PEMBROKE

Pembroke Olive Downs Pty Ltd

Initial Development Plan

May 2018

Contents

Glossary **5**

1. Introduction **7**

1.1 Background 7

1.2 Plan content and layout 8

1.3 Term of plan 9

1.4 Interpretation 9

1.5 Appropriateness of IDP 9

2. Project overview **10**

2.1 Project location 10

2.2 Underlying tenements 13

2.3 Underlying land tenure 17

2.4 Overlapping petroleum tenements 19

3. Geology and resource **21**

3.1 Exploration history 21

3.1.1 Olive Downs South exploration history and drilling density 21

3.1.2 Willunga exploration history and drilling density 23

3.2 Regional geology 25

3.3 Permo Triassic Stratigraphy 25

3.3.1 Moranbah Coal Measures 25

3.3.2 Fort Cooper Coal Measures 26

3.3.3 Rangal Coal Measures 26

3.3.4 Rewan Formation 26

3.4 Local geology 26

3.4.1 Quaternary and Tertiary 26

3.4.2 Weathering 27

3.4.3 Structure 27

3.5 Coal seams 30

3.5.1 Olive Downs South 30

3.5.2 Willunga 33

4. Coal quality **37**

4.1 Sampling and analyses styles 37

4.1.1 Olive Downs South 38

4.1.2 Willunga 38

4.2 Modelling 38

4.2.1 Structure modelling 38

4.2.2 Coal quality modelling 39
4.3 Olive Downs South raw coal quality 39
4.4 Olive Downs South clean coal quality 42
4.5 Olive Downs South plant simulation yield 43
4.6 Olive Downs South CSR 44
4.7 Willunga raw coal quality 45
4.8 Willunga clean coal quality 47
4.9 Willunga yield 49
4.10 Resource classification 49
5. Mine development 52
5.1 Mine lease term 52
5.2 Pit optimisation 52
5.3 Mine design 52
5.3.1 Geological models 52
5.3.2 Mine design constraints 52
5.3.3 Slope design criteria 55
5.3.4 Floor dip 55
5.3.5 Mining method 55
5.3.6 Equipment Selection 57
5.3.7 Drill and Blast 58
5.3.8 Dump Planning 58
5.4 Activities to be carried out on MLs and SPMLs 58
5.4.1 MLa [1] Olive Downs South 58
5.4.2 MLa [2] Olive Downs South Extended 59
5.4.3 MLa [3] Willunga 61
5.4.4 SPML [1] 63
5.4.5 SPML [2] 63
5.5 Production 63
5.6 Mining schedule 64
5.6.1 Mine development sequence 64
5.6.2 Mining schedule assumptions 68
5.6.3 Mine schedule 68
6. Coal handling & processing 73
6.1 Overall plan layout 73
6.2 Process design 78
6.3 Plant operating capacity 78
6.4 ROM dump station 79

6.5	Crushing and screening plants	79
6.6	Coal processing plant	79
6.7	Tailings and reject facilities	79
6.8	Coal handling and processing	80
6.9	Overland conveyor	82
7.	**Infrastructure**	**83**
7.1	Rail	83
7.2	Port	84
7.3	Haul Roads	84
7.4	Access Roads	84
7.4.1	Olive Downs South access road	84
7.4.2	Willunga access road	87
7.4.3	Internal access roads	87
7.5	Power	88
7.6	Mine industrial facilities	88
7.7	Water	91
7.7.1	Raw water services	92
7.7.2	Raw water storage	93
7.7.3	Potable water	93
7.7.4	Potable water treatment plant	93
7.7.5	Potable water storage	93

Glossary

4C	4 Inch Air Core
AGL	AGL Energy Limited
Arrow	Arrow Energy Pty Ltd
ATP	Authority to prospect
CCC	Clean Coal Composite
CHA	Coal Handling Area
CHPP	Coal Handling Preparation Plant
CSN	Crucible Swelling Number
CSR	Coke Strength after Reaction
CPP	Coal Preparation Plant
CQCA	Central Queensland Coal Associates
CSG	Coal Seam Gas
CSIRO	Commonwealth Scientific and Industrial Research Organisation
DBCT	Dalrymple Bay Coal Terminal
DMC	Dense Medium Cyclone
DNRME	Queensland Department of Nature Resources, Mines and Energy
EA	Environmental Authority
EPC	Exploration Permit for Coal
ETL	Electricity Transmission Line
FCCM	Fort Cooper Coal Measures
FixDhD	Vulcan seam interpolator
F/S	Float sink data
HGI	Hardgrove Grindability Index
kL	Kilolitre
km	Kilometre
IDP	Initial development plan
IPCM	Isaac Plains Coal Mines
LD	Large Diameter Air Core
LG&A	Lance Grimstone and Associates
LL1	Lower Leichhardt 1 seam
LL2	Lower Leichhardt 2 seam
LL2B	Lower Leichhardt 2 seam Bottoms
LL2T	Lower Leichhardt 2 seam Tops
LL3B	Lower Leichhardt 3 seam Bottoms
LL3T	Lower Leichhardt 3 seam Tops
LU	Leichhardt Upper seam
LoM	Life of Mine
Lox	Limit of Oxidation
Macarthur	Macarthur Coal Pty Ltd
MBCM	Million bulk cubic metres
MCM	Moranbah Coal Measures
MDL	Mineral Development Licence
mg/L	Milligrams Per Litre
MIA	Mine Infrastructure Area
Ml	Million Litres
Mlpa	Million Litres Per Annum

MJ/kg	Mega Joules per Kilogram
ML	Mining Lease
MLA	Mining Lease Application
MR Act	*Mineral Resources Act 1989* (Qld)
MOM	Mine Operations Manager
Mt	Million Tonnes
Mtpa	Million Tonnes per Annum
NE	North-East
NNW	North North-West
NPRB	Norwich Park Branch Railway
ODS	Olive Downs South
PCI	Pulverised Coal Injection
Pembroke	Pembroke Olive Downs Pty Ltd
PGM	Projects General Manager
Phos	Phosphorus
PL	Petroleum Lease
PLA	Petroleum Lease Application
Project	The Olive Downs Project
PWTP	Potable Water Treatment Plant
PWT	Potable Water Tank
RCM	Rangal Coal Measures
RD	Relative density
Ro Max	Mean maximum reflectance of vitrinite
ROM	Run-of-Mine
SE	South East
SG	Specific Gravity
SPMLs	Specific purpose mining lease
SPMLAs	Specific purpose mining lease applications
SR	Strip ratio
SSE	South South-East
STP	Sewage Treatment Plant
t	Tonne
tph	Tonnes Per Hour
TLA	Train Loadout Area
TLO	Train Loadout Facility
TS	Total Sulphur
VL1	Vermont Lower Seam 1
VU1	Vermont Upper Seam 1
VU2	Vermont Upper Seam 2
VM	Volatile Matter
Walloon	Walloon Energy Pty Ltd

1. Introduction

1.1 Background

Pembroke Olive Downs Pty Ltd (ACN 611 674 376) ("**Pembroke**") is an Australian-based company focused on the acquisition and development of a portfolio of high quality metallurgical coal assets. Established in 2014, Pembroke is backed by Denham Capital, a leading energy and resources-focused global private equity firm. Pembroke's team have a proven track record in value creation in the coal industry having worked together in previous successful metallurgical coal projects.

Pembroke proposes to develop the Olive Downs Project ("the **Project**"), a large metallurgical coal development located in the Bowen Basin, approximately 40 kilometres ("**km**") south east of Moranbah, in Queensland. Pembroke intends on developing the Project into a world class independent and large-scale producer of metallurgical coal, delivering high quality coking coal and pulverised coal injection products ("**PCI**") to key markets including Japan, South Korea, China and India. Once fully developed, the complex will be one of the largest metallurgical mines in the world, producing up to 15 million tonnes per annum of product coal over an anticipated operational life of 66 years.

The Project comprises two domains, Olive Downs South ("**ODS**") and Willunga which will be developed as an integrated mining complex processing coal through a two-stage coal preparation and handling facility and stored in a large product coal storage facility. The Isaac River passes between the ODS and Willunga domains. The two domains would be connected by crossings of the Isaac River for vehicular access and transfer of crushed ROM coal via overland conveyor. Associated, significant infrastructure for the Project includes a high capacity automated train loading facility (with the ability to load 10,000 tonne trains), a rail spur connecting to the Norwich Park Branch Railway ("**NPRB**"), a coal conveyor, a water pipeline connecting to the Eungella pipeline network, an electricity transmission line and access roads. Product coal will be exported from the Dalrymple Bay Coal Terminal ("**DBCT**") located at the Port of Hay Point.

The Project contains coal resources within the Rangal Coal Measures ("**RCM**"), which together with the Moranbah Coal Measures ("**MCM**"), are the dominant source of metallurgical coal exported from Australia. The Leichhardt and Vermont Seams of the RCMs form the principal economic coal resources in the Project area, with cumulative Leichhardt and Vermont Upper Seam coal thickness in the order of 10 metres. The Leichhardt Seam is typically 1.5 metres to 2.5 metres thick and the Vermont Upper Seam is typically 3.5 metres to 4 metres thick.

Pembroke currently holds three granted mineral development licences ("**MDLs**"), being MDLs 3012, 3013 and 3014, a mineral development licence application 3025, as well as having beneficial interests in parts of three exploration permits for coal ("**EPCs**"), being EPCs 649, 721 and 850.

The collective workforce for the Project will employ up to 700 people during construction and up to approximately 1,600 during peak operations. The construction and operational workforce is largely expected to be housed within the Isaac Regional Council limits and predominately in the greater Coppabella, Moranbah and Dysart town areas. No new workforce accommodation construction is anticipated due to the large number of beds available in the region.

The initial capital costs have been forecast by infrastructure consultants. The project capital is estimated at $440 million with sustaining capital of approximately $13 million per annum. It is anticipated that approximately $980 million of development capital will be required later in the schedule in line with the progression of the mine plan.

The Project is a greenfield development that has been declared as a Coordinated Project by the Queensland Minister for State Development and the Coordinator General of the Queensland Department of State Development. The Coordinated Project status will provide for efficient coordination of the requisite state and federal environmental assessment processes.

1.2 Plan content and layout

This initial development plan ("**IDP**") has been prepared in accordance with the *Mineral Resources Act 1989* (Qld) ("**MR Act**"). Table 1 outlines the legislative requirements of the MR Act for an IDP.

Table 1 Checklist of legislative requirements

Section (MR Act)	Requirement	IDP ref
318DT(1)(a)	Provide an overview of the activities proposed to be carried out under the proposed mining leases ("**MLs**") and proposed specific purpose mining leases ("**SPMLs**") during the plan period	Section 5
318DT(1)(b)	Detail the nature and extent of activities proposed to be carried out under the proposed MLs and SPMLs, including where the activities are proposed to be carried out for each year of the plan period;	Section 5
318DT(1)(c)(i)	Describe the location and an estimate of the resources of the coal in the proposed ML area	Sections 2.1, 3.4, 3.5 and 4.3 – 4.10
318DT(1)(c)(ii)	Describe the standards and procedures used to make the estimate	Sections 4.1, 4.2 and 4.10
318DT(1)(c)(iii)	Detail the rate and amount of the proposed mining for the proposed MLs	Sections 5.4 and 5.5
318DT(1)(c)(iv)	Outline when the proposed mining is to start for the proposed MLs	Section 5.4.1
318DT(1)(c)(v)	Provide a schedule for the mining on the proposed MLs during the plan period;	Section 5.5
318DT(1)(d)	Provide maps that support the Project	Throughout IDP
318DT(1)(f)	Provide reasons why the plan is considered appropriate	Section 1.5

1.3 Term of plan

In accordance with the requirements of the MR Act, the term of this IDP shall be 5 years, commencing upon grant of the three MLs and two SPMLs.

1.4 Interpretation

Unless otherwise defined herein, capitalised terms in this document are defined by the Glossary at the beginning of this IDP.

1.5 Appropriateness of IDP

The proposed mine plan is the industry standard large scale open cut mine plan. The project has sufficient base geology data to allow a JORC reserve to be stated. The plan utilises best practise mining practise, drill and blast technics, the latest in mining fleet size and utilisation and environmental rehabilitation practises. The plan maximises the recovery of the coal resource from the ground, with all the coal ply's of the Rangal Coal Measures being recovered. The pit extended to a depth of cover of 300m which is at the limits of current open cut mining practise and as such is deemed appropriate for the project.

2. Project overview

2.1 Project location

The location and overall layout of the Project is shown in and Figure 2-2 below. The proposed Project is located approximately 40 km south east of the township of Moranbah in the region of the Isaac Regional Council, Central Queensland. The Project will develop two coal deposits, underlying the ODS and Willunga domains. It is proposed that these deposits are worked by Pembroke over an anticipated operational life of 66 years. All product coal will be railed approximately 195kms to the DBCT located at the Port of Hay Point, for export.

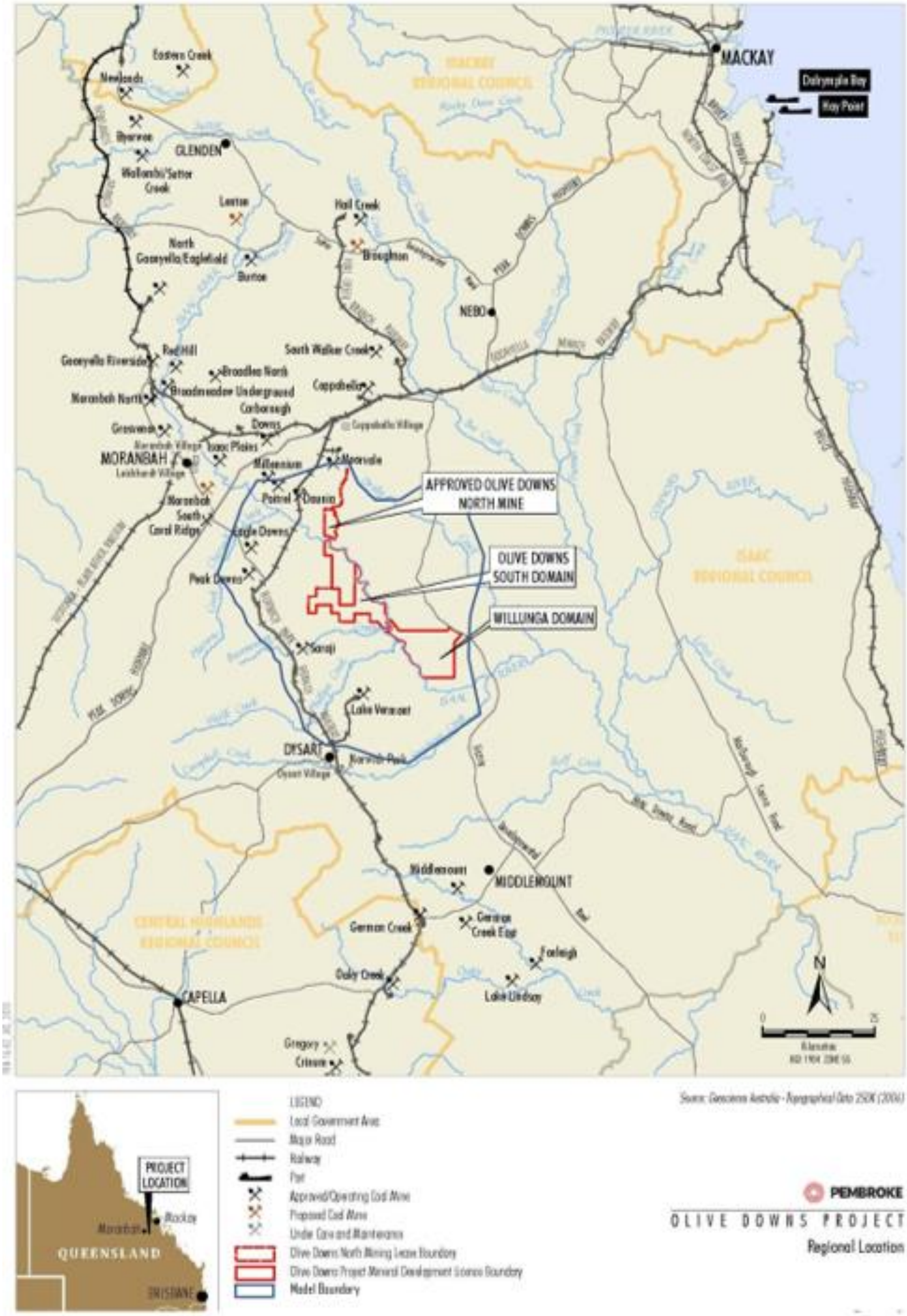
The ODS coal deposit runs north-south along the western side of the Isaac River for a distance of approximately 15km. The Willunga coal deposit runs north-south along the eastern side of the Isaac River and is located to the east of the existing Saraji coal mine and north-east of the existing Lake Vermont mine.

Access to the ODS domain from Moranbah is via the Moranbah Access Road, then Peak Downs Highway and then on to Daunia Road. Approximately 10 km from Peak Downs Highway, Daunia Road becomes Annandale Road. A further twenty kilometres along Annandale Road, a new intersection and access road will be constructed to access the ODS domain. Access to the Willunga domain from Moranbah is the same as for the ODS deposit, except that the route does not end at Annandale Road. After Annandale Road, the route continues on to the Iffley Connection Road, and then Fitzroy Development Road to access the Willunga domain. Access within the exploration permits covering the coal deposit is currently limited to existing station tracks (where possible).

The Projects main water supply will be from the Eungella pipeline which draws water from the Eungella dam. The Project will connect to the Eungella pipeline system water supply, 22.3 km along the Eungella pipeline southern extension from the Moranbah Terminal Storage to the ODS offtake point, and a 29.0 km long ODS spur water pipeline from offtake point to ODS MIA location.

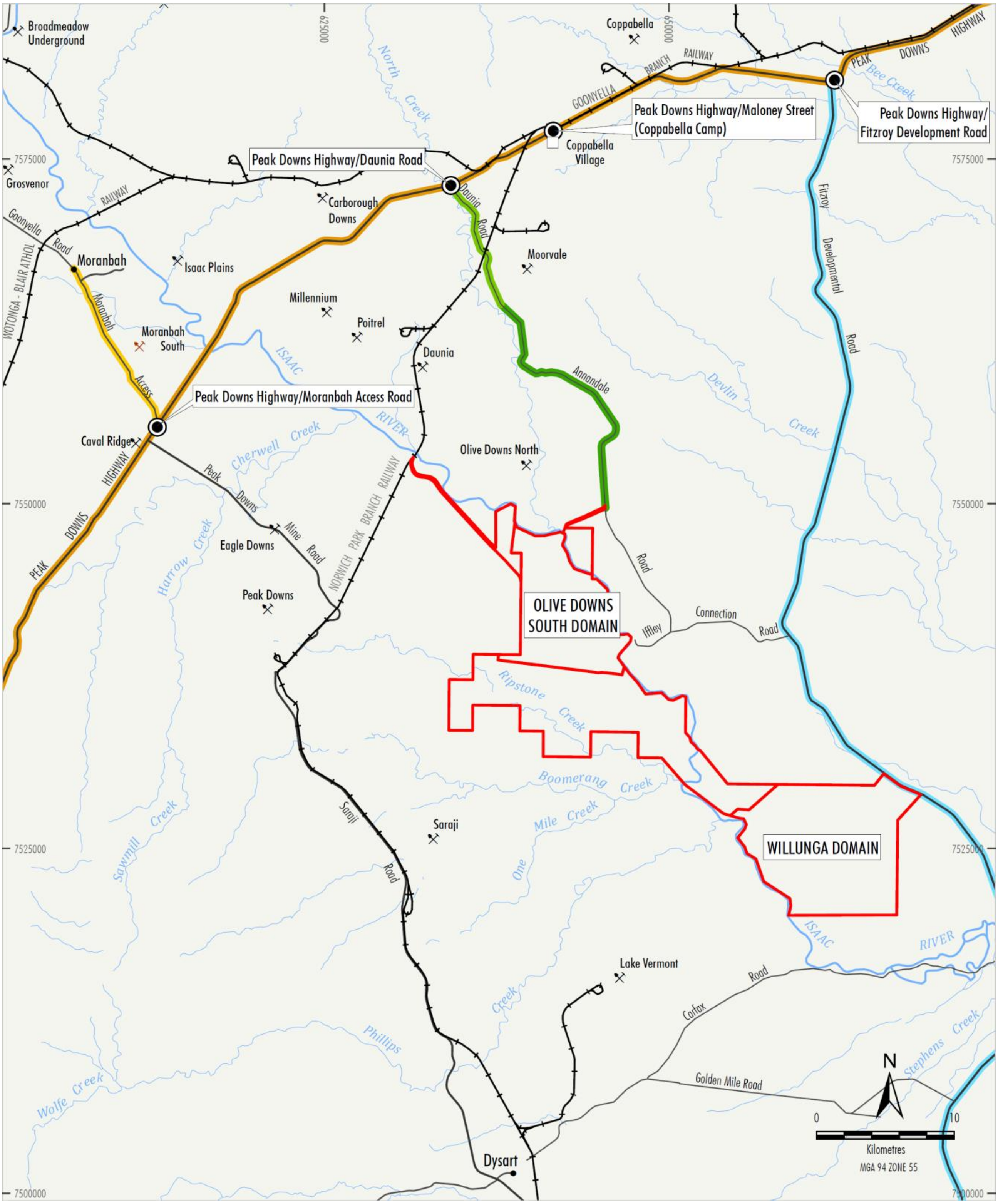
The Broadlea Ergon Energy substation is located approximately 30km north of ODS, between Moranbah and Coppabella. This electric line is available for connection and meets the power capacity requirements for the Project. Figure 2-1 shows the location of the Project in respect of local and regional towns and coal export infrastructure. Figure 2-2 shows the location of the ODS and Willunga domains (together with supporting rail, road, water and electrical infrastructure), in the context of surrounding mining projects and public roads.

