids. Any batters will be one vertical to three horizontal, which will enable the landform to be integrated with the surrounding landscape.</li> <li>▪ Establish a safe and stable land surface that supports vegetation growth.</li> <li>▪ Pit perimeters will be altered to blend in with the topography of the surrounding environment.</li> </ul>
Revegetation	<ul style="list-style-type: none"> <li>▪ The site will be rehabilitated according to best practice, utilising low water use native vegetation comprised of species native to the Swan Coastal Plain 2 (SWA2) IBRA subregion and provides benefits to the conservation of Carnaby’s Black-Cockatoo.</li> <li>▪ The established native vegetation will be sustainable and can be integrated into the past-mining management practices of Parks and Wildlife without the input of extraordinary resources.</li> <li>▪ Alternatively, to leave the excavation areas within the “proposal area” boundaries in a state as directed by the draft Green Growth Plan.</li> </ul>
Water	<ul style="list-style-type: none"> <li>▪ Surface and groundwater hydrological patterns/flows not significantly affected.</li> <li>▪ Any surface water run-off shall have quality compatible with maintenance of local land and water values.</li> <li>▪ There shall be no longer reduction in the availability of water to meet local environmental values.</li> <li>▪ Minimise impacts on downstream vegetation.</li> </ul>
Infrastructure and Waste	<ul style="list-style-type: none"> <li>▪ During decommissioning and through closure, wastes will be managed in accordance with legal requirements and waste minimisation principles.</li> <li>▪ No infrastructure left on site unless agreed to by regulators and post-mining land managers/owners.</li> </ul>



## 6.4 Conceptual Closure Landform Design

Hanson commits to decommissioning its entire infrastructure within the three “proposal area” boundaries. The proposed post-mining landform design incorporates backfilling and re-profiling in areas to achieve a one vertical to three horizontal, which provides gentle “valleys”. Hanson as an interim step (as agreed with DoW) will excavate to a depth of 3 m from the historical maximum groundwater level (i.e. the highest ever recorded groundwater level). Once the DoW has agreed on the methodology for determining the “likely future maximum winter water table” (LFMWWT), then the Water Management Plan can be amended and finalised to be three metres above this modelled level. The batters will be contoured to blend in with the surrounding landscape.

### 6.4.1 Landform Reconstruction

Once quarrying of each stage is complete, the excavation area within the “proposal area” boundaries will be backfilled in areas with oversize screened material and reshaped / re-profiled. Overburden, if suitable, will be spread evenly over backfilled material and other areas where waste has been picked up. Surfaces will be ripped or ploughed along the contour to minimise erosion from water run-off and relieve compaction.

As part of the final landform reconstruction, surface drainage lines will be established to control surface run-off and minimise potential erosion.

### 6.4.2 Topsoil Replacement

Topsoil or overburden will be stockpiled for use in rehabilitation. It is not considered necessary to restore the soil profile as it is highly contaminated with pine seeds, needles and weeds. The project area has been used as a pine plantation since the 1920s; therefore, no native seed bank is anticipated in the topsoil, though if deemed suitable this resource will be utilised.

Vegetation and topsoil from weed-infested areas will be stripped and stockpiled separately from non-weed infested areas.

Hanson will integrate the outcomes of research and development discussed below into its topsoil management practices. Noting that, Hanson has previous experience in the establishment of native vegetation cover within overburden, without the provision of a separate topsoil layer and considers this to be the most effective approach for the Smokebush E70/3279, Tamega Road E70/3275 and Mulga Road M70/1306 area post-sand extraction, given the objective is to establish native vegetation cover in order to limit erosion and weeds.

If the end land use is to change at some time in the future the change would need to be agreed by all stakeholders, e.g. Hanson, DPaW and FPC.

### 6.4.3 Revegetation

Revegetation of pine plantations is currently being subject to research program by Hanson and Kings Park. This research is in its infancy; however, significant steps in rehabilitation have been made over the past six years. The closure object is to return native vegetation to post-extraction sites utilising the available seed resources and rehabilitation techniques developed to date.

If pines are not replanted Hanson proposes the following measures based on the pine plantation research currently known and outcomes of the research program.

Broadcast seeding will likely be required with some tubestock and seedling planting out to encourage native vegetation cover establishment if pine trees are not replanted. If available, native seed(s) will be collected from within the mining tenement and used as part of the revegetation program. However, it is not anticipated the seed supply will be a significant revegetation source. To supplement this, seed will be sourced from seed farm(s) or other external sources.

The broadcast native species list will determined by Hanson and the Botanic Gardens and Parks Authority (based upon their Gnangara mound restoration knowledge. To achieve this Hanson will:

1. Leverage from over 20 years Banksia woodland restoration experience and research.
2. Continue to measure and monitor rehabilitation works that have been undertaken in the Gnangara pine plantation (including Gaskell Avenue) since 2009.
3. Utilise the pine plantation rehabilitation research to develop best practice at the time of rehabilitation (depending on the rehabilitation resources (e.g. seed bank) available).
4. Continue the research partnership with Kings Park (or a suitable alternative) and utilise these leanings for rehabilitation for future pine plantation rehabilitation programs.

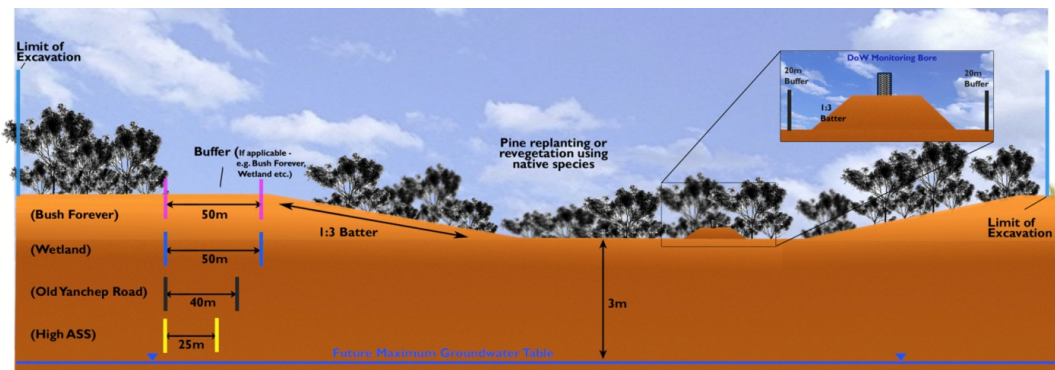
Alternatively, to leave the excavation areas within the “proposal area” boundaries in a state suitable for development as proposed the draft Green Growth Plan as agreed by the stakeholders.

#### 6.4.4 Decommissioning

At the completion of each excavation stages within the “proposal area” boundaries, Hanson will undertake the following actions to decommission the site:

- All buildings and infrastructure will be removed.
- Any hard stand surfaces will be removed and used to backfill the pit.
- Overburden and scalps (oversize screened material) will be used as backfill.
- The area will have the slopes and soils contoured to allow for regeneration of native vegetation that can be returned via seed and tubestock at rates commercially acceptable to Hanson and Kings Park to complete the works, or alternatively pine plantation or an alternative use if agreed by all stakeholders in the future.
- Broadcast seeding and tubestock planting will likely be used, or native vegetation topsoil if available. Alternatively the excavation areas within the “proposal area” boundaries will be left in a state suitable for development.

A summary of the mine closure plan and associated sand extraction buffers is provided in Figure A.



**Figure A: Mine Closure Plan**

### 6.5 Potential Legacy Issues That May Restrict Post-mining Land Use

There are no major legacy issues known that will restrict the post-mining land use at the Smokebush E70/3279, Tamega Road E70/3275 and Mulga Road M70/1306 extraction area. Evaluation of potential closure issues and the reason they are not considered legacy issues is outlined in Table 10.