Figure 2-1 Project location map



PEMBROKE

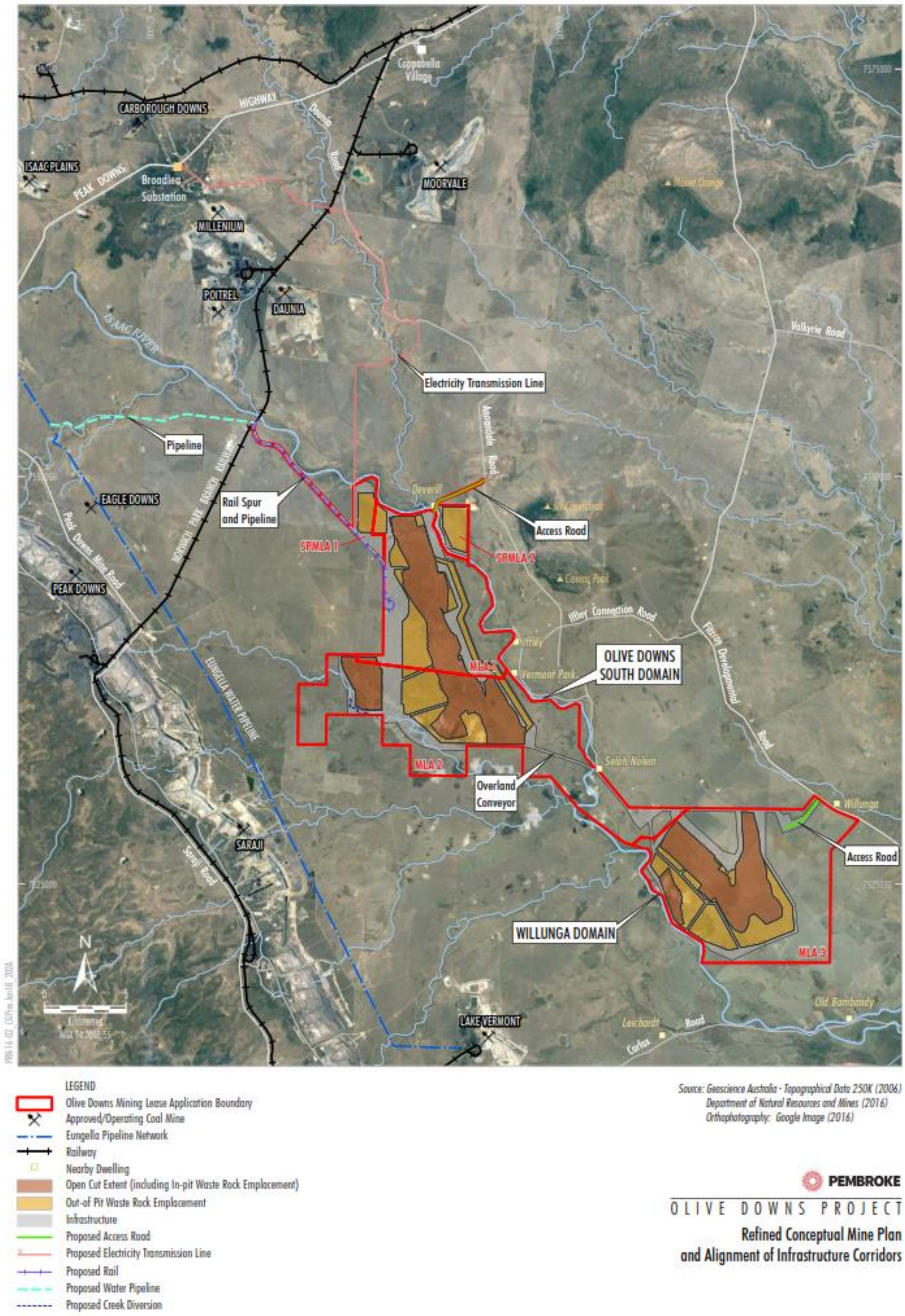
Figure 2-2 Olive Downs Complex



2.2 Underlying tenements

The Project will comprise three MLs and two SPMLs primarily located on grazing properties. The proposed layout of the Project is indicatively shown in Figure 2-3.

Figure 2-3 Conceptual mine plan and alignment of infrastructure

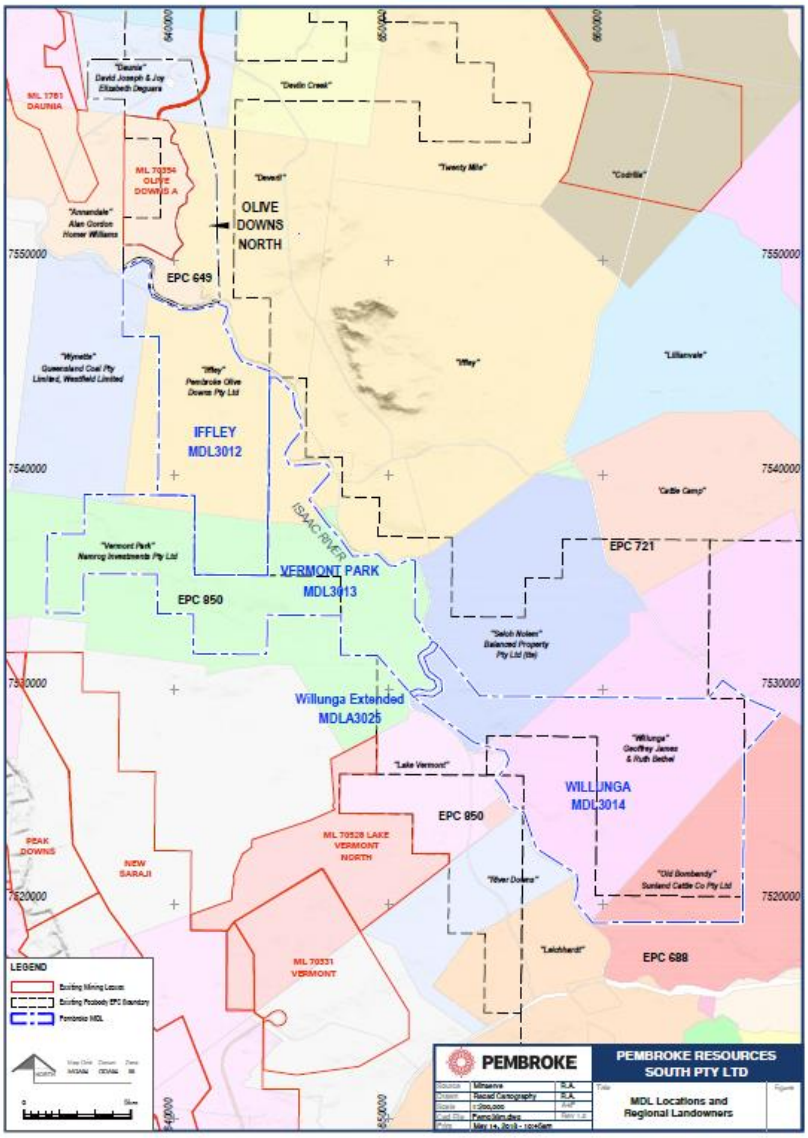


The five tenements that will comprise the Project include:

- MLA [1]; Olive Downs South
- MLA [2]; Olive Downs South Extended
- MLA [3]; Willunga
- SPMLA [1]; and
- SPMLA [2].

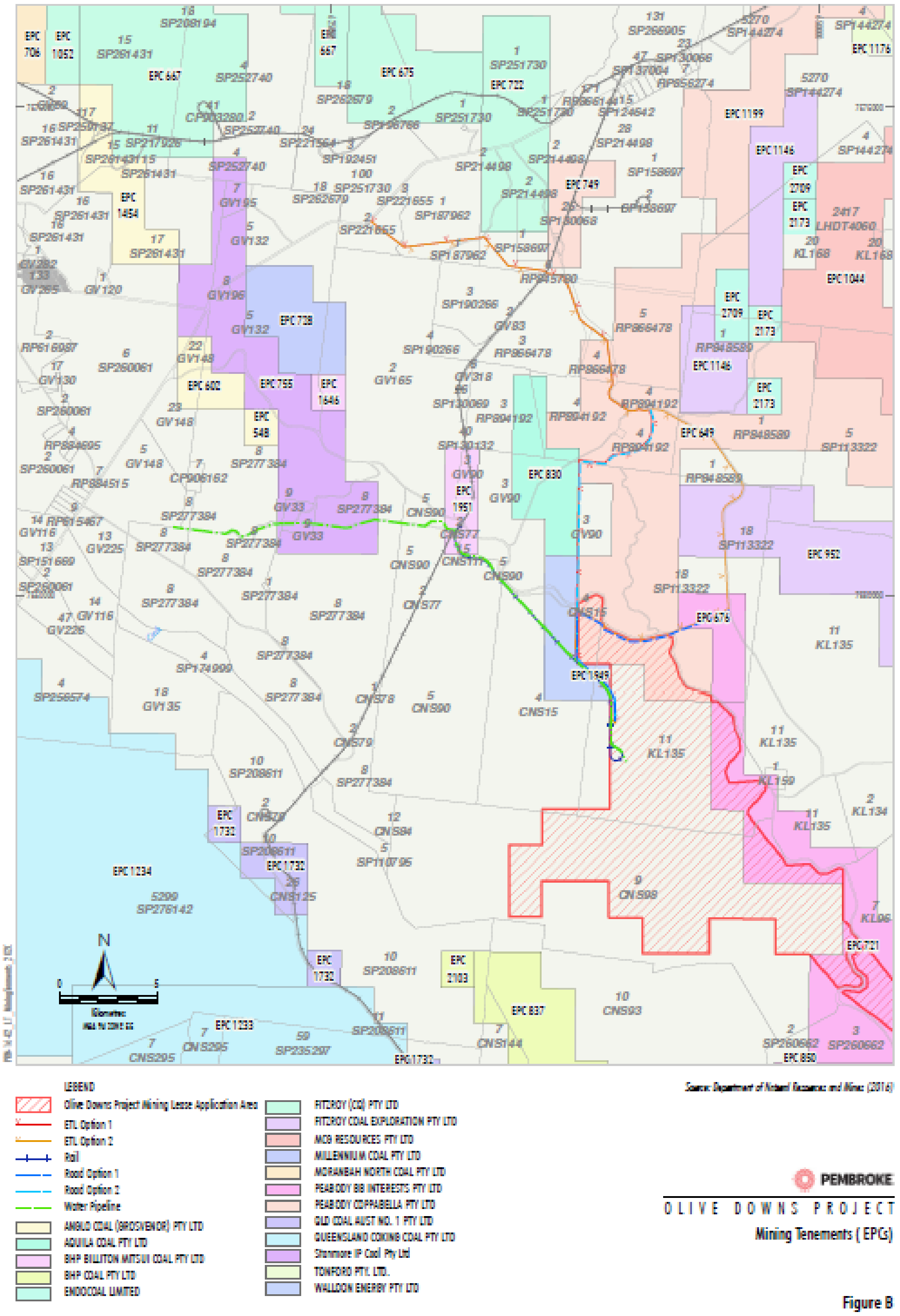
The proposed ML areas are substantially contained within MDLs 3012, 3013 and 3014, which were granted to Pembroke Resources South Pty Ltd on 3rd July 2016 for a period of 5 years. Figure 2-4 shows the boundaries of MDLs 3012, 3013 and 3014. The current mining Lease application will over print the granted MDL areas.

Figure 2-4 Current Granted MDL boundaries



The proposed SPML areas are predominately off tenure and intersect a number of EPCs. SPML [1] intersects parts of EPCs 1949 and 1951, while SPML [2] intersects parts of EPC 649. Figure 2-5 shows the proposed ML and SPML areas intersecting the EPC areas.

Figure 2-5 Proposed ML and SPML areas with nearby EPCs



SPML [1] will serve a number of purposes, including a transportation corridor for rail infrastructure and water, to expand the dam which currently sits on the boundary of MDL 3012 and EPC 1949, and for out-of-pit waste rock emplacement. Part of the area of the proposed SPML 1 currently overlaps part of Pembroke's MDL 3012 (where the waste emplacement is proposed to occur). The remaining area of SPML [1] is partially overlapped by EPCs 1949 (held by Walloon Coal Pty Ltd) and EPC 1951 (held by members of the Central Queensland Coal Associates ("**CQCA**"). Pursuant to the MR Act, Pembroke has requested the written consents of Walloon Coal and the CQCA members to the grant of SPML [1].

It is intended that SPML [2] will be used for river access and a spoil dump. Pembroke holds a beneficial interest in EPC 649 for the area within SPML [2] proposed for the spoil dump. As the area of the Isaac River between EPC 649 and Pembroke's existing MDL 3012 is "excluded land" from EPC 649, there is currently no underlying tenure in that part of proposed SPML [2], which is proposed to be the subject of road access across the river.

In relation to the proposed access road for SPML 2 to Annandale Road, Pembroke does not have beneficial interests in the underlying third party tenure or consents from the holders of underlying third party EPCs for the use of this area. However, we note that Pembroke has recently purchased the underlying real property tenure for this access road area. Following completion of the transaction, as the landholder, Pembroke will be entitled to construct a road for the purpose of access.

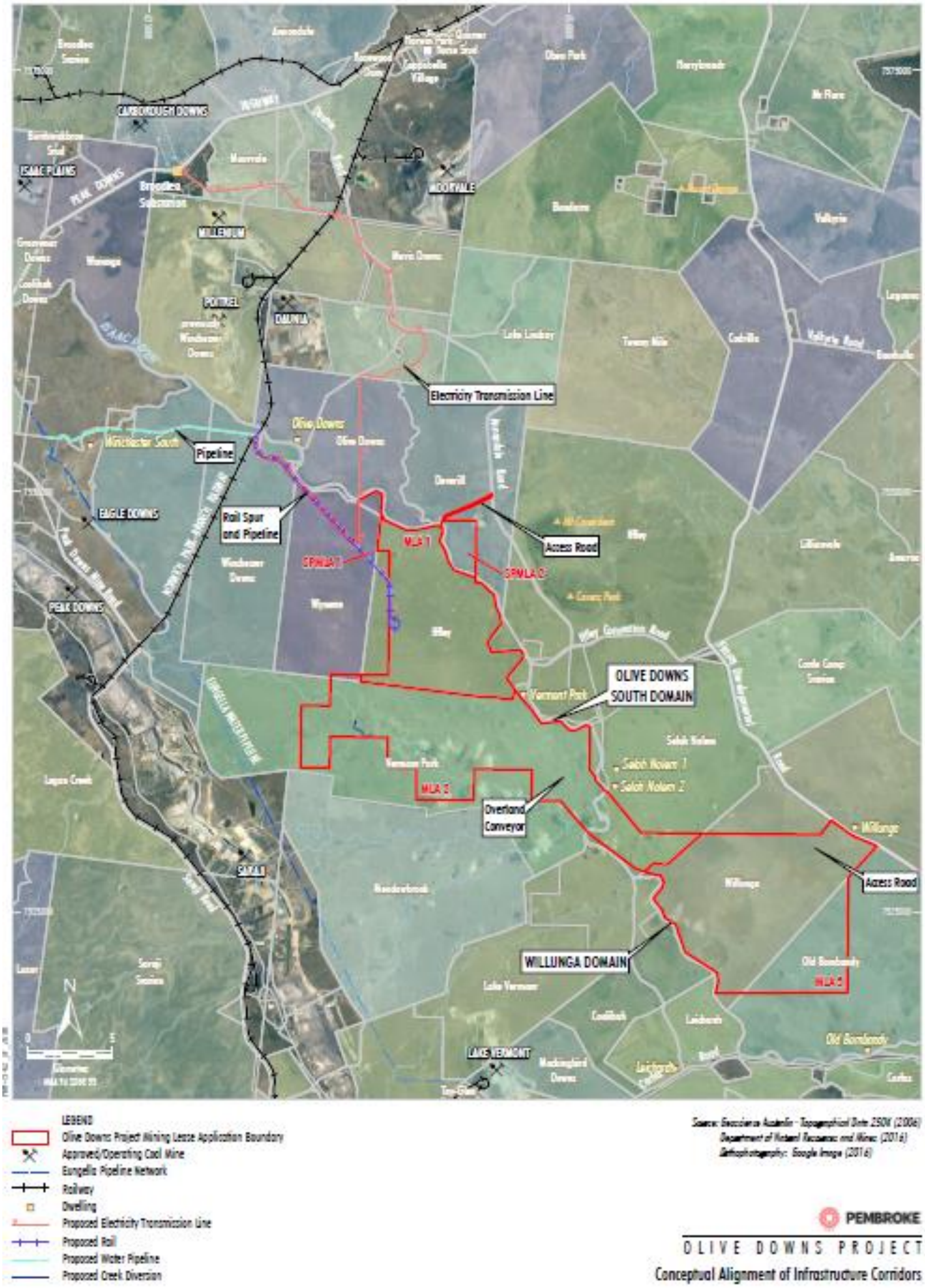
2.3 Underlying land tenure

Details of the underlying real property to the proposed MLs and SPMLs are shown in Table 2 and Figure 2-6.

Table 2 Real property

Lease	Area (ha)	Lot on plan	Tenure	Native title status
MLA 1	[TBC]	Lot 11 on KL135 'Iffley Station'	Freehold	Extinguished
		Lot 4 on CNS15 'Winchester South'	Freehold	Extinguished
		Lot 9 on CNS98 'Vermont Park'	Freehold	Extinguished
MLA 2	[TBC]	Lot 11 on KL135 'Iffley Station'	Freehold	Extinguished
		Lot 4 on CNS15 'Winchester South'	Freehold	Extinguished
		Lot 9 on CNS98 'Vermont Park'	Freehold	Extinguished
MLA 3	[TBC]	Lot 8 on KL95 'Willunga Station'	Freehold	Extinguished
		Lot 7 on KL96 'Seloh Nolem'	Freehold	Extinguished
		Lot 9 on KL97 'Old Bombandy Station'	Freehold	Extinguished
SPMLA 1	[TBC]	Lot 4 on CNS15 'Winchester South'	Freehold	Extinguished
		Lot 5 on CNS90 'Winchester Downs'	Freehold	Extinguished
		Lot 15 on CNS111	Reserve Land	Native title determined to exist in Barada Barna native title determination
		Lot 2 on CNS77	Leasehold	Excluded from Barada Barna determination area on the basis that native title is extinguished as a previous exclusive possession act
SPMLA 2	[TBC]	Lot 18 on SP113322 'Deverill'	Freehold	Extinguished

Figure 2-6 Rural properties:



2.4 Overlapping petroleum tenements

The Project is overlapped by current petroleum exploration and production permits as shown in Figure 2-7 (“**Overlap Area**”). The project area is overlapped by ATP 1103 (held by AGL Energy Limited (“**AGL”**), CH4 Pty Ltd and Arrow CSG (ATP 364) Pty Ltd), ATP 1031 (held by BOW CSG Pty Ltd) and PL application (“**PLA**”) 488 (held by CH4 Pty Ltd and Arrow CSG (ATP 364) Pty Ltd).

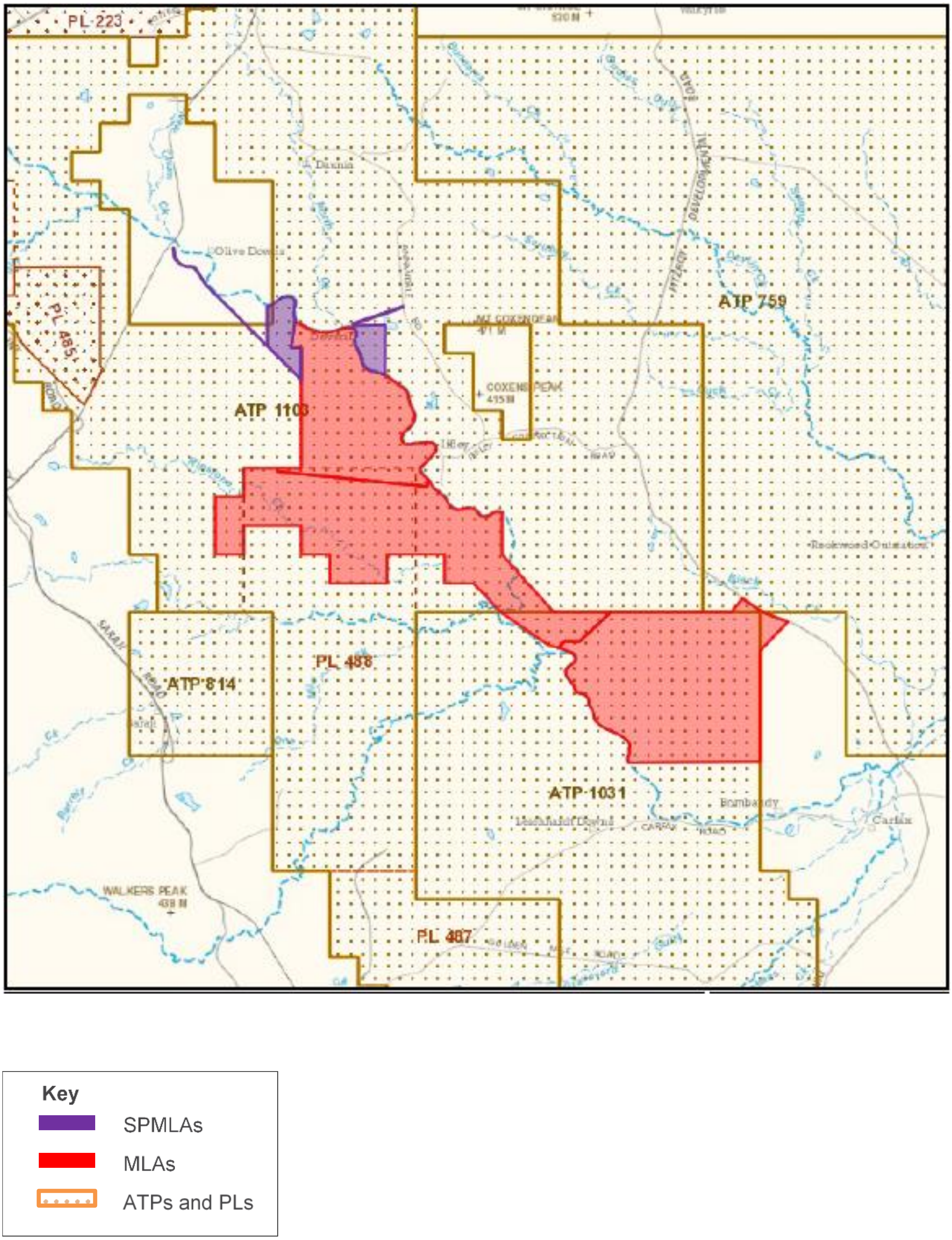
Apart from AGL, Arrow Energy Pty Ltd (“**Arrow Energy**”) is the parent company of the above petroleum tenure holders. Arrow Energy is also the operator of ATP 1103 (for which AGL is a co-holder). Therefore, Arrow Energy is the only relevant party in respect of potential interactions with petroleum activities and infrastructure in the Overlap Area.