**Table 10: Analysis of Potential Legacy Issues**

Potential Legacy	Analysis
Final Voids	Section 6.3 above outlines the final landform objectives. There will not be large final voids. However, there will be small depressions; at the completion of the stage any batters will be one vertical to three horizontal, which will be integrated with the surrounding landscape.
Oversize and Overburden	Given oversize and overburden will be used to backfill the voids, these will not present any legacy closure issues.
Acid Forming Material	The DER compiled ASS risk maps for several regions of Western Australia, which provide broad-scale indication of the areas where ASS is most likely to exist. ASS categories surrounding the project area are displayed in Figure 6a–6c. The majority of tenement is within a moderate to low risk or no risk area. As the proposed activities will not disturb the ground below the water table it is unlikely that any existing ASS will be exposed.
Unsuccessful Revegetation	Revegetation processes as outlined in Section 6.4.3 will ensure the success of rehabilitation so that a suitable vegetative cover to limit weeds and erosion is established. If the end land use changes to require native vegetation establishment, this objective will be revisited by relevant stakeholders.
Contaminated Sites	Minimal quantities of hydrocarbons and chemicals will be used on site. Hydrocarbon management measures will be implemented to prevent contamination.

## 7.0 IDENTIFICATION AND MANAGEMENT OF CLOSURE ISSUES

Key closure issues identified to date and management programs/plans in place or proposed are outlined below in Table 11.

**Table 11: Closure Issues and Management Plans**

Closure Issue	Management Measure
Ensuring final voids do not become a closure legacy	<p>This Closure Plan:</p> <ul style="list-style-type: none"> <li>▪ There will not be large final voids. Any batters will be one vertical to three horizontal, which will enable the landform to be integrated with the surrounding landscape.</li> <li>▪ Establish a safe and stable land surface that supports vegetation growth.</li> <li>▪ Pit perimeters will be altered to blend in with the topography of the surrounding environment.</li> </ul>
Ensuring oversize and overburden material does not become a legacy	<p>This Closure Plan:</p> <ul style="list-style-type: none"> <li>▪ Given oversize and overburden will be used to backfill the voids it will not present a closure issue.</li> </ul>
Successful revegetation	<p>This Closure Plan:</p> <ul style="list-style-type: none"> <li>▪ The site will be rehabilitated with broadcast seeding and with some tubestock and seedling planting out to encourage native vegetation cover establishment if pine trees are not replanted (which is not likely).</li> <li>▪ Alternatively, to leave the excavation areas within the “proposal area” boundaries in a state suitable for development if agreed by the stakeholders.</li> </ul>
Prevention of contaminated sites	<p>This Closure Plan:</p> <ul style="list-style-type: none"> <li>▪ Minimal quantities of hydrocarbons and chemicals will be used or stored on site.</li> <li>▪ Hydrocarbon management measures will be implemented to prevent contamination.</li> <li>▪ Monitoring will be implemented to monitor groundwater quality on an ongoing basis.</li> </ul>
Acid Forming Material	<p>This Closure Plan:</p> <ul style="list-style-type: none"> <li>▪ As the proposed activities will not disturb the groundwater table it is unlikely that any existing ASS will be exposed.</li> </ul>
Disturbance of Groundwater Regime	<p>This Closure Plan:</p> <ul style="list-style-type: none"> <li>▪ Mining will not extend below the groundwater table.</li> <li>▪ Monitoring will be implemented to confirm the depth to the groundwater table on an ongoing basis.</li> </ul>
Ensuring the site does not present a risk to public safety after closure	<p>This Closure Plan:</p> <ul style="list-style-type: none"> <li>▪ Public Access and Safety will be considered as part of detailed closure planning.</li> </ul>

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## 8.0 CLOSURE / COMPLETION CRITERIA

Indicative Completion Criteria have been developed for the Smokebush E70/3279, Tamega Road E70/3275 and Mulga Road M70/1306 tenements (in particularly for the three proposed “proposal area” boundaries) as outlined in Table 12. These completion criteria will be refined and agreed with by Parks and Wildlife over the life of the quarry to incorporate the relevant findings of the research program and through subsequent revisions of this Closure Plan. Revised completion criteria will be specific, measurable, achievable, relevant and time-bound, and reflect the guiding closure principles and closure objectives. Hanson accepts this approach.