In February 2018, Pembroke met with Arrow Energy to discuss Arrow Energy’s plans for petroleum exploration and production within the Overlap Area during the term of this plan (“**Arrow Meeting**”).

At the Arrow Meeting, Arrow Energy confirmed that:

- the company was focussed on petroleum exploration and development in areas other than the Overlap Area (i.e. the Surat Basin);
- there were currently no plans for petroleum exploration and/or production in the Overlap Area during the plan term or otherwise in the foreseeable future;
- the company was planning to withdraw PLA 488 from assessment by DNRME imminently (the withdrawal is currently being signed-off on); and
- the company has no objection to Pembroke’s mining activities as planned for the IDP term or the Project more generally.

Figure 2-7 Overlapping petroleum tenements



3. Geology and resource

3.1 Exploration history

The only known previous coal exploration completed within the ODS Project area prior to Macarthur Coal Pty Ltd ("**Macarthur**") and Peabody Energy was a mapping exercise by Enterprise Exploration Pty Ltd for Consolidated Zinc Pty Ltd in 1960, and a scout drilling program by Bellambi Coal Company Limited (Clutha) in 1968. Other sporadic coal exploration in the Bombandy region was undertaken by the Utah Development Company (1960-70s) under AP 6C to the west within EPC 850, and UDC/BHP Coal/Capcoal/Anglo in the Picardy area to the south.

Target areas were recommended to Macarthur in 1997 by Lance Grimstone and Associates ("**LG&A**"). LG&A's interest in the area arose from its involvement in data compilation for CSIRO study teams to re-evaluate the structure of the Bowen Basin. EPCs 688, 721 and 850 were targeted as part of the regions exploration potential and became part of a group of properties recommended to Macarthur, and subsequently its JV partner, CITIC Exploration Pty Ltd.

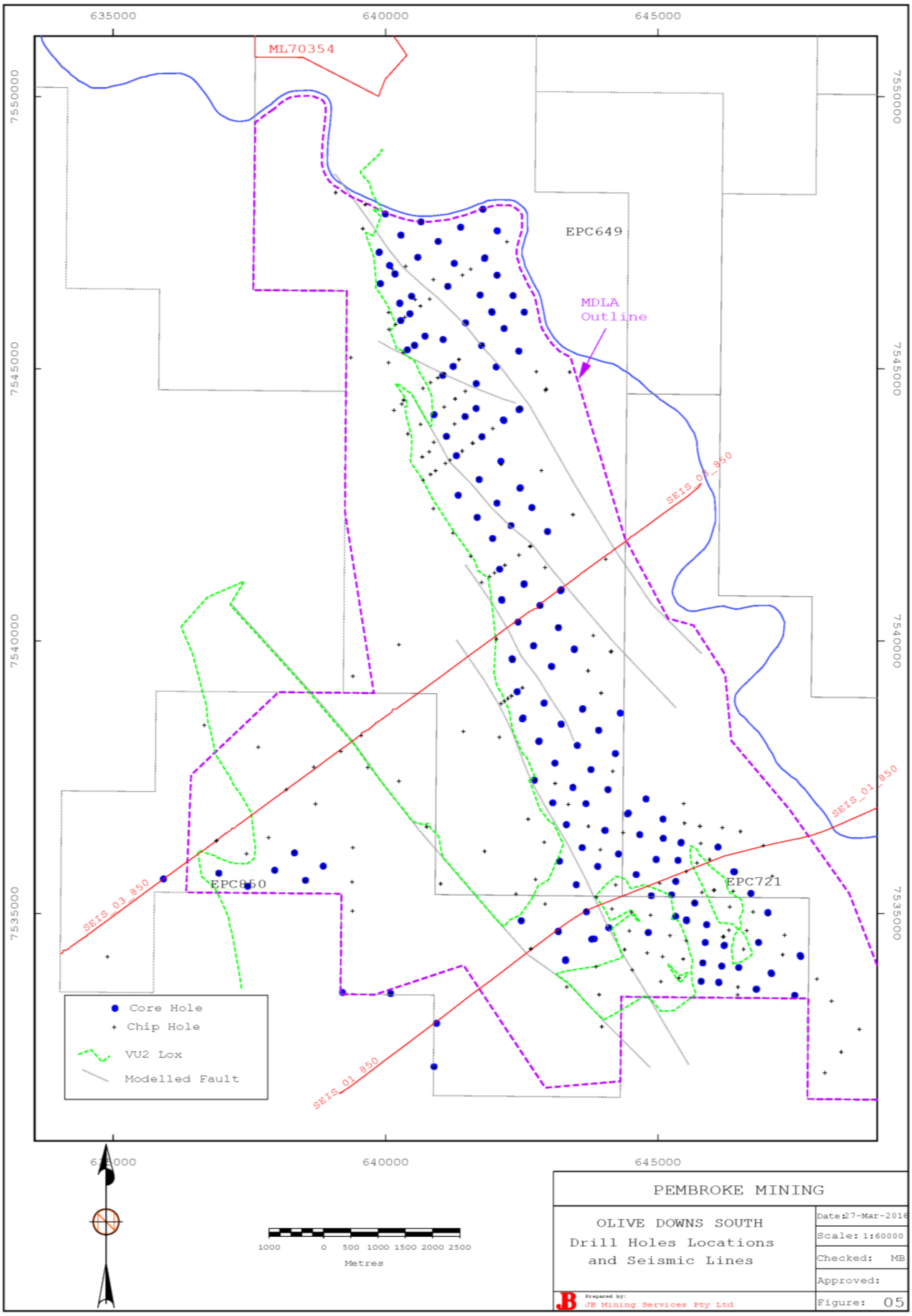
3.1.1 Olive Downs South exploration history and drilling density

Broad spaced chip and core drilling commenced at the Vermont East/ODS Project area in 1998. Three mini-sosie seismic lines in the ODS resource area were completed in 2000. Drilling continued through to 2014.

There are 498 holes in the lithological database of which 312 are chip holes and 186 are core holes. 290 of these holes are used in the modelling of the coal seam structure. Approximately 208 holes are drilled on the same site as an existing hole (pilot for core, redrill, gas and geotechnical). Only 22 holes did not intersect a horizon of interest.

Drill sites were planned on 400 to 500 metre spaced lines in the north and 500 to 600 metre spaced lines in the south. This results in actual drill spacing in the order of 300 to 400 metres in the north and 400 to 500 metres in the south. No Lox drilling has been conducted. Initial holes were chip drilled and then followed by a cored hole at the same site. Often a third hole was drilled at the same site, see Figure 3-1.

Figure 3-1 Olive Downs South drill holes location and seismic lines



3.1.2 Willunga exploration history and drilling density

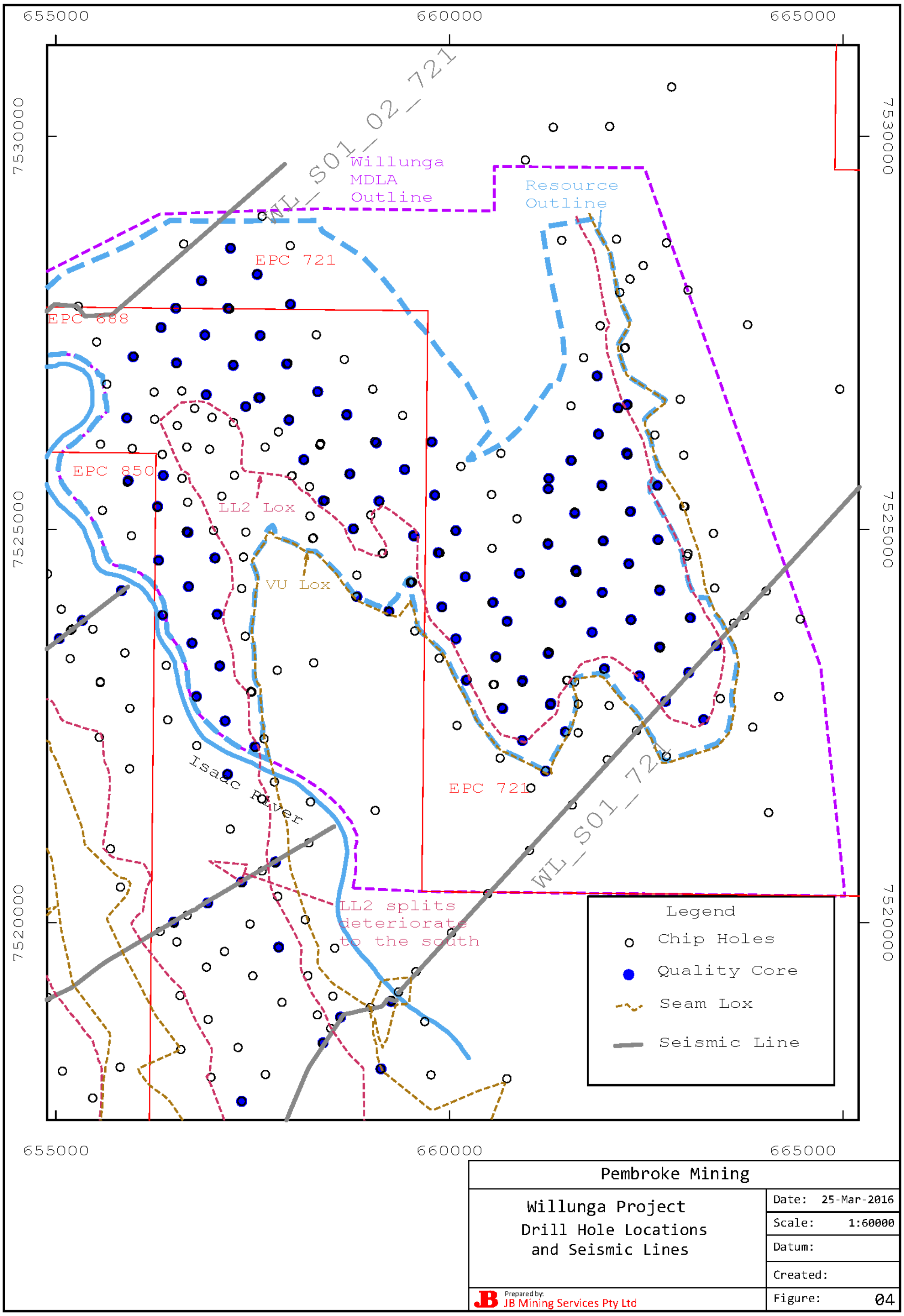
Broad spaced chip and core drilling commenced at the Vermont East/Willunga Project area in June 2000 following the completion of mini-sosie seismic survey's which identified the highly folded nature of the area. Three survey lines are located in or close to the Willunga resource area.

Scout drilling quickly identified the laterally continuous nature of the 4 to 5 metre thick Leichhardt Lower 2 Seam and the Vermont Upper Seams throughout the area. Subsequent drilling campaigns were completed in 2001, 2003, 2006 and 2007 through to 2013.

There are 656 holes in the lithological database of which 433 are used in the modelling of the coal seam structure. 322 of the 656 holes are in the Willunga area, the remainder are in the Vermont East area. Approximately 113 holes are drilled on the same site as an existing hole (pilot for core, redrill, gas and geotechnical). 119 holes are barren of the modelled seams. 11 holes were drilled after the 2011 resource assessment. The results from the 11 holes will not have materially affected the resource estimate as most were drilled on an existing site (LD core for washability data for example) or drilled outside the resource area.

Drill sites were planned on a 500 metre offset grid resulting in actual drill spacing in the order of 350 to 500 metres. No Lox drilling has been conducted. Initial holes were chip drilled and then followed by a cored hole at the same site. Often a third hole was drilled at the same site. Core holes were sited where the target seams were less than 250 metres deep (Figure 3-2).

Figure 3-2 Willunga drill holes location and seismic lines



3.2 Regional geology

The ODS resource area is located in the central part of the Permo-Triassic Bowen Basin containing principally fluvial and some marine sediments. The Bowen Basin is part of a connected group of Permo-Triassic basins in eastern Australia, which includes the Sydney and Gunnedah Basins. The basins axis orientation is NNW-SSE roughly parallel to the Paleozoic continental margin. Tectonically, the basin can be divided into NNW-SSE trending platforms or shelves separated by sedimentary troughs. The units from west to east are the Springsure Shelf, Denison Trough, Collinsville Shelf/Comet Platform, Taroom Trough, Connors and Auburn Arches (interrupted by the Gogango Over-folded Zone) and the Marlborough Trough. Development of the basin in the Early Permian was in the form of half grabens, which subsequently became areas of regional crustal sag. Variations in depositional patterns and deformation styles along strike suggest the possibility of NE trending deep-seated crustal transfer faults referred to as transfer corridor. The basin has suffered oriented NE-SW extensional and compressional events. Structurally, the deposit lies close to, but west of, the deformed Nebo Synclinorium.

The economic seams are contained in the Late Permian RCMs, which is approximately 100 metres thick. The RCMs are overlain by the Late Permian to Early Triassic Rewan Group. Below the RCM are the Fort Cooper Coal Measures ("**FCCM**") and the MCM. The following table details the regional stratigraphy of the North Bowen Basin.

Table 3 Permian – Triassic Stratigraphy of the North Bowen Basin

Moolayember Formation: Jensen (1975), Koppe (1978), Staines & Koppe (1980)		
Clematis Group	Expedition Sandstone Glenidal Formation	
Rewan Group	Arcadia Formation Sagittarius Sandstone	
Blackwater Group	Rangal Coal Measures (RCM) Fort Cooper Coal Measures (FCCM) Moranbah Coal Measures (MCM)	
Back Creek Group	Exmor Formation	German Creek Formation
	Blenheim Formation Gebbie Formation Tiverton Formation	Blenheim Formation Gebbie Formation Tiverton Formation

3.3 Permo Triassic Stratigraphy

3.3.1 Moranbah Coal Measures

The MCMs comprise mainly volcanic lithic sandstones, with lesser siltstone, mudstones and coal. Quartz clasts form up to 20%, but more commonly less than 10% of the sandstones. The transition between the MCM and the overlying FCCMs is difficult to identify with precision, and is usually seen by the absence of tuffaceous coaly bands in the MCM, and the presence of more lithic sandstones. Approximately 20 metres of coal is present over the northern section of the MCM, and is generally concentrated into four or five coal seams, which show extensive splitting and coalescing.

3.3.2 Fort Cooper Coal Measures

The FCCMs are approximately 350m thick and comprise typically tuffaceous sandstones, siltstones, mudstones and coal seams. The transition between the RCM and the FCCM is generally clearly marked by the Yarrabee Tuff, a basin-wide marker bed comprised of weak, brown tuffaceous claystone.

3.3.3 Rangal Coal Measures

The RCM range from 90 to 195 metres thick and comprise light grey, cross-bedded, fine to medium grained labile sandstones, grey siltstones, mudstones and coal seams. Cemented sections are common in the sandstones.

3.3.4 Rewan Formation

Immediately overlying the RCMs is the non-coal bearing Rewan Formation of Triassic age. This group of sediments consists of red-brown mudstones with fine to coarse-grained light greenish-grey lithic sandstones.

The transition from the RCM to the Rewan Formation is generally difficult to define and is often based on the change from the greenish-grey colour of the Rewan sandstones to the bluish-grey colour of the Rangal sandstones. The transition between the formations is 15 to 60 metres above the first major seam in the RCMs, the Leichhardt Seam.

3.4 Local geology

3.4.1 Quaternary and Tertiary

Olive Downs South

Alluvium and semi consolidated sediments consisting of sand, clay and gravel cover the deposit area. This material is described as Tertiary but a component of it is likely to be Isaac River Quaternary sediments.

Tertiary/Quaternary sediment thickness increases towards the south. Average depth of Tertiary is in the order of 45 metres ranging from 0 to 90 metres.

Willunga

In the Willunga area the average depth to the base of Tertiary is in the order of 20 metres ranging from 0 to 70 metres in the resource area. The thickness of Tertiary does not seem to be related to the current river location.

There does not appear to be any clear relationship between the Tertiary depth and the structure of the areas. There are no indications of any surficial basalt in either Olive Downs South or Willunga.

3.4.2 Weathering

Olive Downs South

Average depth of weathering is in the order of 65 metres ranging from 20 to 80 metres. Comparison of depth of weathering with depth of Tertiary indicates almost no consistent relationship, however both increase to the south.

Willunga

Average depth of weathering is in the order of 60 metres ranging from 20 to 100 metres. There appears to be a broad relationship between the depth of weathering and the structure of the area - the deeper weathering occurring in the syncline.

3.4.3 Structure

Olive Downs South

The ODS and Willunga resources lie in the western section of the informally named Coxendean Basin, a sub-basin of the Bowen Basin. The ODS area straddles the regional NNW trending. The Isaac fault zone has a throw in the order of 500 metres. The area has suffered compression from the east resulting in both folding and east-over-west thrust (and associated) faulting.

2D seismic sections clearly indicate at least four other NNW trending east-over-west thrust fault zones with throws up to 100 metres. The seismic data indicates that the fault zones are composed of many smaller faults. Some folding occurs with NNW trending fold axes. Fault repetition of coal seams is not uncommon in the fault zones.

Dips are to the east and appear to be lower in the north, approximately 7 degrees, steepening to up to 15 degrees in the south. Higher dips occur adjacent to faults.

The floor of the basal Vermont Upper Seam 2 ("**VU2 Seam**") is a weak mudstone. It is suspected that this floor has taken a lot of the thrust faulting "strain" leading to an even weaker slickensided floor. The nearby Moorvale deposit has such a pit floor, although steeper dip, that has to be conditioned to reduce geotechnical risk.

Figure 3-3 Regional Geology- (after Dickins and Malone, (1973))

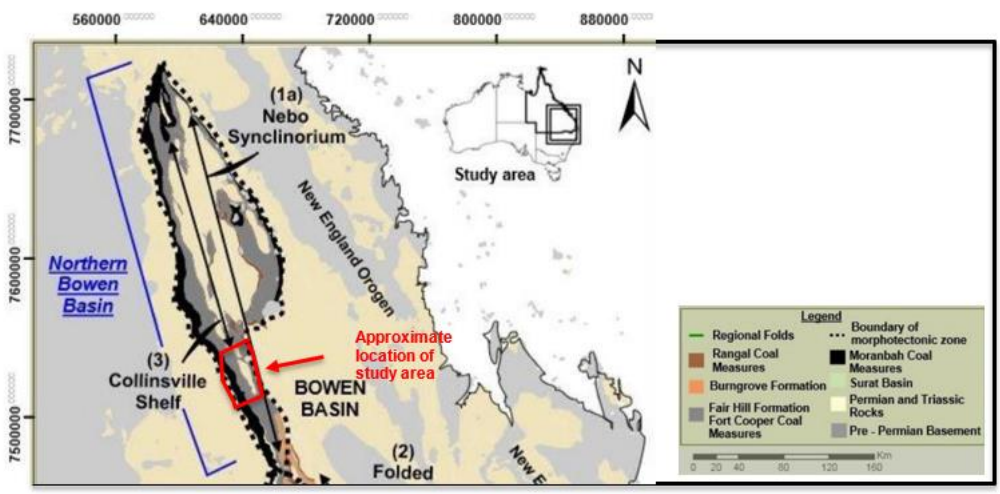


Figure 3-4 Iffley Vermont Park MDL Indicative Cross Section and Stratigraphic Column

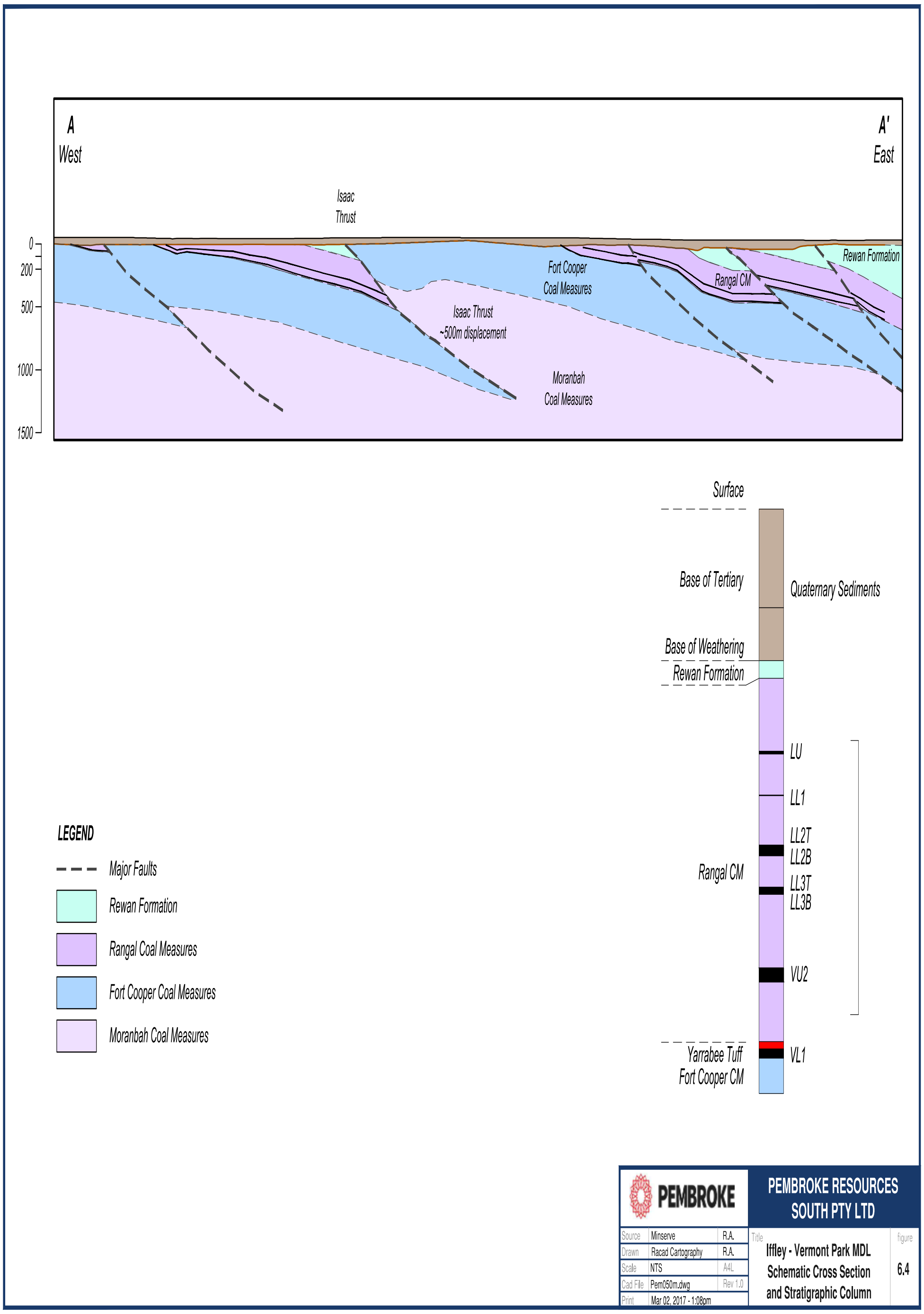
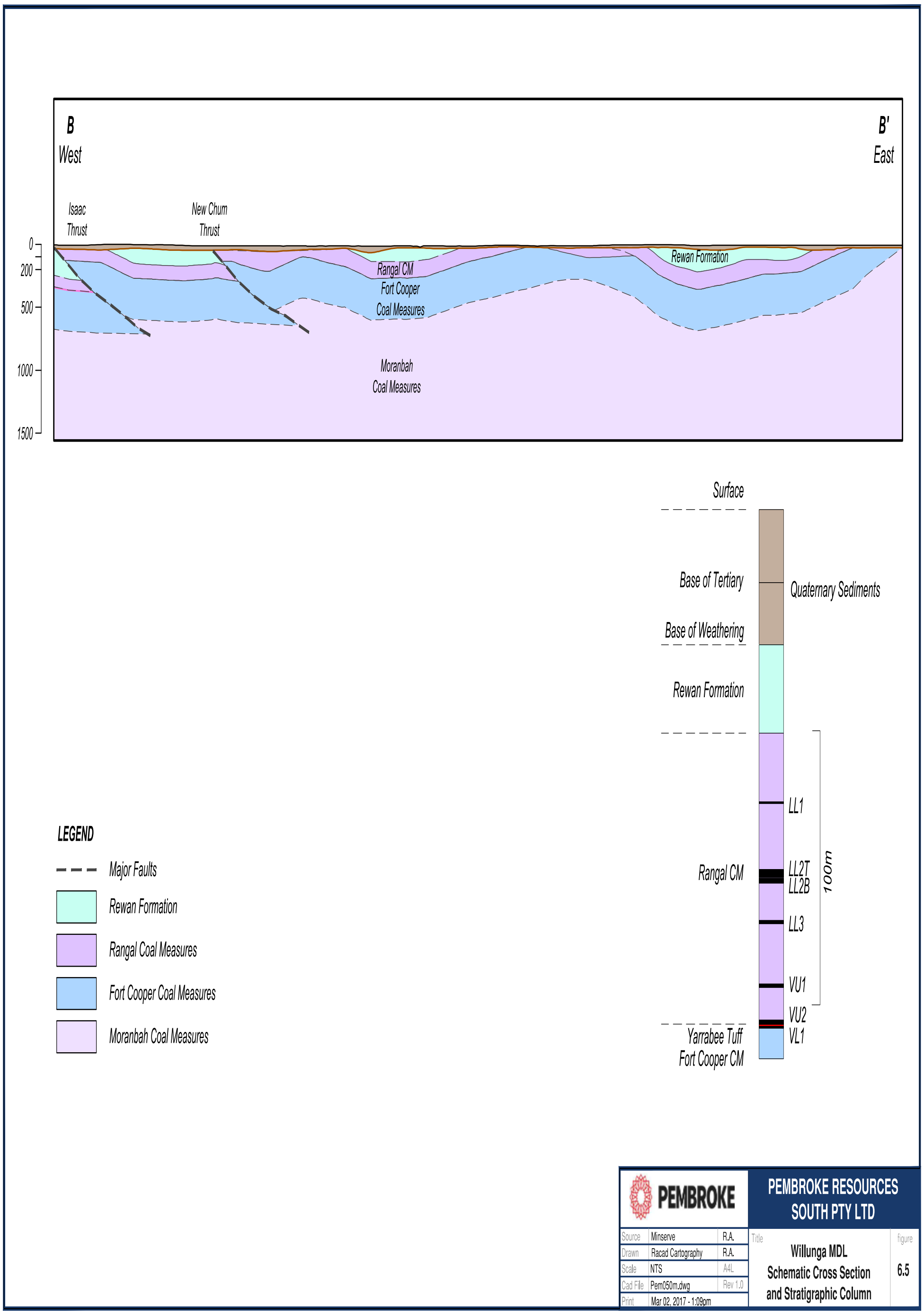


Figure 3-5 Willunga MDL Indicative Cross Section and Stratigraphic Column



Willunga

The Willunga area lies to the east of the regional New Chum Thrust system. 2D seismic sections clearly indicate moderate structural deformation with NNW trending east-dipping thrust faults and similar trending fold axes. The area has suffered compression from the east resulting in both folding and east-over-west thrust (and associated) faulting. Fault repetition of coal seams does occur in some drill holes.

Dips are lower in the fold noses (<5 degrees) and are in the order of 8 to 12 degrees on fold limbs. Higher dips occur adjacent to faults.

3.5 Coal seams

3.5.1 Olive Downs South

The Leichhardt and Vermont Seams of the RCM form the principal economic coal resources in the ODS resource area. In this area the principal seams have been named Lower Leichhardt 1 (“**LL1**”), Lower Leichhardt 2 (“**LL2**”), Lower Leichhardt 3 (“**LL3**”), and Vermont Upper 2 (“**VU2**”). The Vermont Upper 1 (“**VU1**”) is thin and non-pervasive. A high gamma marker occurs several metres below the floor of the Vermont Upper Seam and it is interpreted to be the Yarrabee Tuff. The Yarrabee Tuff ranges from 0.5 to 1.5 metres thick. This tuff marks the interpreted top of the FCCM. See Figure 3-6, for the typical seam stratigraphy of the area.

The LU Seam is thin, generally less than 0.5 metres. It has an average raw ash of 23%.

The LL1 Seam is thin 0.5 to 1 metres in the north and south thinning to less than 0.5 metres in the central portion of the deposit. It has an average raw ash of 22%.

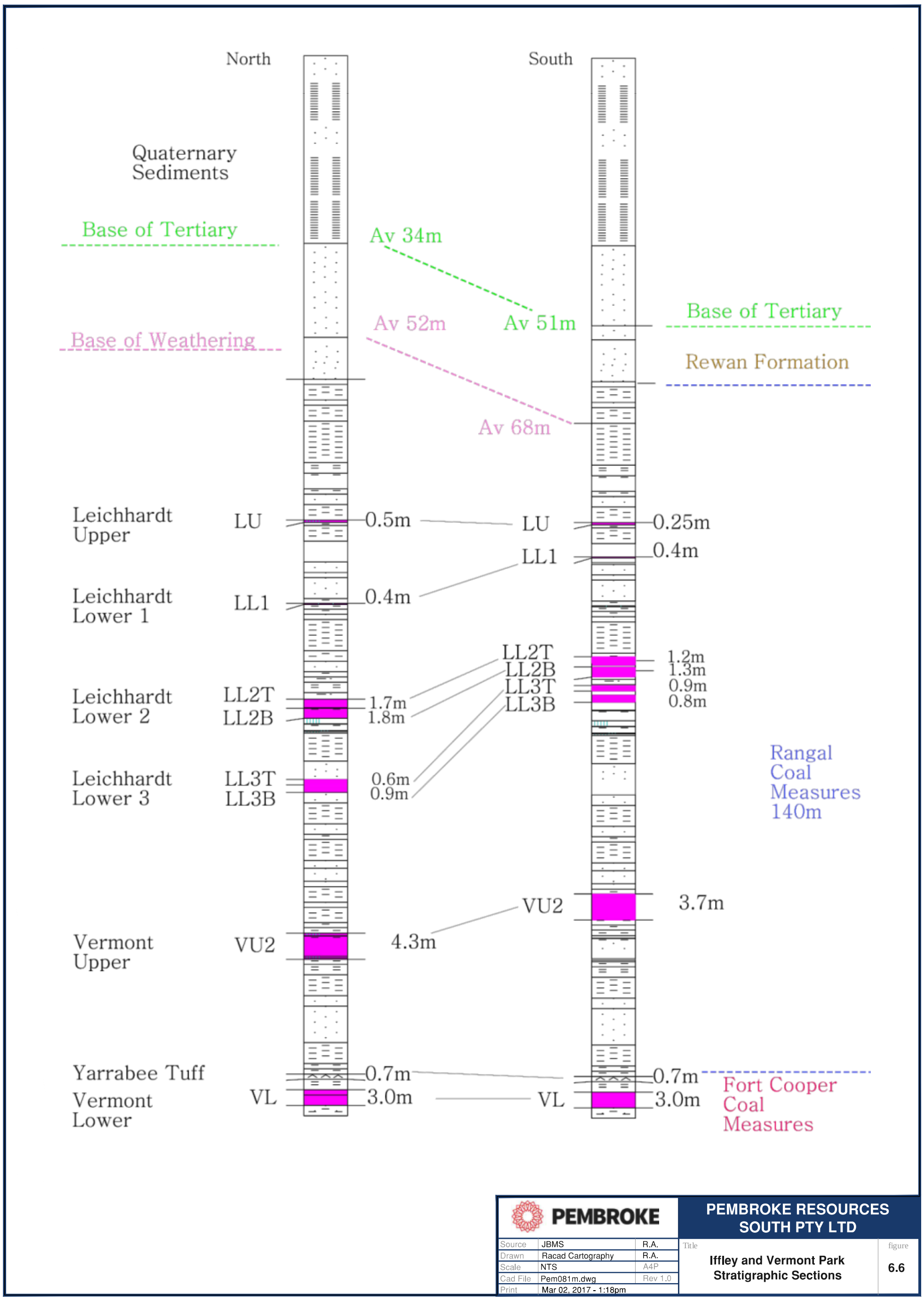
The LL2 Seam consists of a dull upper working section (“**LL2T**”) with an average thickness of 1.7 metres. This section has a low CSN but can produce a satisfactory PCI product. The LL2B Seam basal section has an average thickness in the order of 1.8 metres. This section can produce both coking and PCI product (based on sizing).

The LL3 Seam consists of an upper working section (“**LL3T**”) that averages 1 metre thick. This section thins to less than 0.5 metres in the north. The basal LL3B Seam section has an average thickness in the order of 0.9 metres. Despite the LL3 Seam being split into two sections in the structural database, Peabody has combined the sections for the product quality assessment probably due to the thin thickness of the combined unit. The LL3 Seam is close to the LL2 Seam in the southern half of the deposit.

The VU2 Seam averages 3.8 metres thick ranging from 1.5 to 6.5 metres. This seam appears to have larger thickness variability probably as a result of thrust faulting. This seam has an average raw ash in the order of 18% and will produce coking coal.

The Vermont Lower Seam (“**VL1**”) is high ash, banded and not considered prospective. The VL1 Seam is close to the VU2 Seam in the north but splits away to the south and is more than 20 metres below the VU2 Seam over most of the deposit.

Figure 3-6 Olive Downs South stratigraphic section

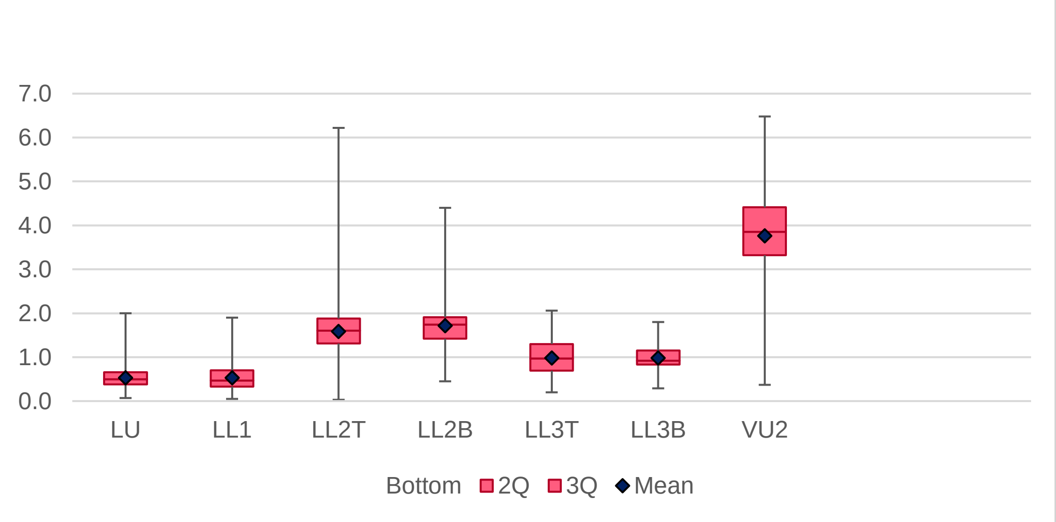


All seams show reasonably consistent trending in thickness with some bull's eye seam thickness variation due to faulting, natural sedimentary variation, and in uncommon cases, igneous intrusion thickening the seam. The VU2 Seam shows the most thickness variation. Fault thickening and seam repeats are not uncommon in the fault zones. Anomalous thicknesses (super thick or super thin) are generally removed from the modelling data. Seam repeats are not included in previous resource estimations or this assessment. It is possible that mining losses around fault zones could be offset by gains from seam repeats.

Note that in this area drill hole deviation is generally not large as the drill holes are generally < 350 metres in depth and the first 60 metres is soft weathered material in which the drill holes tend not to deviate.

The following whisker plot chart displays seam thickness variation.

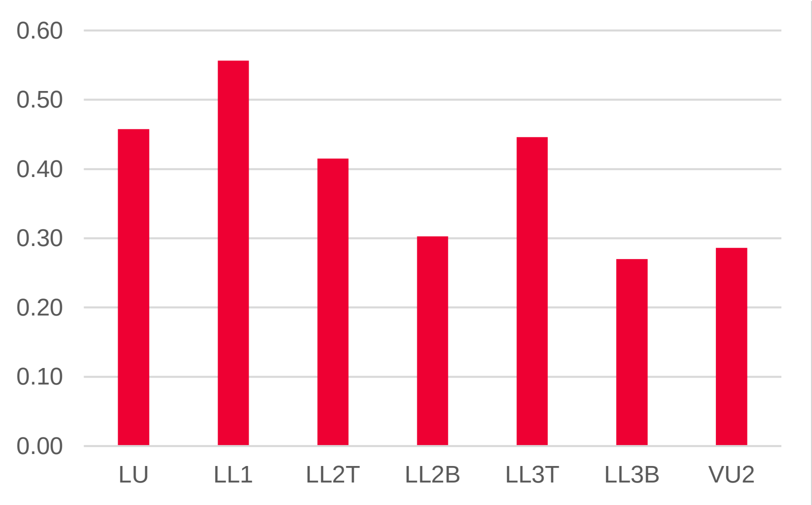
Figure 3-7 Olive Downs South seam thickness whisker plot



The following chart provides a non-spatial indication of the consistency of the seam thickness. The coefficient of variation ("**CV**") is one of many statistical methods that provides an indication of the variability of an element. The CV is defined as the ratio of the standard deviation to the mean. Data sets with a CV below 1 are considered low-variance. The following charts show the CV's for ply thickness. The CV's of ply thickness are, with few exceptions, well below 1 indicating low variance. This is supported by contour plots of these parameters.

It should be noted that classical statistics are non-spatial. They are useful however, in highlighting potential errant data.

Figure 3-8 Olive Downs South seam thickness coefficient of variation



3.5.2 Willunga

As for Olive Downs South, the Leichhardt and Vermont Seams form the principal economic coal resources in the Willunga resource area. The principal seams are LL1 Seam, LL2 Seam, LL3 Seam, VU1 Seam and VU2 Seam. The high gamma marker at or near the floor of the Vermont Upper Seam is interpreted to be the Yarrabee Tuff.

Figure **3-9** represents a diagrammatic section of the typical seam stratigraphy of the area.

The uppermost seam in the sequence is the LU Seam. The occurrence of this seam is inconsistent and it is not regarded as a resource.

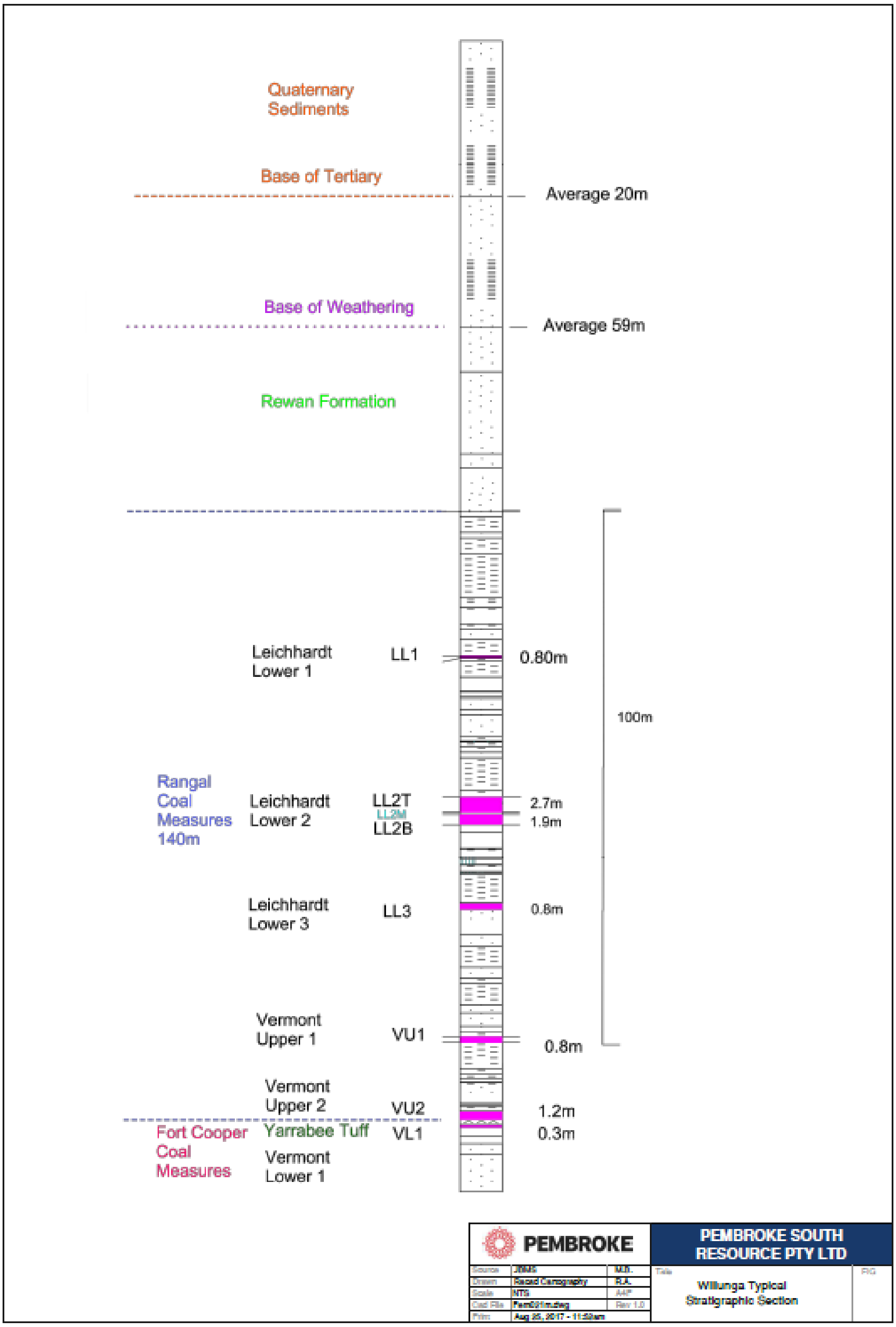
The LL1 Seam is thin 1 to 2 metres and tends to thicken to the south. The seam has a high raw ash.

The LL2 Seam consists of an upper working section (LL2T) having a moderate raw ash in the order of 22%, a high ash middle section (LL2M generally >50% ash), which tends to be stony. The LL2B Seam basal section is generally low ash. The LL2 Seam splits rapidly and deteriorates approximately 1 km south of the Isaac River. The LL2 Seam splits are set to zero thickness in this area. Both the LL2T and LL2B Seam sections thin to the west, however the LL2B Seam thinning has a more severe effect on ratios in the western lobe of the resource area.

The LL3 Seam is generally less than 1 metre thick. This seam also thins and deteriorates south of the Isaac River.

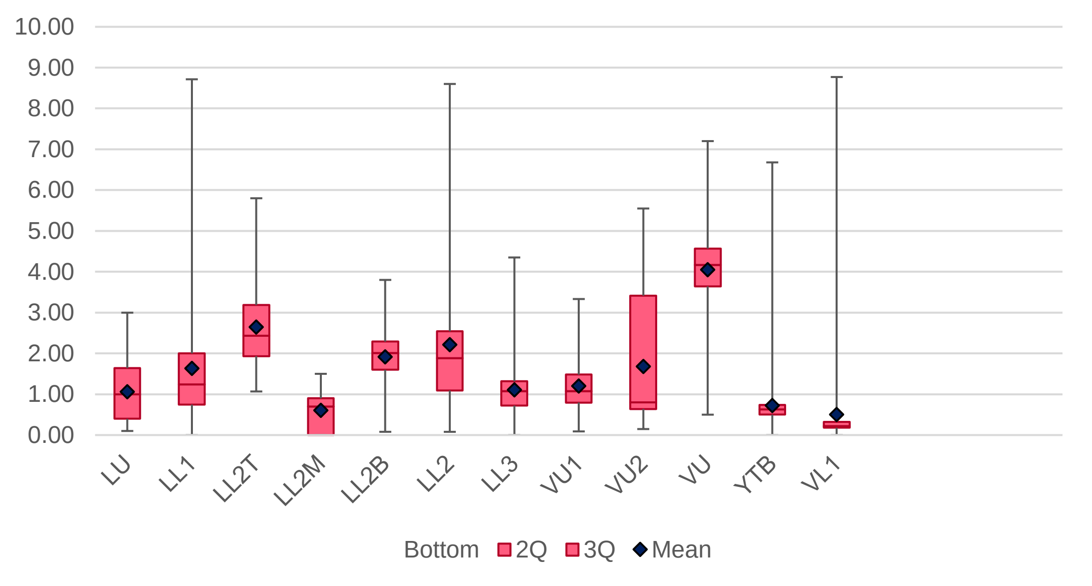
The Vermont Upper Seam splits into its components, VU1 and VU2, in the central and central north areas. The VU1 Seam is in the order of 1 to 1.5 metres thick. The VU2 Seam is thick where it coalesces with the VU1 Seam (~3.5 metres) but thins rapidly away from the split line to less than 1 metre.