**Table 12: Indicative Completion Criteria**

Area	Objective	Indicative Completion Criteria
Compliance	All legally binding conditions and commitments relevant to rehabilitation and closure will be met	Closure audit confirms full compliance with all legally binding conditions and commitments relevant to rehabilitation and closure.
Landforms	<ul style="list-style-type: none"> <li>▪ Within the constraints imposed by the physical nature of the materials, the final landform will be designed to be similar to the existing regional landforms and be suitable for the chosen end land use.</li> <li>▪ Establish a safe and stable land surface that supports vegetation growth.</li> <li>▪ Pit perimeters will be altered to blend in with the topography of the surrounding environment.</li> </ul>	Concept level engineering designs for final landforms that are compatible with the surrounding landscape. There will not be large final voids. Any batters will be one vertical to three horizontal which will enable the landform to be integrated with the surrounding landscape.
Revegetation	<p>Revegetate the quarry landforms to establish vegetation appropriate for the area and final land use.</p> <p>Note: If the end land use changes to require native vegetation establishment this objective will be revisited by relevant stakeholders.</p>	<ul style="list-style-type: none"> <li>▪ The “proposal area” boundaries will be rehabilitated with broadcast seeding and with some tubestock and seedling planting out to encourage native vegetation cover establishment if pine trees are not replanted (which is not likely).</li> <li>▪ Alternatively, to leave the “proposal area” boundaries in a state suitable for development if agreed by the stakeholders.</li> </ul>

Area	Objective	Indicative Completion Criteria
Water	<ul style="list-style-type: none"> <li>▪ Surface and groundwater hydrological patterns/flows not significantly affected.</li> <li>▪ Any surface water run-off shall have quality compatible with maintenance of local land and water values.</li> <li>▪ There shall be no long term reduction in the availability of water to meet local environmental values.</li> <li>▪ Minimise impacts on downstream vegetation.</li> </ul>	<ul style="list-style-type: none"> <li>▪ Concept level engineering designs for final landforms that are consistent with site hydrological flows/patterns.</li> <li>▪ Contaminant sources and erosion potential eliminated at final closure to avoid potential for surface water quality impacts.</li> </ul>
Infrastructure and Waste	<ul style="list-style-type: none"> <li>▪ During decommissioning and through closure, wastes will be managed in accordance with legal requirements and waste minimisation principles.</li> <li>▪ No infrastructure left on site unless agreed by the regulators and post-mining land managers/owners.</li> </ul>	<ul style="list-style-type: none"> <li>▪ All wastes disposed of in accordance with legal requirements – waste disposal receipts available as evidence.</li> <li>▪ All infrastructure removed at final closure.</li> </ul>



## 9.0 FINANCIAL PROVISION FOR CLOSURE

The objective of a financial provision is to ensure that at the end of Smokebush E70/3279, Tamega Road E70/3275 and Mulga Road M70/1306 development areas operation life, when no further revenue will be generated, but closure expenditure is still to be incurred, there is adequate provision to cover the anticipated expenditure.

### 9.1 Closure Costing Methodology

Hanson has in place closure provisioning processes in which the annual costs of rehabilitation activities, decommissioning activities and closure programs are calculated out to final closure. A “closure provision” is then created to address site final closure costs. Key aspects of the closure costing methodology are outlined in the subsections below.

### 9.2 Schedule of Rates

Hanson utilises a schedule of rates for various required activities to estimate closure costs. The schedule of rates is kept up to date on the basis of current undiscounted costs, current legal requirements and current technology.