Figure 3-9 Willunga stratigraphic section



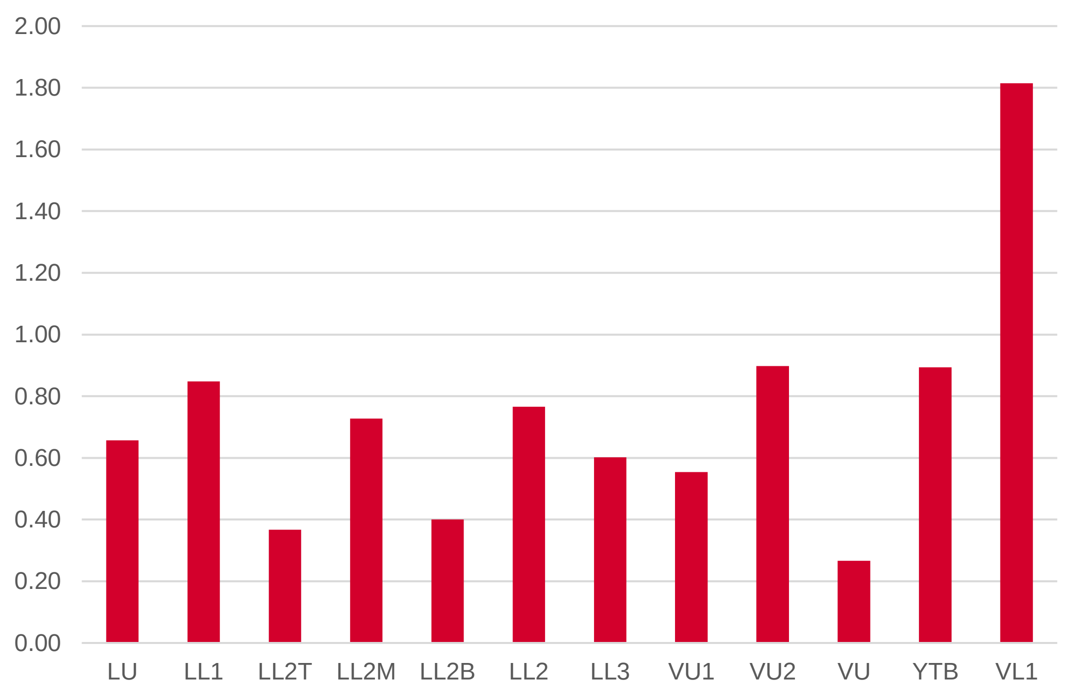
There is a fair variation in seam thickness in Willunga. Seam thickness variation as shown by the following whisker plot chart (Figure 3-10) is due to natural sedimentary variation faulting and in uncommon cases igneous intrusion thickening the seam.

Figure 3-10 Willunga seam thickness whisker plot



The following CV chart (Figure 3-11) provides a non-spatial indication of the consistency of the seam thickness in Willunga. Willunga seam CV are slightly larger than the ODS seam CV indicating greater variability.

Figure 3-11 Willunga seam thickness coefficient of variation



4. Coal quality

Both ODS and Willunga deposits have comprehensive coal quality data to support three MLs and two SPMLs and the overall development of the Project. The resources at ODS and Willunga are considered to have excellent prospects of eventual extraction by open cut, highwall mining and in places underground methods.

The ODS coal seams will deliver both high rank, low volatile coking coal product and have a JORC Resource of 460Mt. The reflectance of the ODS seams is in the order of 1.30% to 1.40%. Lowering seams may be beneficiated to a PCI product. Phosphorus ("**Phos**") is not excessive (<0.08) with the exception of the LL2T, section which will only produce a PCI product. Despite a fair degree of structural deformation, the seams in this area demonstrate reasonably consistent trends in quality.

Willunga coal seams will deliver a low volatile PCI product and have a JORC Resource of 353Mt. The reflectance of the Willunga target seams is in the order of 1.70% to 1.90%.

The ODS and Willunga deposits' regional and local geological setting is well understood and adequately defined by drilling. Comprehensive coal quality analyses have been undertaken. Data analyses and verification throughout the exploration phase has identified and allowed correction of outlier data (where valid). Critical data is viewed as raw ash and yield, which are well defined by core analyses. The seams show consistent coal quality and thickness, demonstrated by locally trending model contours and low CV. 2D seismic surveys contribute to the structural understanding and provide support for seam continuity.

Optimiser studies on both deposits using various pricing scenarios indicate that an open cut mine is viable within a 10-year period to depths in the order of 200 - 300 metres. Highwall and underground mining of the various seams is also possible, thereby extending the resources.

4.1 Sampling and analyses styles

Samples were taken on a ply by ply basis. Raw coal quality analyses were carried out on coal samples including proximates, RD, CSN and TS. Stone samples were analysed for RD and ash. Table 4 summarises the sampling and analyses statistics.

Table 4 Sampling and analyses summary

Sampling and Analyses	Olive Downs South	Willunga
Sampling detail	Ply samples generally < 0.5m	Ply samples generally < 0.5m
Raw Coal analyses	142 holes	166 holes
Clean Coal Composite analyses	138 holes	145 holes

Generally, a seam was re-drilled if core recovery of coal was < 95%. Core size was predominately 102 mm (4C) – the remainder being 63 mm size core.

4.1.1 Olive Downs South

Ply samples were combined into working section composites, generally whole seam for thin seams (LU and LL1) or LL2T, LL2B, LL3T and LL3B Seams and VU2 Seams. The working section composites were subject to detailed float/sink testing on crushed, unsized samples (12.7 metres x 0).

Based on the washability results a target ash for the clean coal composite ("**CCC**") was chosen from the following nominal targets: 7.0% coking coal, 8.5%, 9.0%, 9.5%, 10% coking coal or 10% PCI, 14% PCI. The most common CCCs were to a 10% ash product.

CCC analyses were very comprehensive including proximates, CSN, TS, SE, Hardgrove Grindability Index ("**HGI**"), ultimate analyses, ash fusion temperatures (oxidising and reducing), ash analyses. Low target ash composites were subject to Gieseler Fluidity and Dilation testing as well as vitrinite reflectance.

4.1.2 Willunga

Ply samples were combined into working section composites, generally whole seam for thin seams (LL1, LL3) or LL2T, LL2M, LL2B for the LL2 Seam and VU1 and VU2 for the VU Seam. The working section composites were subject to detailed float/sink testing on crushed, unsized samples (12.7 metres x 0).

Based on the washability results a target ash for the CCC was chosen from the following nominal targets: 7.0% coking coal, 8.5% PCI, 10% PCI, 14% PCI or 17% thermal coal. The most common CCCs were 10% PCI and 17% thermal. The thermal composites were only conducted on the poor yielding working sections such as LL1, LL2M and LL3 Seams.

CCC analyses were very comprehensive including proximates, CSN, TS, SE, HGI, ultimate analyses, ash fusion temperatures (oxidising and reducing), ash analyses. Low target ash composites were subject to Gieseler Fluidity and Dilation testing as well as vitrinite reflectance.

4.2 Modelling

Modelling was carried out using Maptel's Vulcan Software.

4.2.1 Structure modelling

As most drill sites had two or more holes intercepting the seams, declustering was necessary to obtain an optimum model. Constraints are applied in seam thickness modelling to exclude over-thickened and under-thickened intersections from the model. Over-thickened intercepts are due to thrust fault repeating or lack of geophysical logs allowing correction. Under-thickened seam intercepts are principally due to faulting and in some cases lack of geophysical logs. In the process of eliminating an "errant" seam thickness intercept, one of either the seam roof or floor is re-interpolated based on the seam thickness in surrounding holes. This method allows the seams' relative position to be maintained while correcting the thickness.

The Vulcan "**FixDhD**" seam interpolator is used to interpolate missing seams and to break the LL2 and VU Seams into their component splits. In addition, FixDhD calculates seam/ply intercepts using down hole deviation data. Hole deviation is generally not significant in this deposit due to the relatively deep weathering.

The grid size for structural modelling is 25 metres x 25 metres in ODS and 50 metres x 50 metres in Willunga. A sedimentary model (un-faulted model) of seam structure roof and floor are generated using the "fixed" intercepts. In this stage the thickness of seams and mid-burdens are calculated.

A reference surface is created based on interpolated seam floor points, faults, fold axes and dummy control points using the triangulation algorithm with first order trending and no smoothing. The seam sequence is re-stacked around the reference surface using the sedimentary thickness models.

The seam thickness is re-set to zero in intruded zones (as delimited by intrusion mask strings). Each seam has a unique mask. This only applies to a small area of the VU2 Seam in the north in ODS and small areas in Willunga.

Lox lines are calculated by the intersection of the base of weathering surface with the seam structure roof (full fresh Lox) and seam structure floor (full weathered Lox).

The seam models are subsequently clipped to the base of weathering surface. Finally, the fresh coal thickness is back calculated from the clipped surfaces.

4.2.2 Coal quality modelling

Olive Downs South

Whole seam raw coal quality models (100 metres x 100 metres grid size) were generated using the inverse distance algorithm (power = 1, maximum of 6 points). Raw quality parameters modelled are laboratory RD, inherent moisture, ash, CSN and Volatile Matter ("**VM**").

Clean coal quality parameters modelled are plant simulation F1.55 yield and ash. VM, TS and Phos in coal is calculated from dry ash free data and based on the F1.55 ash and assuming an inherent moisture of 1.56. Other CCC data modelled is CSN, log fluidity, Ro Max, total vitrinite, reactives and basicity index.

Willunga

Whole seam raw coal quality models (100 metres x 100 metres grid size) were generated using the inverse distance algorithm (power = 1, maximum of 6 points). Raw quality parameters modelled are laboratory RD, inherent moisture, ash, VM, TS and Phos in coal.

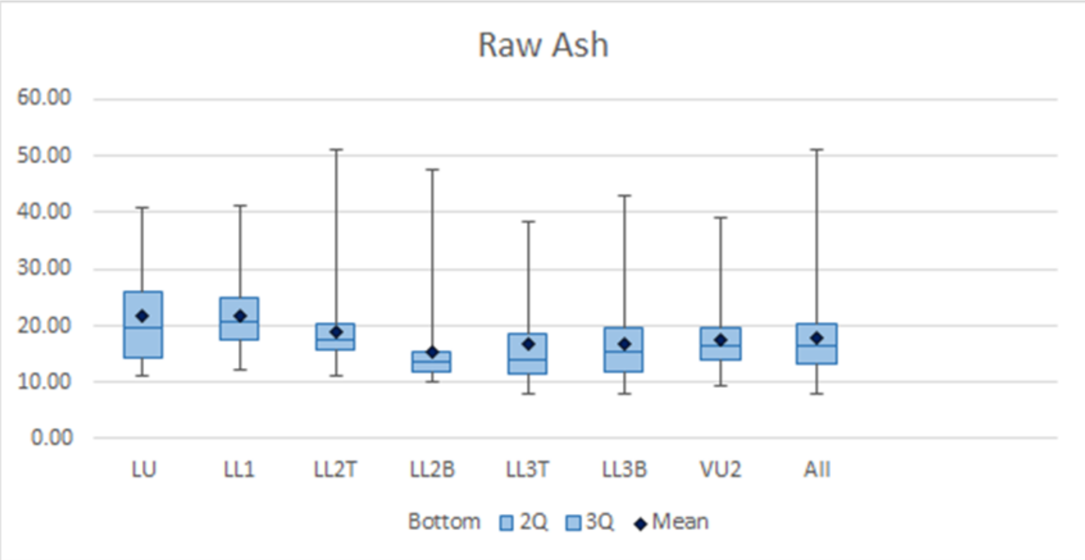
Clean coal quality parameters modelled are laboratory yield, ash, VM (adb), VM (daf), CSN, TS and Phos in coal.

4.3 Olive Downs South raw coal quality

The following raw ash whisker plot chart (

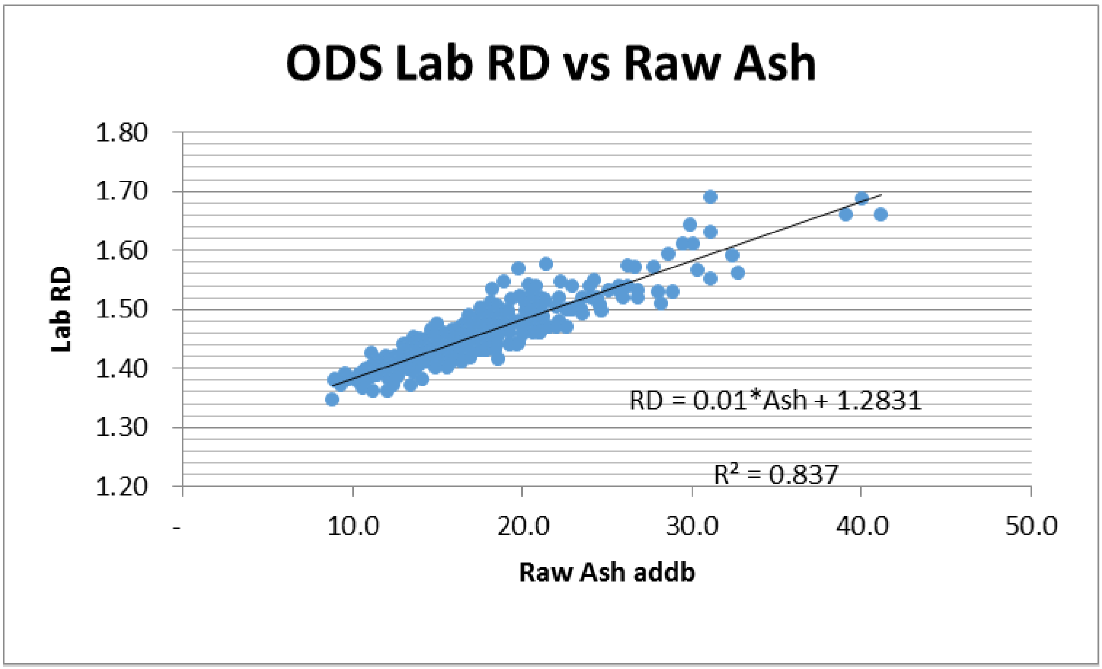
Figure 4-1) demonstrates seam raw ash statistics.

Figure 4-1 Olive Downs South Seam Raw Ash Statistics



There is a strong relationship between Raw Ash and Laboratory (pycnometer) RD as shown in the following Figure 4-2.

Figure 4-2 Olive Downs South Laboratory RD versus Raw Ash



Similarly, there is a strong relationship between Raw Ash and Specific Energy (MJ/kg) as shown in the following Figure 4-3.

Figure 4-3 Olive Downs South Specific Energy versus Raw Ash

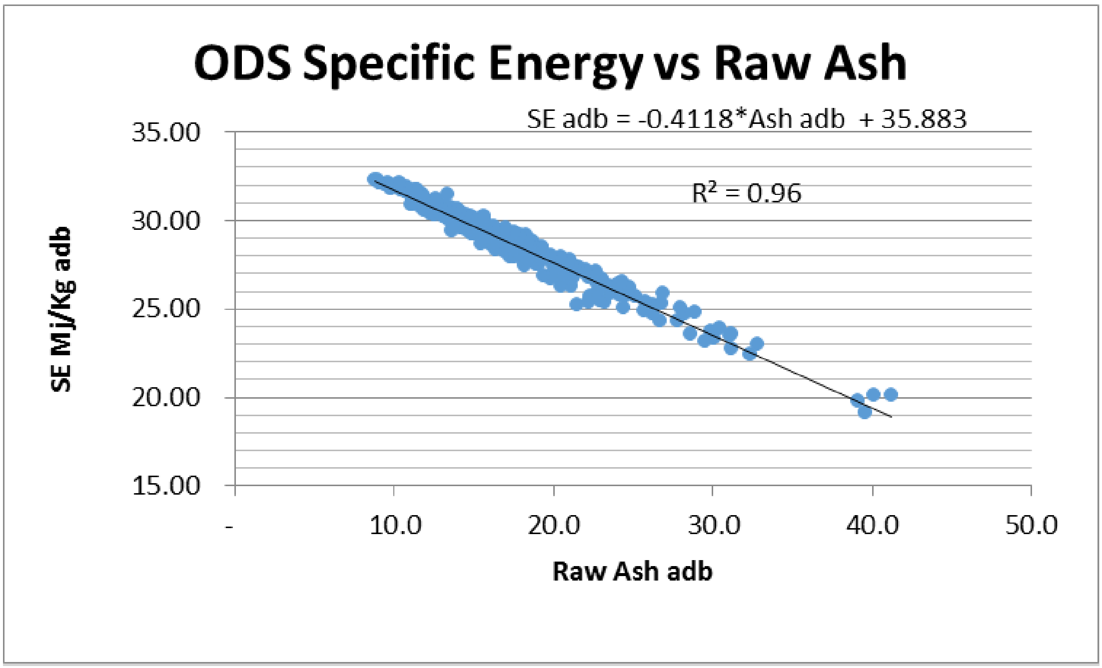


Table 5 summarises the working section Raw Coal quality within the 12:1 ratio area.

Table 5 Raw Coal Quality Summary

Seam	Tonnes (Mt)	Lab RD (g/cc)	Inherent Moisture (ad)	Raw Ash (ad)	Raw Volatiles (ad)	CSN
LU	2.7	1.49	1.2	23.1	20.8	6.6
LL1	3.5	1.49	1.3	22.1	19.0	3.8
LL2T	28.5	1.49	1.3	17.7	18.2	1.2
LL2B	30.4	1.42	1.4	14.3	19.1	2.9
LL3T	13.4	1.42	1.3	14.6	18.7	3.8
LL3B	18.2	1.42	1.2	15.6	19.7	6.9
VU2	90.1	1.46	1.4	18.4	18.9	3.9
Total	187					

4.4 Olive Downs South clean coal quality

Ply samples were combined into working section composites, generally whole seam for thin seams (LU, LL1) or LL2T, LL2B, LL3T, LL3B and VU2 Seams. The working section composites were subject to detailed float/sink testing. Based on the washability results a target ash for the CCC was chosen.

The CCC are 9-10% ash coking or PCI product. The LL2T section is a PCI product. The LL2B section produces a coking and PCI product based on a sizing classification. The LL3 sections have been combined for product quality assessment probably due to the low thickness of the combined unit and that both sections produce a coking product.

Table 6 details the product by seam.

Table 6 Target product by seam

Seam	Primary Coking	Secondary PCI
LU		
LL1		
LL2T		
LL2B		
LL3		
VU2		

In order to model and evaluate the product qualities a modelling database was compiled. The database is based on the following data sources:

- CCC with a target ash close to 10%. This data includes proximates, CSN, TS, ash analyses and petrographics. Fluidity results were not included; and
- Plant simulation results for F1.55 yield and ash and also yield and ash at a 10% ash target.

A density of SG 1.55 will deliver an ash closest to the target range of 9-10%.

Table 7 summarises the coking product qualities by seam in the SR = 12:1 area, assuming the plant simulation F1.55 ash and a product inherent moisture of 1.56%.

Table 7 Coking product qualities by seam in the SR = 12:1 area

	Floats F1.55					Clean Coal Comp Product @~10 Ash					
Seam	Plant Sim Yield %	Plant Sim Ash %(ad)	Phos %(ad)	TS %(ad)	VM %(ad)	CSN	Max Fluidity Log_{10}	R_o Max	Vitrinite %	Total Reactives	Basicity Index
LU	70.3	10.0	0.063	0.46	21.8	7.1	1.59	1.28	74	80	0.21
LL1	84.0	12.7	0.060	0.38	18.9	4.6	0.78	1.31	51	63	0.14

LL2B	60.8	9.5	0.069	0.34	18.9	4.3	0.34	1.36	46	62	0.16
LL3B	81.7	9.4	0.079	0.40	19.3	5.0	0.37	1.36	48	63	0.15
LL3T	83.8	10.0	0.081	0.45	19.6	6.2	0.95	1.36	55	67	0.16
VU2	79.7	10.0	0.043	0.39	18.7	4.4	0.38	1.40	54	66	0.27
Weighted Av	76.5	10.0	0.055	0.39	19.0	4.7	0.47	1.38	53	65	0.23

Reactives = Total Vitrinite +1/3 Semifusinite

Basicity Index (BI) = (Fe2O3 + CaO + MgO + K2O + Na2O)/(SiO2 + Al2O3)

Approximately 80% of the product is coking coal.

Gieseler fluidity and Dilatometer results are viewed unreliable due to delays in testing clean coal composites (6 months or more) and the use of organic liquids for float sink have a detrimental effect on the results due to oxidation. This is a real problem for Rangal coals which typically have lower fluidity with high decay rates. Using lab fluidity from CCC would give a biased low result.

Table 8 summarises the PCI product qualities by seam with the 12:1 area.

Table 8 PCI Product Qualities by seam in the SR = 12:1 area

Seam	Plant Sim F1.55 Yield (%)	F1.55 Ash (% ad)	F1.55 Phos (% ad)	F1.55 TS (% ad)	F1.55 VM (% ad)
LL2T	81.5	11.9	0.142	0.32	17.8
LL2B	37.6	11.6	0.074	0.33	18.3

4.5 Olive Downs South plant simulation yield

Peabody created "feed files" for plant simulations from the CCC washability data. That data, however, is unsized so some significant "assumptions" must have been made as to size distribution. These assumptions have not been revealed to Pembroke.

Simulations were run on an average washability feed file to determine that a Dense Medium Cyclone ("**DMC**") cut-point of SG 1.55 would on average produce a 10% ash product.

On the individual bore cores for each seam both fixed density simulations (DMC SG 1.55 & Spirals SG 1.70) and fixed ash simulations (10.0% Target) were run.

Having both options allows the ability to optimise yield by either fixed SG or fixed ash for each seam. There will be seams from some pits where the coking coal ash is >10% and other seams where the ash is <10%.

The yield basis is feed moisture. An adjustment (increase) will be required to convert to product moisture. The yields do not account for out-of-seam dilution.

4.6 Olive Downs South CSR

There are no CSR test results on ODS coal. A CSR of 54 has been estimated by Peabody for the ODS product from data obtained from Olive Downs North coal. Exploration planned for ODS includes large diameter cores to generate sufficient sample mass for 10 kg oven CSR tests to be conducted.

The following table provides comparison quality data for current RCM mines.

Table 9 Rangal Coal Measures mines product quality

	Ash (ad)	VM (ad)	R_OMax	Basicity Index	Vit (%)	Reactives (%)	CSR (%)
Hail Creek standard	8.5	20.4	1.33	0.09	52.9	>53	NA
Lake Vermont	9	20.5	1.22	0.14	NA	NA	62
Daunia	9	21.5	1.28	0.11	48	59	NA
Curragh	7	21.5	1.27	0.20	55	64.7	NA
Poitrel	8.7	22.8	1.16	0.17	61	NA	NA
ODS	10	19.0	1.38	0.23	52.5	65	
Burton standard	8.5	22.6	1.18	0.11	47.3	56	60

ODS is similar to Curragh in quality, with a slightly higher basicity index.

The following table shows ash analyses numerical averages that Iron in ash.

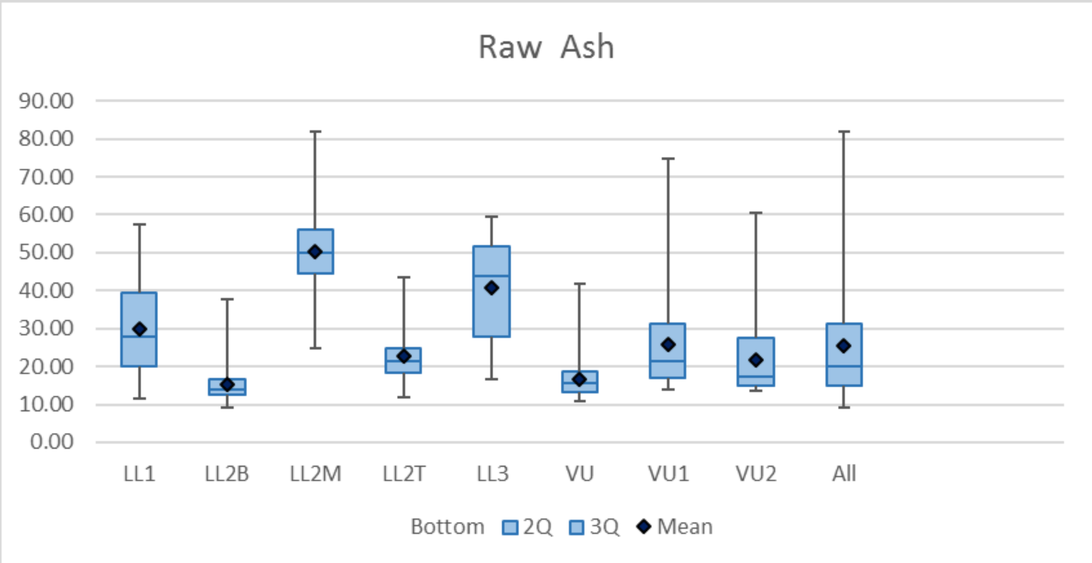
Table 10 Seam average ash analysis

Seam	Primary SiO2	Primary Al2O3	Primary Fe2O3	Primary CaO	Primary MgO	Primary Na2O
LU	60.2	19.9	4.1	8.83	0.68	0.23
LL1	62.8	21.9	4.6	4.99	0.68	0.28
LL2B	49.2	32.8	7.1	4.04	1.36	0.44
LL3T	54.2	28.2	6.5	4.08	1.20	0.42
LL3B	56.4	25.5	6.3	4.62	1.07	0.39
VU2	50.5	26.6	11.6	3.55	1.71	0.41
Weighted Average	51.8	27.3	9.6	3.92	1.49	0.41

4.7 Willunga raw coal quality

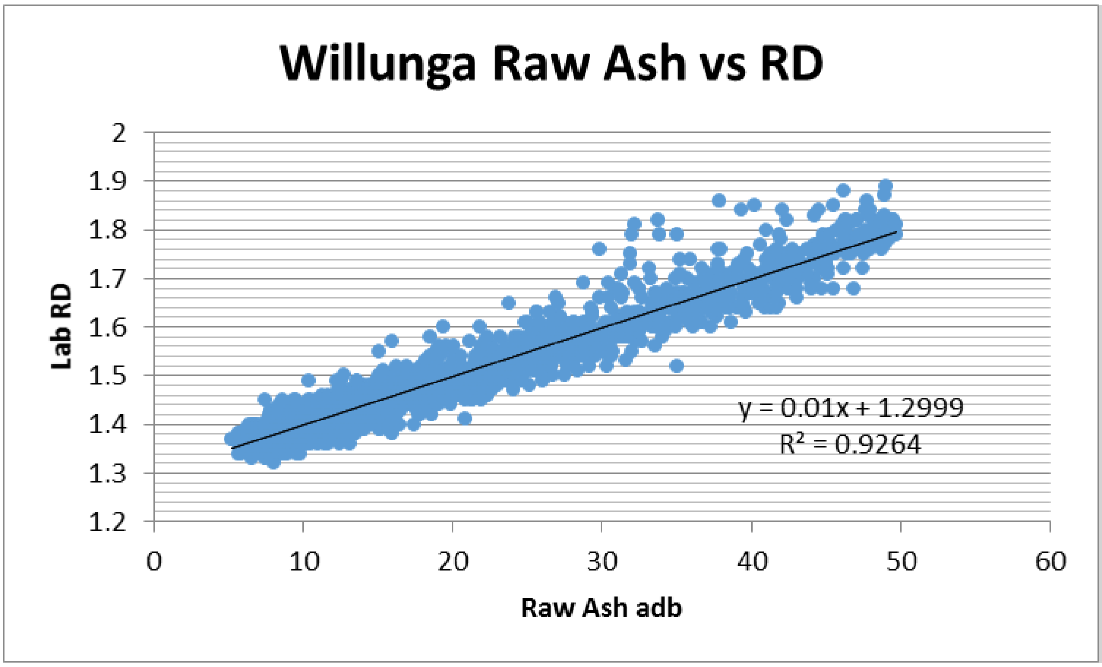
Figure 4-4 demonstrates seam raw ash statistics.

Figure 4-4 Willunga seam raw ash statistics



There is strong relationship between raw ash and laboratory (pycnometer) RD as shown in the Figure 4-5. This relationship is essentially linear for ash < 50%.

Figure 4-5 Willunga Laboratory RD versus Raw Ash



Similarly, there is a strong relationship between Raw Ash and Specific Energy ("**MJ/kg**") as shown in

Figure **4-6**.

Figure 4-6 Willunga Specific Energy versus Raw Ash

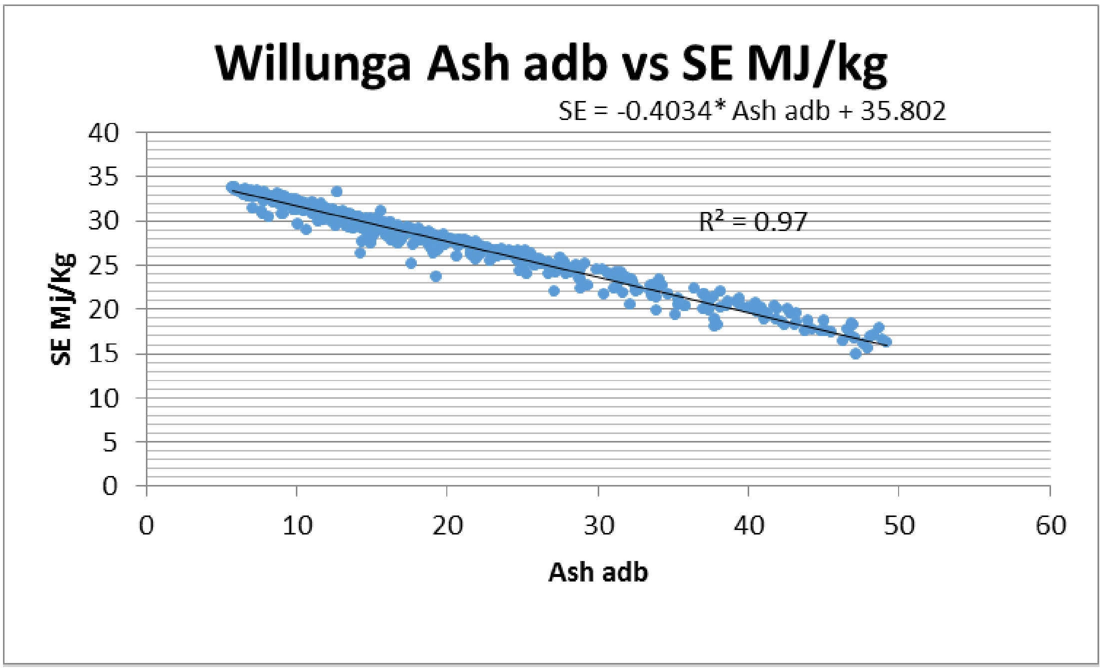


Table 11 summarises the Raw Coal Quality within the 12:1 strip ratio area.

Table 11 Raw Coal quality summary

Seam	Av Thick (m)	RD (g/cc)	Tonnage proportion	IM (% ad)	Ash (% ad)	VM (% ad)
LL1	0.97	1.68	4%	1.6	36.3	12.2
LL2T	2.72	1.53	32%	1.4	22.1	12.3
LL2M	0.75	1.80	2%	1.8	45.3	11.3
LL2B	2.02	1.45	23%	1.3	15.2	12.6
LL3	1.03	1.69	6%	1.5	35.3	13.2
VU	4.46	1.48	23%	1.5	17.5	11.1
VU1	1.28	1.61	4%	1.5	30.8	11.6
VU2	1.62	1.52	6%	1.3	23.1	10.9

4.8 Willunga clean coal quality

Ply samples were combined into working section composites – generally whole seam for thin seams (LL1, LL3) or LL2T, LL2M, LL2B for the LL2 Seam and VU1 and VU2 for the VU Seam. The working section composites were subject to detailed float/sink testing. Based on the washability results a target ash for the CCC was chosen. The most common CCCs were 10% PCI and 17% thermal. The thermal composites were only conducted on the poor yielding working sections such as LL1, LL2M and LL3.

Note that LL2M is the parting between the LL2T and LL2B and only qualifies as a resource when the raw ash is < 50%.

Table 12 Target product by seam

Seam	Product/Target Ash
LL1	17% Ash Thermal
LL2T	10% Ash PCI
LL2M	17% Ash Thermal
LL2B	10% Ash PCI
LL3	17% Ash Thermal
VU1	10% Ash PCI
VU2	10% Ash PCI
VU	10% Ash PCI

Approximately 90% of the tonnage in the Measured and Indicated area can produce a PCI product.

Table 13 Clean coal composites by seam

Seam	Tonnage proportion	Lab Yield %	Target Ash (% ad)	VM (% ad)	VM (% daf)	CSN	Phos (% ad)	Total Sulphur (% ad)	SE Gross (ad) MJ/kg
LL1	4%	68.5	17.0	12.5	15.4	-	0.122	0.47	28.93
LL2T	32%	72.0	10.0	12.2	13.9	0.5	0.115	0.41	31.76
LL2M	2%	45.8	16.9	12.6	15.4	-	0.072	0.40	28.97
LL2B	23%	90.2	10.0	12.5	14.1	0.5	0.117	0.50	31.76
LL3	6%	68.4	16.9	12.4	15.1	-	0.033	0.48	28.98
VU	23%	83.2	10.0	11.0	12.4	0.5	0.143	0.44	31.76
VU1	4%	73.1	10.0	12.3	13.9	0.5	0.095	0.50	31.75
VU2	6%	68.8	10.0	11.3	12.9	0.5	0.097	0.46	31.76

Phos levels are observed to increase significantly in middlings fractions >F1.45. Two stage washing would allow minimisation of Phos in the primary PCI product to <0.1% by reducing cut points for the primary product and diverting higher Phos secondary product to a specific high Phos PCI product or into thermal product. This provides the additional benefit of maintaining acceptable total yields by recovering the middlings into the secondary product.

Two stage process simulations conducted for Macarthur's Willunga pre-feasibility study on large diameter core (BF1576LC) used Phos as the limiting constraint and not ash, maintained a target Phos at <0.1% at an ash of 9.5% with secondary middlings reporting to a 17% ash product. Higher Phos intervals were processed at low cutpoints and yielded lower Phos low ash, with lower Phos intervals processed at high cutpoints producing low phos and high ash.

The two stage Coal Handling Preparation Plant ("**CHPP**") simulation of the large diameter core data indicated primary product yield of 62.5% at 9.5% ash and 0.099% P, with secondary product yield of 18.8% at 16.6% ash and 0.248% P, allowing specifications to meet premium PCI pricing.

Product blending with ODS-derived product would also benefit lower Phos products.

4.9 Willunga yield

There is no detailed simulated yield data for the Willunga deposit at this stage because no washability data is available. The Willunga pit is not opened until approximately year 10 of the mine plan as such for the purposes of this plan the infrastructure has been designed with a view that yields would be of a similar magnitude as ODS but of a low value product. As further coal testing is undertaken in future stages of the project process this will be adjusted as required. A conservative view on the quantity of product coal has been taken to not under-estimate the infrastructure requirements.

4.10 Resource classification

Confidence classification involves evaluation of both structural definition as well as grade definition.

A quality point of observation for each ply is defined as a cored hole with coal recovery of > 90% and having raw ash data. Almost all raw ash data points have associated CCC and float sink (“**F/S**”) data.

A quantity point of observation for each ply is defined as a ply drill hole intercept with downhole geophysics or fully-cored section. The vast majority of structural holes have geophysics.

Supporting data for coal continuity are holes with downhole geophysics and 2D seismic surveys over the area. The structural geology and the igneous geology is well understood.

Seam thickness contours indicate strong continuity and reasonable consistency with local trending. Seam thickness statistics indicate a generally low CV supporting the view of consistency. Seam correlation is aided by a good stratigraphic marker, the Yarrabee Tuff, and facilitated by downhole geophysics and detailed core logging.

Both raw coal ash and seam thickness have a low CV. The consistency of raw coal ash provides additional confidence in the resource classification.

Results from preliminary geostatistical analyses indicate that the drill hole spacing criteria used in the previous assessment (as detailed below) is conservative.

Given that the geostatistical studies are not exhaustive, the drill hole spacing criteria used in the previous assessment has been used in this assessment.

Table 14 Drill hole spacing for resource classification

Classification	Radius of Influence (m)	Distance Apart (m)
Measured	250	500
Indicated	500	1,000
Inferred	1,000	2,000

Tonnages are divided by depth of cover to each seam into the following categories - < 200 metres and 200 – 300 metres. Resources are also categorised by EPC.

Laboratory (true) RD is modelled directly from laboratory RD data. In situ RD is calculated via the Preston & Sanders formula using the True RD model, Inherent Moisture model and an assumed in situ Moisture of 6%. The Inherent Moisture is in the order of 1.5% for both areas.

Table 15 Olive Downs South resources

Seam	Depth (m)	Measured (Mt)	Indicated (Mt)	Inferred (Mt)	Total
LU	<200m	-	3.6	1.6	5.2
LL1	<200m	1.4	3.9	1.7	7.0
LL2T	<200m	18.4	19.7	11.1	49.1
LL2B	<200m	17.5	22.3	15.5	55.3
LL3T	<200m	2.4	14.1	6.5	22.9
LL3B	<200m	3.3	18.1	5.6	27.0
VU2	<200m	38.7	72.9	37.8	149.4
Total	<200m	**81.6**	**154.6**	**79.7**	**315.9**

Seam	Depth (m)	Measured (Mt)	Indicated (Mt)	Inferred (Mt)	Total
LU	200-300m	-	1.3	0.5	1.8
LL1	200-300m	0.4	0.9	1.0	2.3
LL2T	200-300m	7.4	7.1	12.3	26.9
LL2B	200-300m	9.0	5.2	9.7	23.8
LL3T	200-300m	1.3	5.0	6.4	12.7
LL3B	200-300m	1.6	6.1	8.0	15.8
VU2	200-300m	14.4	33.3	12.9	60.6
Total	200-300m	**34.2**	**58.9**	**50.9**	**144.0**
Grand Total	**<300m**	**115.9**	**213.5**	**130.6**	**459.9**

Table 16 Willunga resources

Seam	Depth	Measured (Mt)	Indicated (Mt)	Inferred (Mt)	Total
LL1	<200m	-	10.6	7.6	18.2
LL2T	<200m	60.1	14.7	8.7	83.6
LL2M	<200m	4.0	0.8	0.3	5.1
LL2B	<200m	41.1	12.6	5.8	59.5
LL3	<200m	2.6	10.9	3.5	17.0
VU	<200m	32.9	15.6	0.6	49.1
VU1	<200m	5.1	5.2	4.0	14.3
VU2	<200m	0.8	9.3	6.6	16.7
Total	<200m	**146.7**	**79.6**	**37.1**	**263.4**

Seam	Depth	Measured (Mt)	Indicated (Mt)	Inferred (Mt)	Total
LL1	200-300m	-	0.7	6.9	7.6
LL2T	200-300m	2.9	9.8	11.6	24.2
LL2M	200-300m	-	-	0.6	0.6
LL2B	200-300m	0.1	9.0	9.5	18.6
LL3	200-300m	-	4.0	4.2	8.2
VU	200-300m	6.8	9.4	0.7	16.8
VU1	200-300m	-	1.7	2.0	3.7
VU2	200-300m	-	5.9	3.8	9.7
Total	200-300m	**9.8**	**40.5**	**39.2**	**89.5**
Grand Total <300m	200-300m	**156.5**	**120.1**	**76.3**	**352.9**

Table 17 provides a comparison of resources with previous work.

Table 17 Olive Downs South comparison of JORC resource estimates

Assessment	Measured Mt	Indicated Mt	Inferred Mt	Total Mt
Macarthur 2013	**103.4**	**146.6**	**71.0**	**321.0**
Pembroke 2016	**115.9**	**213.5**	**130.5**	**459.9**

Differences are principally due to additional drilling and coal quality data post 2013.

Table 18 Willunga comparison of JORC resource estimates

Assessment	Measured Mt	Indicated Mt	Inferred Mt	Total Mt
Macarthur 2011	**167.9**	**90.1**	**51.0**	**309.0**
Pembroke 2016	**156.5**	**120.1**	**76.3**	**352.9**

Differences in the Indicated and Inferred are due to extra drilling post 2011.

Table 19 states a summary of the 2017 JORC Reserves estimate.

Table 19 2017 JORC Reserves Estimate Summary (31st December 2017)

Location	Coal Type	Reserves			Marketable Reserves		
		Proved Mt	Probable Mt	Total Mt	Proved Mt	Probable Mt	Total Mt
Olive Downs South	**Met/PCI**	**0**	**290**	**290**	**0**	**223**	**223**
Willunga	**PCI/ Thermal**	**0**	**224**	**224**	**0**	**163**	**163**
Total		**0**	**514**	**514**	**0**	**386**	**386**

Notes:
1. Coal Resources quoted are inclusive of Coal Reserves quoted.
2. Coal Reserves have been estimated in accordance with the JORC Code (2012).
3. Olive Downs South and Willunga are planned to be mined using opencut mining methods.
4. Coal types: Met = Metallurgical Coal Product, PCI = Pulverised Coal Injection Product, Thermal = Thermal Coal Product
5. Coal Reserves are quoted on a Run of Mine (ROM) coal tonnage basis (7.0% moisture), which represent the tonnes delivered to the plant, and on a Marketable Reserve tonnage basis, which represent the product tonnes produced (10.0% moisture).
6. The tonnage is quoted as metric tonnes and abbreviated as Mt for million tonnes.

5. Mine development

5.1 Mine lease term

The applied term of the proposed MLs and SMPLs is 30 years each, with an operational life of mine plan for 79 years in total.

5.2 Pit optimisation

Pit optimisation studies have been undertaken on the ODS and Willunga deposits. These studies identified potentially mineable pit shells for both deposits that have formed the basis of the pre-feasibility mine design. Sensitivities were also conducted to show the relative change in pit shell footprint and floor with changes in margin, and this information has provided guidance on pit development and sequencing.

5.3 Mine design

The mine design for the ODS and Willunga domains has been based on an assessment of the output from the pit optimisation process described above, including slope design criteria, equipment assumptions, the basal seam dip direction and magnitude and physical working room restrictions.

Constraints have been placed on the design for maximum total depth below topography, proximity to the Isaac River, and the EPC boundaries.

5.3.1 Geological models

Two separate geological models have been used in the mine design process, one covering each of the ODS and Willunga domains. Both models are in Maptek Vulcan format and consist of structure and quality grids. The footprint for all grids exceeds that of the ODS and Willunga mine designs.

Grid spacing for each domain is shown below.

Table 20 Geological model grid spacing

Domain	Structure Grid Spacing (m)	Quality Grid Spacing (m)
Olive Downs South	25 m	100 m
Willunga	50 m	100 m

5.3.2 Mine design constraints

The pre-feasibility mine design was constrained to a total depth of 300 metres below topography, which is in line with the depth cut-off used in the calculation of resources.

The optimiser pit shells extended deeper than 300 metres, but this is not considered practical to mine by open cut methods at this time.

Where possible, the mine designs extend to the optimiser shell limits or the 300 metre total depth limit. It should be noted however that the financial inputs to the optimiser process are simplistic, and more detailed design, scheduling and financial analysis may reduce the overall design footprint and therefore the contained coal tonnes.

The overall design footprints for Olive Downs South and Willunga are shown below.