### 9.3 Costs Included

Closure costs are calculated to reflect, as far as possible, the real cost of closure and include:

- decommissioning costs (which occur at or near the end of operation life) such as
  - demolition and removal of unwanted facilities and services on the site
  - remediation: the clean-up of contaminated areas of soil or water to an agreed quality
  - maintenance and monitoring: the management of the site through to relinquishment
- rehabilitation costs, which include the cost of rehabilitating disturbed areas that (for an operational or environmental reason), were not progressively rehabilitated during the life of the operation
- project management costs, which include the human resourcing, facilities and administration related support required to implement closure activities
- contingency costs, which include provisions for unplanned events such as extreme weather or other external factors.

Examples of items included in each category above are further detailed in Table 13.

**Table 13: Examples of Items Included in Provision Accounts**

<b>Closure Category</b>	<b>Example Items Included</b>
Decommissioning	<ul style="list-style-type: none"> <li>▪ Decommissioning and removal of infrastructure, plant and equipment</li> <li>▪ Waste disposal</li> <li>▪ Remediation of contamination                             <ul style="list-style-type: none"> <li>– survey program</li> <li>– remediation program</li> <li>– maintenance and monitoring.</li> </ul> </li> </ul>
Rehabilitation	<ul style="list-style-type: none"> <li>▪ Earthmoving and landscape forming</li> <li>▪ Revegetation</li> <li>▪ Post-closure management of surface water drainage and erosion</li> <li>▪ Maintenance and monitoring programs.</li> </ul>
Project Management	<ul style="list-style-type: none"> <li>▪ Ongoing stakeholder consultation</li> <li>▪ Administration support</li> <li>▪ Office and accommodation facilities</li> <li>▪ Specialists and consultant fees</li> <li>▪ Legal requirements.</li> </ul>
Contingencies	<ul style="list-style-type: none"> <li>▪ Provision for potential delays, extreme events, unsuccessful rehabilitation or other external factors relevant to closure.</li> </ul>

## 9.4 Accounting Practices

The accounting practice of estimating the material end of mine life rehabilitation and decommissioning costs and then building up to that cost over the life of the operation by making periodic provision adjustments is utilised.

The main objective of this approach is to ensure that the full liability is accrued at the end of operation life and closure costs are allocated equitably to the periods of operation.

## 9.5 Bonds / Mining Rehabilitation Fund (MRF)

Statutory MRF provisions to the state government (as part of project approvals to cover costs associated with possible default on rehabilitation commitments or with site closure requirements) are not offset against the provisions for rehabilitation and decommissioning, but are considered external to the provisioning process.

## **9.6 Inflation and Cost Increases**

The provisioning process takes into account inflation costs when undertaking annual reviews of provisions. The schedule rates is also reviewed annually, to take into account inflation and other cost increases.

## **9.7 Unexpected Closure**

The provision includes costs set aside for unexpected closure and/or sudden placement of the site into care and maintenance.

## **9.8 Annual Review**

The Closure Provision is reviewed on an annual basis. This includes review of costing assumptions and any changes in circumstances that have occurred during the year. A reassessment of provision accounts is completed in line with the company reporting schedule. This allows any changes to be factored into budgets and provisions every year. Changes in estimates of closure costs relating to operations are dealt with prospectively over the remaining operation life.

## **9.9 Closure Costing Documentation**

Hanson maintains thorough documentation of its closure provisions and assumptions behind cost estimates in company accounting databases and reports.

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## 10.0 CLOSURE IMPLEMENTATION STRATEGIES

In summary, closure implementation of the Smokebush E70/3279, Tamega Road E70/3275 and Mulga Road M70/1306 quarries will be managed utilising the following strategies:

- detailed geospatial planning of the site into domains / features requiring closure and rehabilitation
- progressive rehabilitation where possible to achieve rehabilitation of areas no longer required for operations prior to closure
- a plan for management of unexpected closure
- full planning and scheduling of decommissioning activities
- full planning and scheduling of closure monitoring and maintenance.

Each of these strategies is detailed further below.

### 10.1 Detailed Geospatial Planning

Figures 3a–3c provides the “proposal area” boundaries for the Smokebush E70/3279, Tamega Road E70/3275 and Mulga Road M70/1306 tenement areas, showing each feature of the site that will require buffers or closure and rehabilitation. This site layout plan will be maintained over the life of the operation using modern ground survey techniques and Geographic Information Systems (GIS) technology to ensure it is accurate and up to date.

### 10.2 Progressive Rehabilitation

The aim of progressive rehabilitation is to ensure that as much as possible of the operation is already rehabilitated at the end of quarry life. Rehabilitation will be undertaken at the completion of each mining stage.

Broadcast seeding will likely be required with some tubestock and seedling planting out to encourage native vegetation cover establishment if pine trees are not replanted. Alternatively, to leave the “proposal area” boundaries (disturbance footprint) in a state suitable for development as proposed the draft Green Growth Plan if agreed by the stakeholders.

The broadcast native species list will depend on the future land use planned by the FPC and DPaW will be detailed by Hanson and the Botanic Gardens and Parks Authority.

If ongoing planning for the area amends the land use, Hanson can then amend its rehabilitation approach after consultation and agreement with relevant stakeholders.

### 10.3 Research and Trials

If Hanson's revegetation knowledge gap requires the undertaking of trials and/or research, Hanson will amend its rehabilitation approach accordingly.

### 10.4 Management of Unexpected Closure

As described in Section 9.0 the closure provision account includes costs set aside for unexpected closure and/or sudden placement of the site into care and maintenance. Should unexpected closure occur, this Closure Plan will be refined with further detail, and then implemented to rehabilitate areas no longer required for future operations. Parts of the operation likely to be required for future mining or other uses will be put into "care and maintenance" until future plans are confirmed. Care and maintenance would involve ensuring staff and equipment were available to ensure the ongoing management of the site, to minimise environmental impacts resulting from infrastructure and facilities that remain on site in accordance with regulatory requirements.

### 10.5 Closure Implementation Schedule

After the end of mining, closure activities will be implemented in the key phases outlined in Table 14.

Time frames have been estimated from the closure date onwards based on current best available information. These time frames may be modified in subsequent reviews of this Closure Plan. Further details on specific tasks required are given in the subsections below. A more detailed closure implementation schedule will be developed closer to the end of quarry life.

**Table 14: Summary of Closure Implementation Activities and Time Frames**

Phase	Task / Activity	Time Frame
1	Demobilisation of mobile plant and equipment and removal from site.	First 6 months
2	Decommissioning and deconstruction of non-mobile equipment and infrastructure and removal from site.	Years 1 and 2
3	Rehabilitation and revegetation of areas of disturbance that were not progressively rehabilitated during the mine life.	Years 1 and 2
4	Maintenance and monitoring of rehabilitated areas to ensure closure objectives and completion criteria have been met.	Years 1–5
5	If required, remedial works for areas that may not perform as expected.	Years 3–5
6	Confirmation of completion criteria met and relinquishment of site or specific areas.	Years 5–6

### 10.5.1 Decommissioning Activity Schedule

The broad activities for decommissioning of infrastructure and support facilities are described below in Table 15.

The decommissioning process will typically involve the removal of infrastructure for off-site reuse, recycling or where possible resale. Once the infrastructure is removed, the land surface will be re-profiled where necessary to integrate with the surrounding topography, prior to revegetation.

The activities outlined below would be undertaken as part of Phase 2 listed in Table 14 above (in years one and two of closure).