Figure 5-1 Olive Downs South Footprint

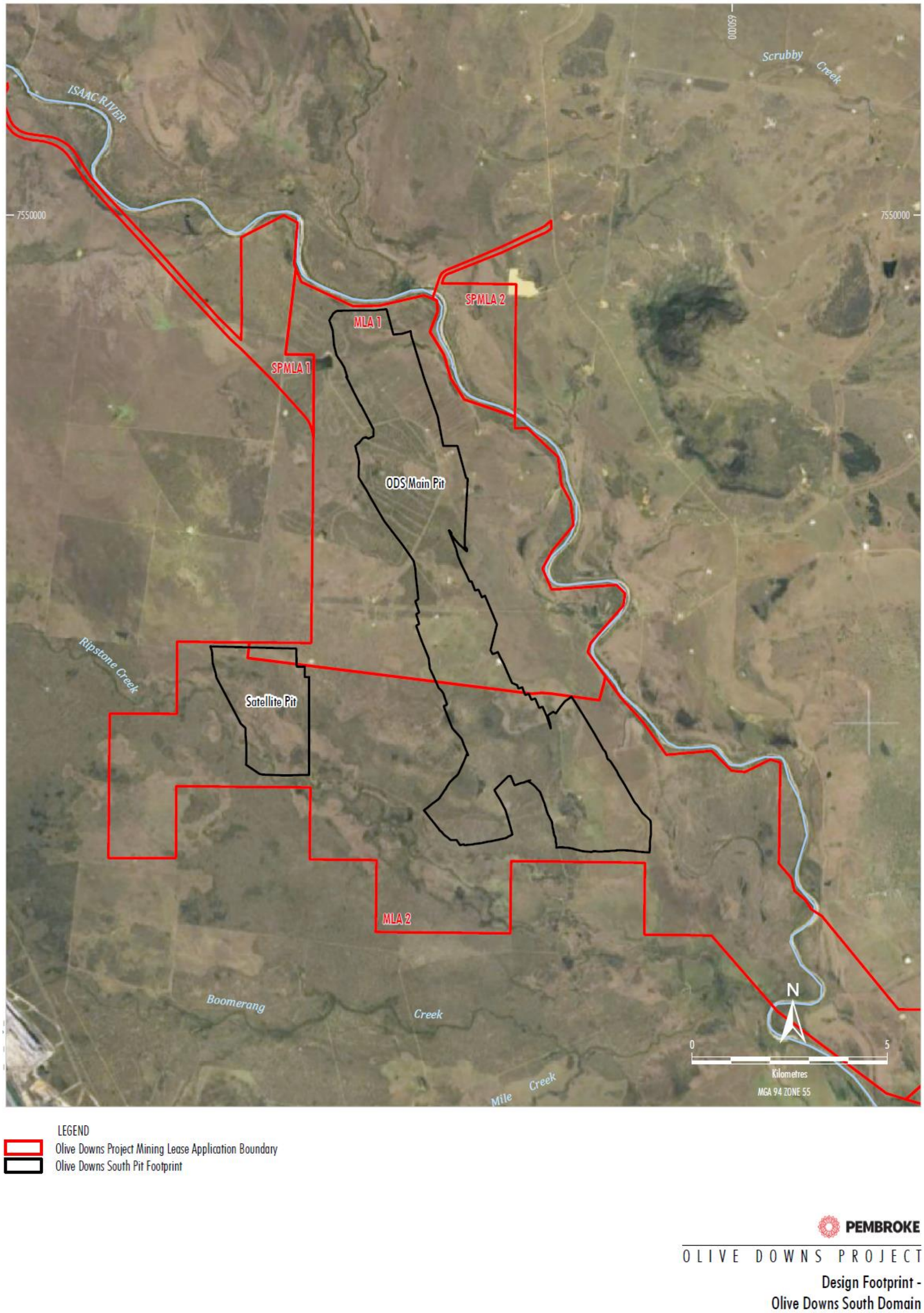
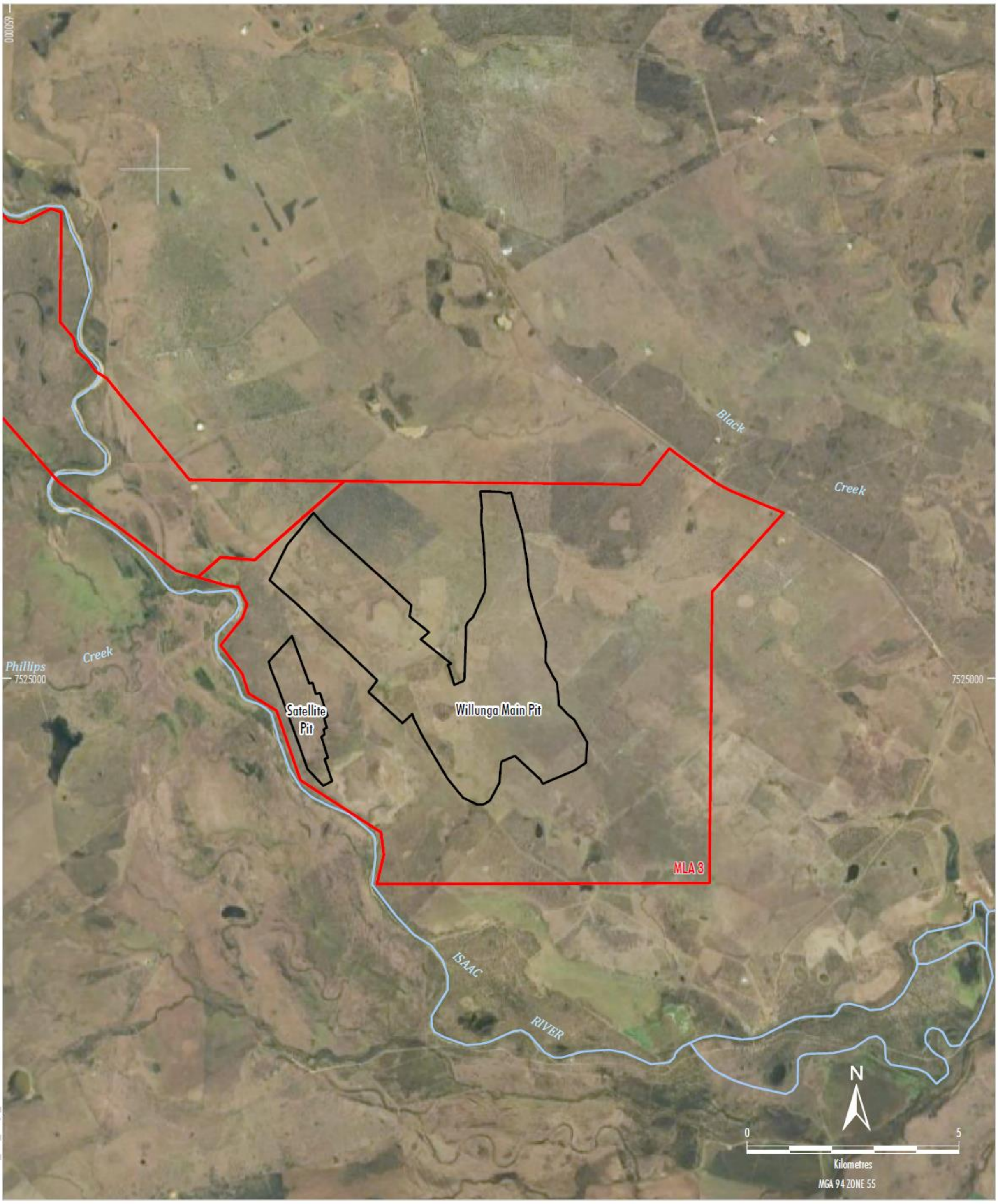


Figure 5-2 Schematic of Willunga Design Footprint



LEGEND
Olive Downs Project Mining Lease Application Boundary
Willunga Pit Footprint

PEMBROKE
OLIVE DOWNS PROJECT
Design Footprint - Willunga Domain

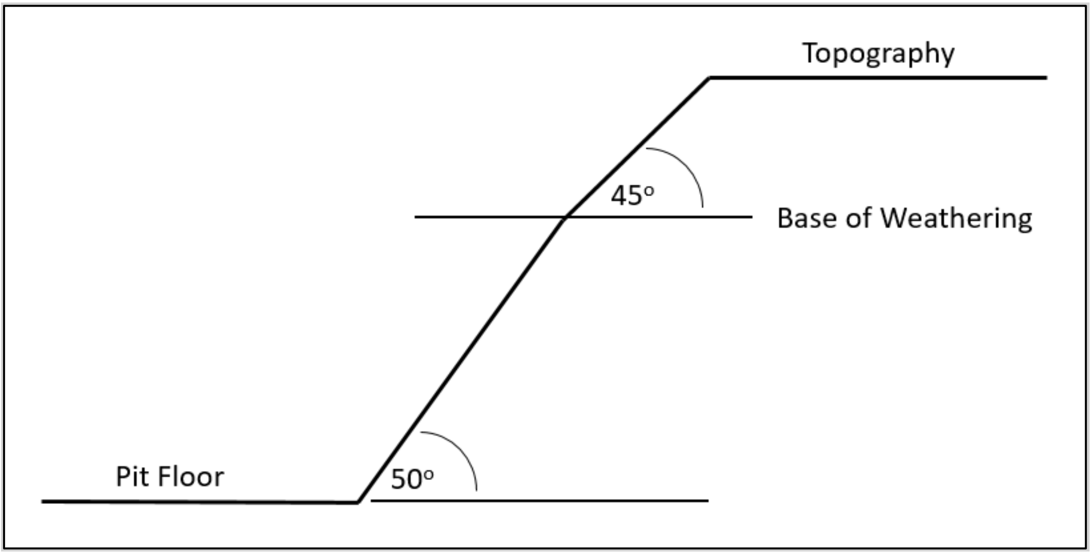
5.3.3 Slope design criteria

The highwall and endwall designs have been designed with a 50 degrees overall angle through fresh material, which equates to a 10 metre catch bench for every 30 metres of height, with a 65 degrees face angle.

Above the base of weathering, a 45 degrees overall angle has been used, representing a softwall.

A schematic of the slope design criteria is shown in Figure 5-3.

Figure 5-3 Pit slope design



5.3.4 Floor dip

The floor dip of the basal seam used for the mine design is generally moderate and less than 15 degrees, however some localised areas show a seam dip exceeding this, generally around fault zones.

At ODS, the dip is generally shallower in the north and steeper to the south. The mine design at Willunga is located in a synclinal area, with dip to the North.

Floor dip was examined by generating a dip surface in Deswik mine design software, which creates a surface with an elevation representing the dip of each surface polygon on the floor seam.

5.3.5 Mining method

The summarised mining sequence will follow a process that is generally common to other surface coal mines:

- Clearing and topsoil stripping ahead of the mining operation will be carried out progressively, with a practical minimum of disturbed area maintained ahead of mining. Topsoil will be stockpiled for later rehabilitation.
- The weathered upper waste areas are expected to be free-dug, using scrapers, excavators and trucks, without the need for drill and blast operations.

- Competent waste material will then be drilled and blasted below the free-dig zone, and removed in benches ahead of coal mining, using excavators and trucks assisted in part by dozers. Waste material will be placed on in-pit and ex-pit dumps as required. As much waste as possible will be placed back in-pit. The mine design also allows for waste to be dumped into adjacent pit areas.

- Coal will be mined using excavators, front-end loaders and trucks, with the ROM coal trucked to a stockpile adjacent to the CHPP.

- The waste dumps will then be rehabilitated by reshaping and the stockpiled topsoil will be placed onto the reshaped dumps. Revegetation completes the mining process. This will happen progressively as the mining operation advances.

Both the ODS and Willunga domains include geographically extensive subcrops, and the mining strategy used is to progressively extract coal down from the subcrops, opening new areas along strike as necessary to maintain the required production profile for as long as possible.

The mining method selected is conventional excavator/truck mining, generally starting at the subcrop of the coal seams and advancing down dip. This method is deemed suitable for the majority of the pit areas covered by the mine design.

Where the floor dip is greater than 15 degrees, however, this method of mining down dip is not considered suitable, and a terrace/haulback mining style is planned, mining along the strike of the coal seams.

In the conventional down-dip mining areas, the strip width has been designed at 100 metres, and the strips have been cut into 200 metre long blocks, and 30 metre high benches.

In the terrace/haulback mining areas, the strip width has been designed at 200 metres, with 200 metre long blocks, and 20 metre high benches. The differences in strip width and bench height allow a flatter advancing angle, required to provide working room for this method.

Overburden and interburden waste will be trucked back into the void from previous mining where possible, either directly behind the mining face in the same pit, or where opportunity allows, sideways into adjacent pit areas. Some upper bench waste will also be hauled forward of the advancing mining face and dumped at topography beyond the final highwall limit.

The waste from initial pit development will need to be trucked to ex-pit dumps, located behind the subcrop for each pit. Due to scheduling constraints and the effect of the floor dip on available in-pit dump room, a portion of waste from strips beyond the initial strips will also need to be trucked to ex-pit dumps.

Figure 5-4 Strip mining schematic

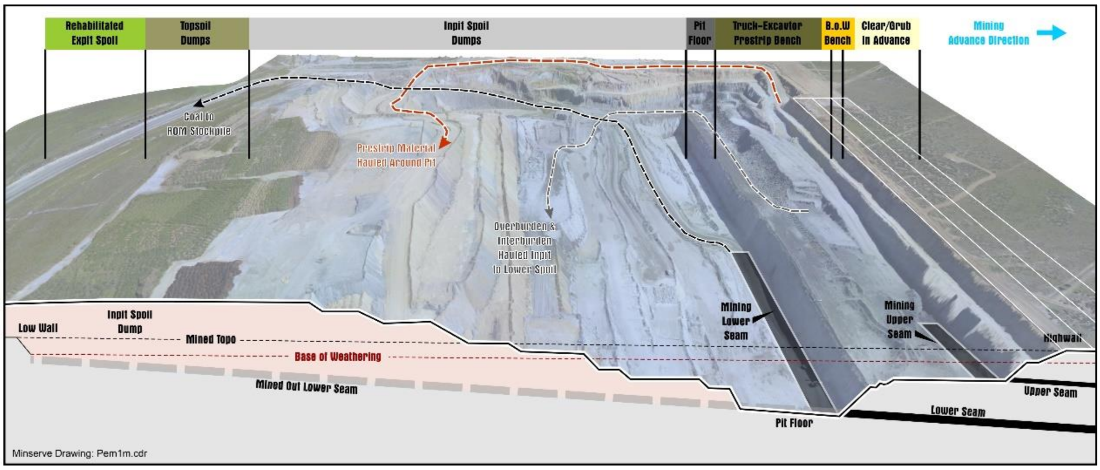
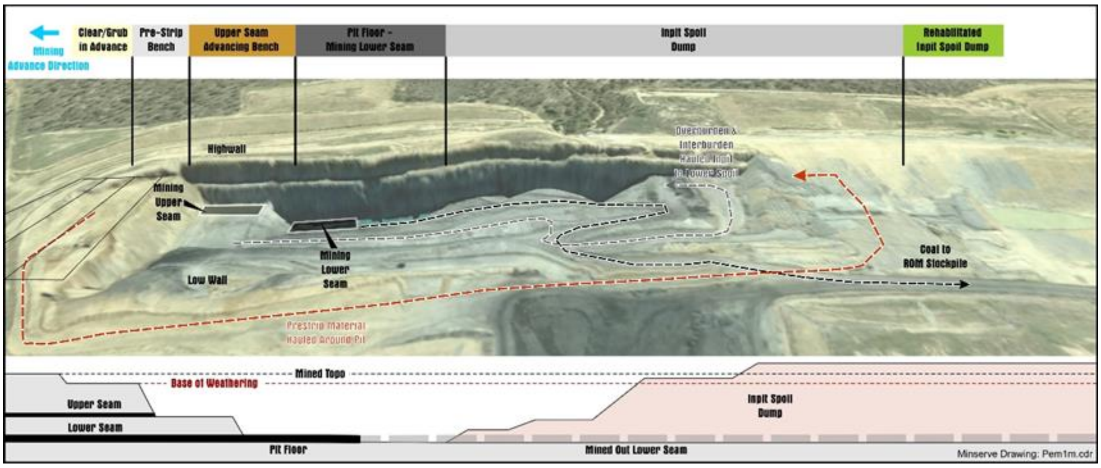


Figure 5-5 Terrace mining schematic



5.3.6 Equipment Selection

The mining equipment selected consists of large (600 t or 800 t class) hydraulic excavators to remove the bulk of the waste material, supplemented by smaller 350 t and 200 t class hydraulic excavators and front end loaders to remove interburden and partings and to mine coal. It's planned to use 170t / 220 t and ultraclass trucks to haul waste and coal.

A fleet of ancillary equipment will be used to support the primary mining equipment, including dozers, graders and water trucks. Rotary drills will be used to drill the waste material and coal as required.

Production dozing will also be used where appropriate, directly dozing waste into the previous strip void.

Hydraulic excavators have been chosen for their flexibility and ability to successfully excavate geologically complex deposits. The geological conditions at both ODS and Willunga are not amenable to dragline mining methods, and while the upper waste material could be suitable for large electric shovels, the additional flexibility afforded by hydraulic machines is desirable.

5.3.7 Drill and Blast

A large percentage of the waste material at both ODS and Willunga is planned to be drilled and blasted, and potentially some of the coal. Drilling and blasting of waste will be conducted to suit excavator waste removal, except for the portion allocated to production dozing, where cast blasting will be utilised as appropriate.

5.3.8 Dump Planning

Both in-pit and ex-pit dumps will be utilised as the mine progresses, with all efforts made to place waste material in-pit where possible.

Ex-pit dumps are located both behind the mining operation, adjacent to the initial development. Some limited waste quantity is also planned to be dumped in front of the mining operation, beyond the final highwall. The ex-pit dumps beyond the final highwall will be used by scrapers removing unconsolidated material near the surface, as well as upper benches of excavator waste via highwall ramps.

The overall in-pit dump advancing angle is designed at 18 degrees, and an overall dump balance has been completed. Some detailed dump scheduling has been undertaken to better understand the ex-pit dumping requirement during operations, as well as truck productivity.

5.4 Activities to be carried out on MLs and SPMLs

Below is an overview of the nature and extent of the activities proposed to be carried out under the proposed MLs and SPMLs for the IDP period.

5.4.1 MLa [1] Olive Downs South

Year 1 (2020, commencement of mining on ML Olive Downs South)

Mining commences in Pit 1 with the initial boxcut development. Waste is dumped either inpit within ML1 or onto the expit dump to the northwest, partly within SPML1.

Year 2 2021

Mining continues in Pit 1, with waste dumped continuing to be dumped either inpit within ML1 or onto the expit dump to the northwest, partly within SPML1.

Year 3 2022

Mining active within Pit 1 and the boxcut of Pit 2, with waste dumped inpit within ML1, onto the expit dump to the northwest (partly within SPML1) or onto the expit dump to the east within ML1, beyond the final highwall.

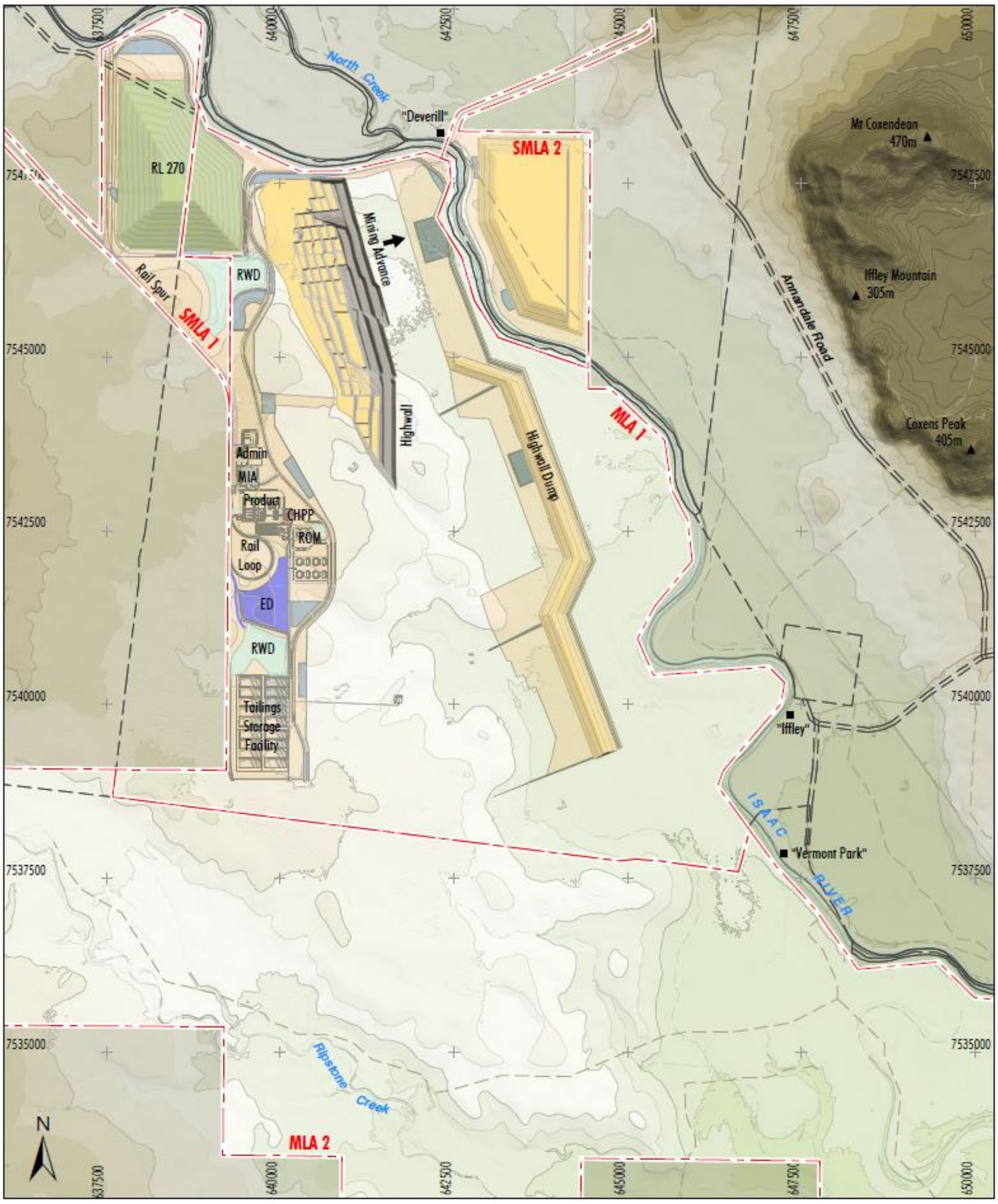
Year 4 2023

Mining continues in Pit 1 and Pit 2, with waste dumped inpit within ML1. The expit dump to the northwest (partly on SPML1) is completed, and the expit dump across the river on SPML2 is commenced. The northern section of the dump to the east (within ML1), in front of the final highwall is completed. Some waste is dumped expit behind Pit 2 on ML1.

Year 5 2024

Mining continues in Pit 1 and Pit 2, with waste dumped inpit within ML1. Expit waste is dumped behind Pit 1 and Pit 2 on ML1, and onto the expit dump to the northeast across the river, on SPML2.