**Table 15: Decommissioning Activities**

Type of Infrastructure / Support Facility	Items	Decommissioning Works
Plant	<ul style="list-style-type: none"> <li>▪ Screening plant</li> </ul>	<ul style="list-style-type: none"> <li>▪ Removal off site.</li> <li>▪ Removal (i.e. breaking up) of concrete footings and slabs and placement within areas of general backfill or in-situ burial.</li> </ul>
Access Roads	<ul style="list-style-type: none"> <li>▪ Cleared road areas</li> <li>▪ Signage</li> <li>▪ Drainage</li> <li>▪ Culverts</li> </ul>	<ul style="list-style-type: none"> <li>▪ Roads that are no longer required on site, and have not been rehabilitated as part of the progressive rehabilitation program will be re-profiled to blend in with surrounding topography.</li> <li>▪ Where necessary, road surfaces will be re-profiled to allow free drainage and minimise interference of surface flows.</li> </ul>
Water and Power Infrastructure	<ul style="list-style-type: none"> <li>▪ Power lines</li> <li>▪ Bores</li> <li>▪ Pipelines</li> </ul>	<ul style="list-style-type: none"> <li>▪ Power lines, bores and pipelines not required for ongoing use will be decommissioned.</li> <li>▪ Collapse or filling of boreholes in accordance with relevant bore abandonment procedures.</li> <li>▪ Concrete footings and slabs associated with pumping equipment will be broken and placed within areas of general backfill or buried in situ.</li> </ul>
Power Generating Equipment	<ul style="list-style-type: none"> <li>▪ Power generators</li> </ul>	<ul style="list-style-type: none"> <li>▪ Breaking up of concrete footings and slabs for placement within areas of general backfill or burial in situ.</li> <li>▪ Following the removal of power generating and supply infrastructure the land surface will be re-profiled to blend in with surrounding topography.</li> </ul>
Buildings	<ul style="list-style-type: none"> <li>▪ Office and weighbridge</li> <li>▪ Shed</li> <li>▪ Clean down area</li> </ul>	<ul style="list-style-type: none"> <li>▪ Removal of buildings and equipment.</li> <li>▪ Removal (i.e. break up) of concrete footings and slabs and placement within areas of general backfill or in-situ burial.</li> </ul>

**10.5.2 Rehabilitation and Revegetation Activity Schedule**

Standard rehabilitation and revegetation procedures will be implemented (where possible progressively) throughout operations. Areas that have not been progressively rehabilitated will be rehabilitated after closure using appropriate rehabilitation and revegetation techniques. The revegetation program will aim to re-establish native vegetation that is appropriate to the agreed final land use. The broad strategies for rehabilitation and revegetation are outlined in Table 16.

The activities outlined below would be undertaken as part of Phase 3 listed in Table 14 above (in years one to two of closure).

**Table 16: Rehabilitation and Revegetation Activities**

Type of Activity or Area	Works Required
Quarry Depression	<ul style="list-style-type: none"> <li>▪ Fill with oversize and overburden material.</li> <li>▪ Contour to blend with surrounding landform.</li> <li>▪ Create a surface water “diversion” upstream, to prevent unnecessary collection of stormwater from the surrounding catchment.</li> <li>▪ Revegetation (refer below).</li> </ul>
General Revegetation Methods	<ul style="list-style-type: none"> <li>▪ Re-profiling of land surface to blend with surrounding landforms.</li> <li>▪ Broadcast seeding with suitable native species to meet agreed closure objectives.</li> <li>▪ Infill planting with seedlings if necessary.</li> </ul>



## 11.0 CLOSURE MONITORING AND MAINTENANCE

As outlined above in Table 14, closure monitoring and maintenance would be an ongoing process during years one to six of closure. The monitoring work will ensure the completion criteria can be measured to determine success.

### 11.1 Monitoring and Maintenance Framework

#### 11.1.1 If Revegetation Is To Be Undertaken Monitoring Program

Hanson incorporates a three-stage approach to revegetation monitoring:

- initial establishment assessment in the first year
- ongoing development monitoring in years one to four (with an assessment in years one and three)
- completion monitoring in years five to six.

The purpose of the Hanson's revegetation monitoring is to assess development of the vegetation that has been planted against agreed completion criteria. These detailed completion criteria will be developed in subsequent revision of this plan. It includes quantitative, visual and photographic monitoring of:

- plant establishment (e.g. species diversity, density and vegetation condition)
- weeds
- erosion.

#### 11.1.2 Groundwater Monitoring

A groundwater monitoring program will be implemented to monitor groundwater elevation and groundwater quality in the areas adjacent to "proposal area" boundaries. The monitoring program will establish before quarry operations commence to obtain baseline data and it will continue for the quarry life until five years after closure. The monitoring program will be implemented as soon as possible so that relevant baseline data can be collected. The proposed monitoring program is outlined in Table 17.

In conjunction with in conjunction with groundwater elevation monitoring data, it is proposed to monitor baseline groundwater quality.

**Table 17: Proposed Groundwater Monitoring Program**

Location	Proposed Analytes	Potential Source	Frequency
Three bores adjacent to the “proposal area” boundaries	Total Petroleum Hydrocarbons	Hydrocarbon spill / leak	Biannual (winter high and summer low)
Three bores adjacent to the “proposal area” boundaries	pH, Total Iron, Total Aluminium	Acidic Groundwater from Regional ASS issues	
Three bores adjacent to the “proposal area” boundaries	Total N, Total P	On-site toilets	
All bores	Water Levels	Regional	Monthly

## 11.2 Closure Monitoring Methodology

A Closure Monitoring Program will be developed prior to the end of mine life to provide a framework including:

- a schedule of monitoring required including
  - type
  - frequency
  - location
  
- procedures for all monitoring outlining a step by step methodology for
  - sampling / field data collection
  - sample analysis
  - data recording
  - data analysis
  - reporting
  
- procedures for quality control including
  - sampling / field work quality control
  - laboratory quality control (if relevant)
  - data analysis quality control
  - reporting quality control
  
- a remedial strategy should monitoring indicate inadequate performance of closure activities.

## 12.0 CLOSURE INFORMATION AND DATA MANAGEMENT

This Closure Plan will be made publicly available.

### 12.1 Review of the Closure Plan

This Closure Plan will be reviewed every five years.

### 12.2 Reporting

Reporting on rehabilitation management is required by Mining Tenement Conditions as part of the Annual Environmental Report.

Details on reporting required are outlined in Table 18.

**Table 18: Hanson’s Rehabilitation and Closure Reporting Requirements**

Reporting Requirement	Description	Frequency	Relevant Guideline	Authority
Annual Environmental Report/Annual Monitoring Report	<ul style="list-style-type: none"> <li>▪ Summary of progress and performance.</li> <li>▪ Summary of new rehabilitation activities (location and area of revegetation)</li> </ul>	Annually	Revised <i>Guidelines for the Preparation of an Annual Environmental Report</i> , May 2010 will be used.	Annual Environmental Report provided to the DMP, DPaW and other relevant authorities. Provide copies to other interested parties if requested.
Incident Reports	Incident reports will be prepared and submitted in the event of a significant environmental incident or non-compliance. Report to be submitted to the Director General of DPaW within 14 days of the incident.	As required	Not applicable	DPaW

### 12.3 Records and Data Management

Hanson maintains copies of all environmental approvals, licences and permits relevant to the Smokebush E70/3279, Tamega Road E70/3275 and Mulga Road M70/1306 “proposal area” boundaries within the three tenements. These records are updated as necessary to include new operating approvals and updated licences.

In addition, Hanson maintains a Legal Obligations Register which summaries all environmental legal obligations relevant to closure.

## **I3.0 CONFIDENTIALITY**

This plan is required to be made publicly available in accordance with Guideline for Preparing Mine Closure Plans (Department of Mines and Petroleum 2015), and therefore, it is not considered confidential.

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