Figure 5.6 Olive Downs South Domain Mine Plan Detailed- 2027



5.4.2 MLa [2] Olive Downs South Extended

Year 1 (2031, commencement of mining on ML Olive Downs South Extended)

Mining commences on ML2 in the Pit 4, 6 and 9 boxcuts, with waste dumped expit on ML2 and ML1 behind and beside the active pits.

Year 2 2032

Mining continues in Pits 4, 6 and 9, with waste dumped inpit on ML2. Expit waste continues to be dumped behind and beside the active pits on ML2, with some expit waste dumped onto ML1.

Year 3 2033

Mining continues in Pits 4, 6 and 9, with waste dumped inpit on ML2. Expit waste continues to be dumped behind and beside the active pits on ML2, with some expit waste dumped onto ML1.

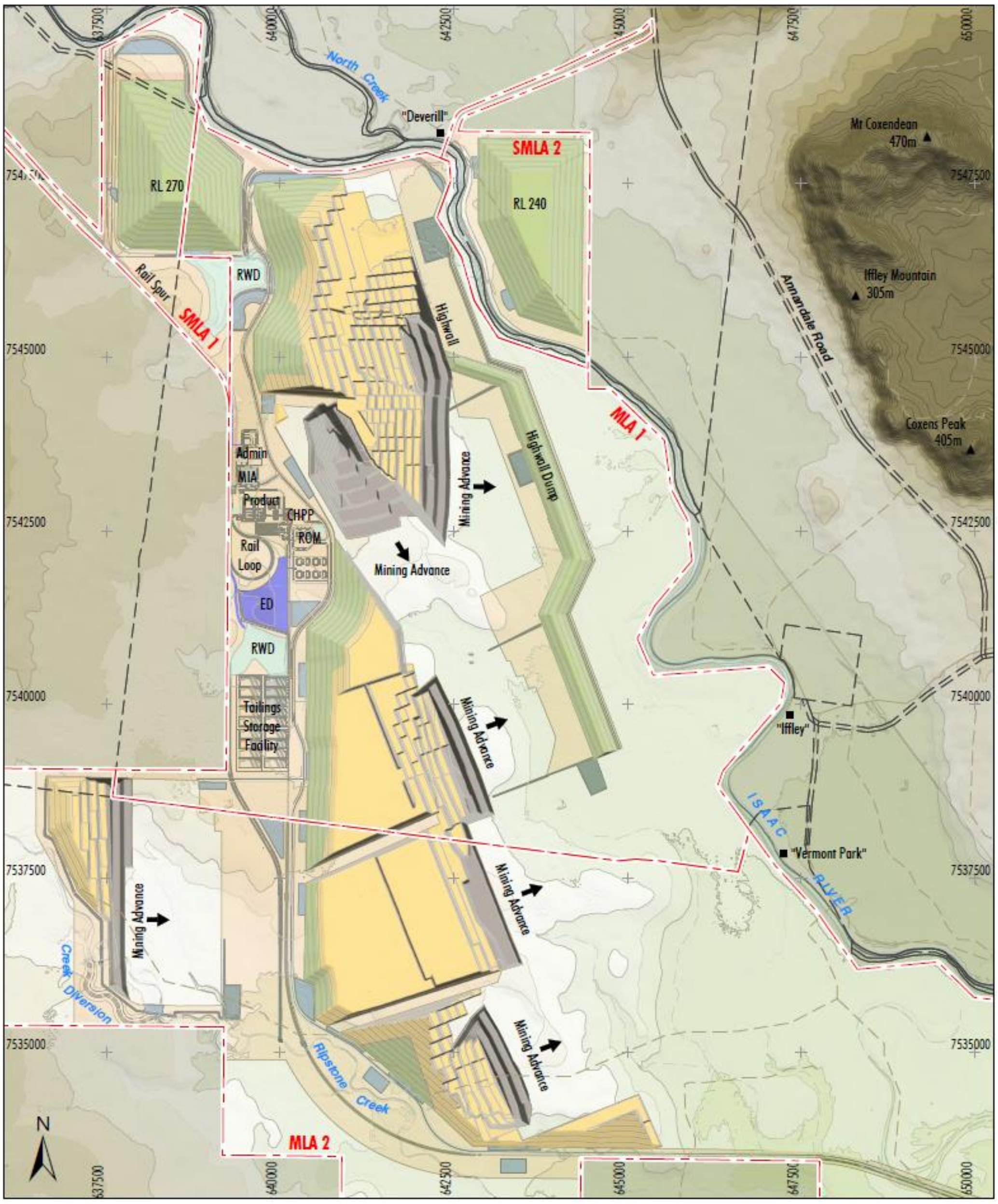
Year 4 2034

Mining continues in Pits 4, 6 and 9, with waste dumped inpit on ML2. Expit waste continues to be dumped behind and beside the active pits on ML2, with some expit waste dumped onto ML1. Most of the waste in the first five years on ML2 is dumped expit behind the active pits.

Year 5 2035

Mining continues in Pits 4, 6 and 9. The boxcut of Pit 5 commences mining waste. Waste is dumped inpit on ML2. Expit waste continues to be dumped behind and beside the active pits on ML2, with some expit waste dumped onto ML1.

Figure 5.7 live Downs South Domain Mine Plan Detailed- 2036



5.4.3 MLa [3] Willunga

Year 1 (2030, commencement of mining on ML Willunga)

The boxcuts of West, West 2 and Satellite Pits commence mining waste. All waste is dumped expit behind the Satellite Pit on ML3. A very small amount of coal is recovered in Year 1. All waste dumped on ML3.

Year 2 2031

West, West 2 and Satellite pits continue mining, with most waste dumped expit behind the Satellite pit. Some small amounts of inpit waste are dumped in each of the three active pits during the year as the boxcuts are completed. All waste dumped on ML3.

Year 3 2032

West, West 2 and Satellite pits continue mining. The boxcut on South Pit commences. Waste is dumped inpit within the active pits (South pit excluded), and expit behind the Satellite Pit and South Pit, as well as between South and Satellite pits, behind the coal subcrops. All waste dumped on ML3.

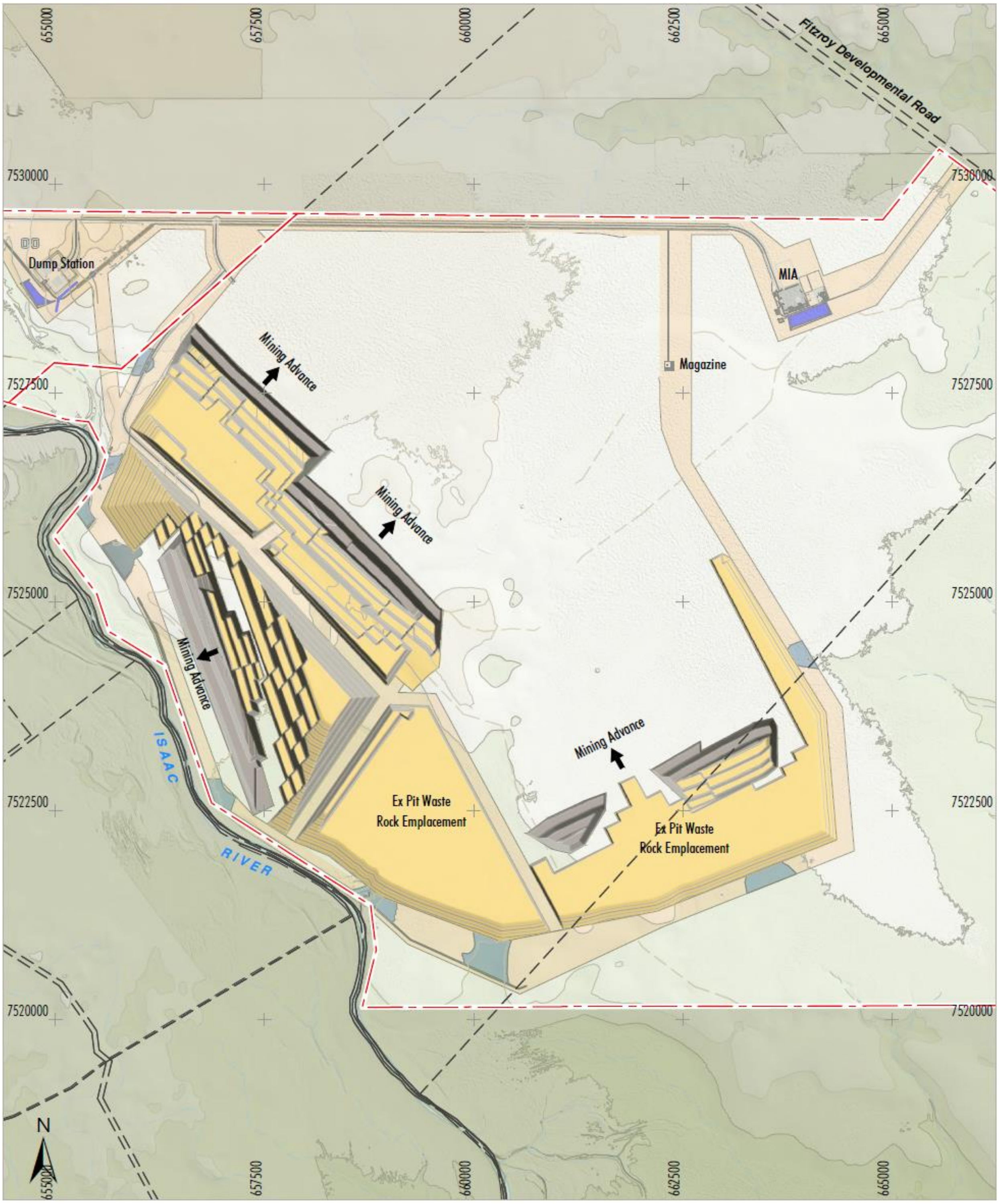
Year 4 2033

West, West 2, Satellite and South pits all continue mining, with waste dumped inpit within West, West 2 and Satellite pits, and expit behind Satellite and South pits, as well as between South and Satellite pits, behind the coal subcrops. All waste dumped on ML3.

Year 5 2034

West, West 2, Satellite and South pits all continue mining, with waste dumped inpit within all active pits, and expit behind Satellite and South pits, as well as between South and Satellite pits, behind the coal subcrops. Expit dumps also commence behind West and West 2 pits. All waste dumped on ML3.

Figure 5.8 Willunga Domain Mine Plan Detailed - 2036



5.4.4 SPML [1]

Upon ML grant the rail spur and water supply pipeline will commence construction, with a 12 month construction period forecast.

5.4.5 SPML [2]

Upon grant the section of mine access road from the intersection with Anandale Road through to the Isaac river will commence. During year 3 of operations dumping will commence in the out of pit waste rock dump, with the dump completed in year 9.

5.5 Production

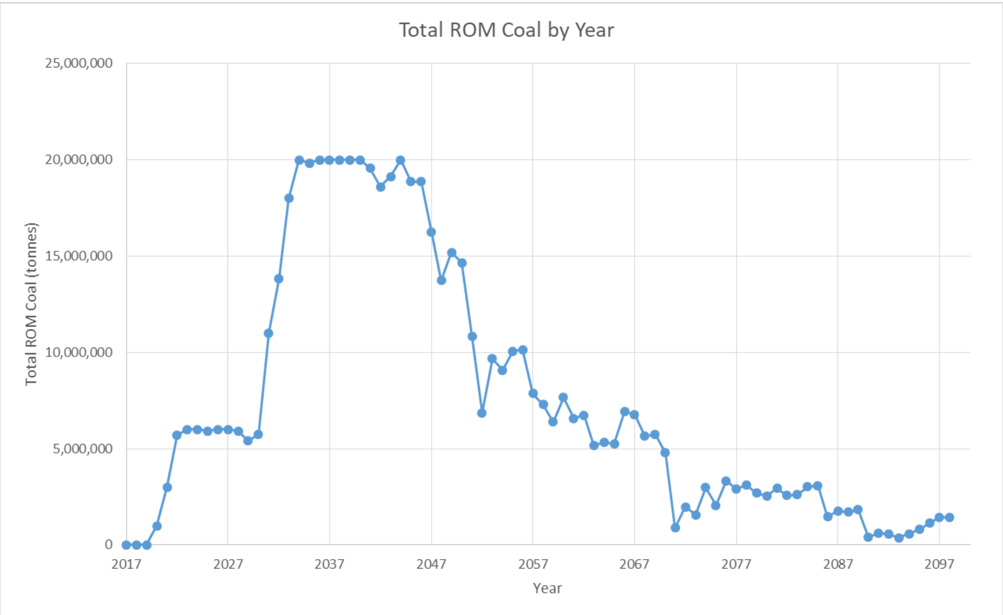
The likely Project ROM coal capacities are outlined in Table 21.

Table 21 Project production profile

	Capacity @ 2020 (Mtpa - ROM)	Capacity @ 2021 (Mtpa - ROM)	Capacity @ 2022 (Mtpa - ROM)	Capacity @ 2030 (Mtpa - ROM)	Capacity @ 2034 (Mtpa - ROM)
ODS	1	3	6	6	12
Willunga	0	0	0	0	8
Total	1	3	6	6	20

Figure 5-6 shows the Project production profile for the total ROM coal over the years. The production of the total ROM coal ramps up to 6 Mtpa over the first 3 years from the production at ODS only, maintaining this rate until 2030. It then increases to 20 Mtpa over the next 4 years including production from Willunga. The 20 Mtpa rate is maintained approximately for over 12 years in this schedule.

Figure 5-6 Project production profile graph

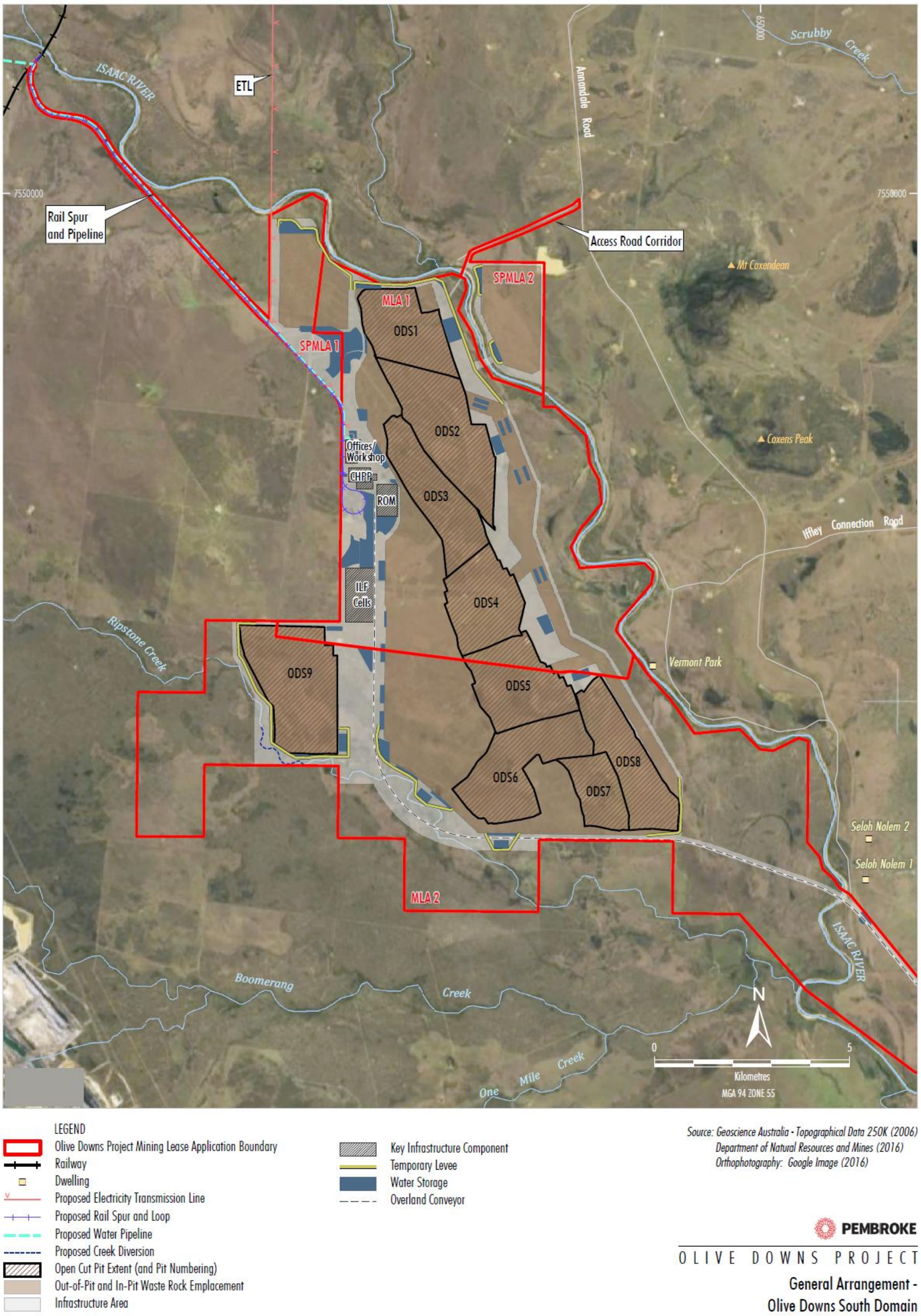


5.6 Mining schedule

5.6.1 Mine development sequence

The mine design has been broken into a number of pit areas for both ODS and Willunga, as shown in Figure 5-7 and Figure 5-8. The time sequence of mining at the ODS and Willunga pits are shown in Figure 5-9 and Figure 5-10.

Figure 5-7 Olive Downs South Pits



At ODS, mine development commences in Pit 1 in 2020 and in Pit 2 in 2022. The high-dip terrace mining Pit 3 starts in 2028. The boundary between Pit 2 and Pit 3 is a major fault.

As the production rate is ramped up, Pit 4, Pit 6 and Pit 9 commence mining in 2031. Pit 5, offset behind Pit 4, commences mining in 2035. The final two pits to start, late in the schedule, are the remaining terrace mining pits, Pit 7 (starting 2056) and Pit 8 (starting 2050).

Pit 5 lags behind Pit 4 to provide some opportunity to dump waste in the adjacent pit to reduce haul distance. Pit 6 lags behind Pit 5 for the same reason.

Figure 5-8 Willunga Pits

At Willunga, the production ramp up is quite steep. West Pit, West 2 Pit and the Satellite Pit all start in 2030, with mining commencing in the main South Pit soon after in 2032. West 2 Pit lags West Pit to again provide the opportunity for dumping of waste into the adjacent pit.

As South Pit completes, the terrace mining East Pit commences from the South Pit highwall in 2070.

The mine development sequence has been based on guidance provided by the pit optimisation process where practicable, by considering the areas that were shown to be economic at lower margin sensitivities first and expanding along strike from these initial mining areas.

Multiple working faces have been scheduled as the production ramps up, to allow sufficient working strike length to maintain the required production profile.

Figure 5-9 Olive Downs South progress plot

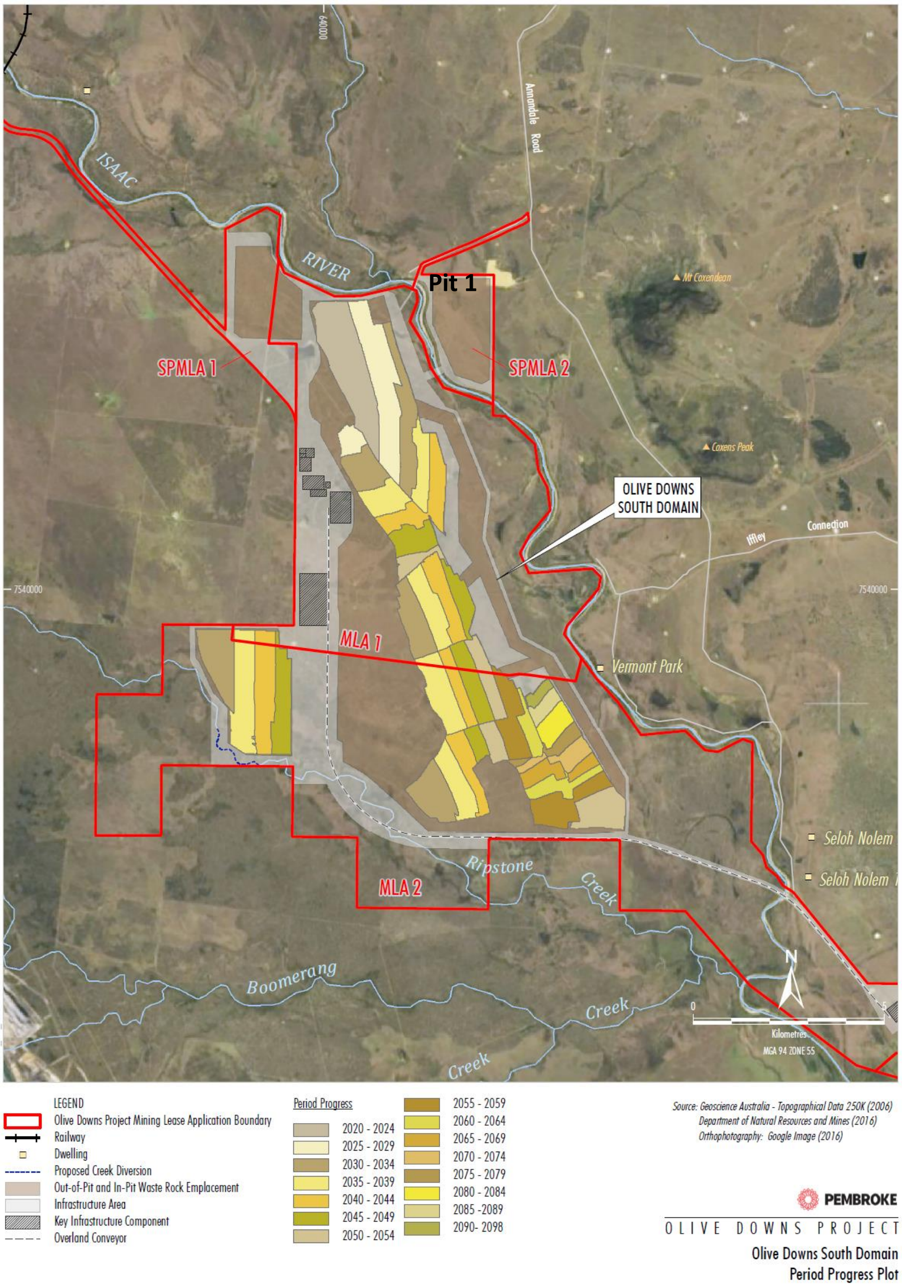
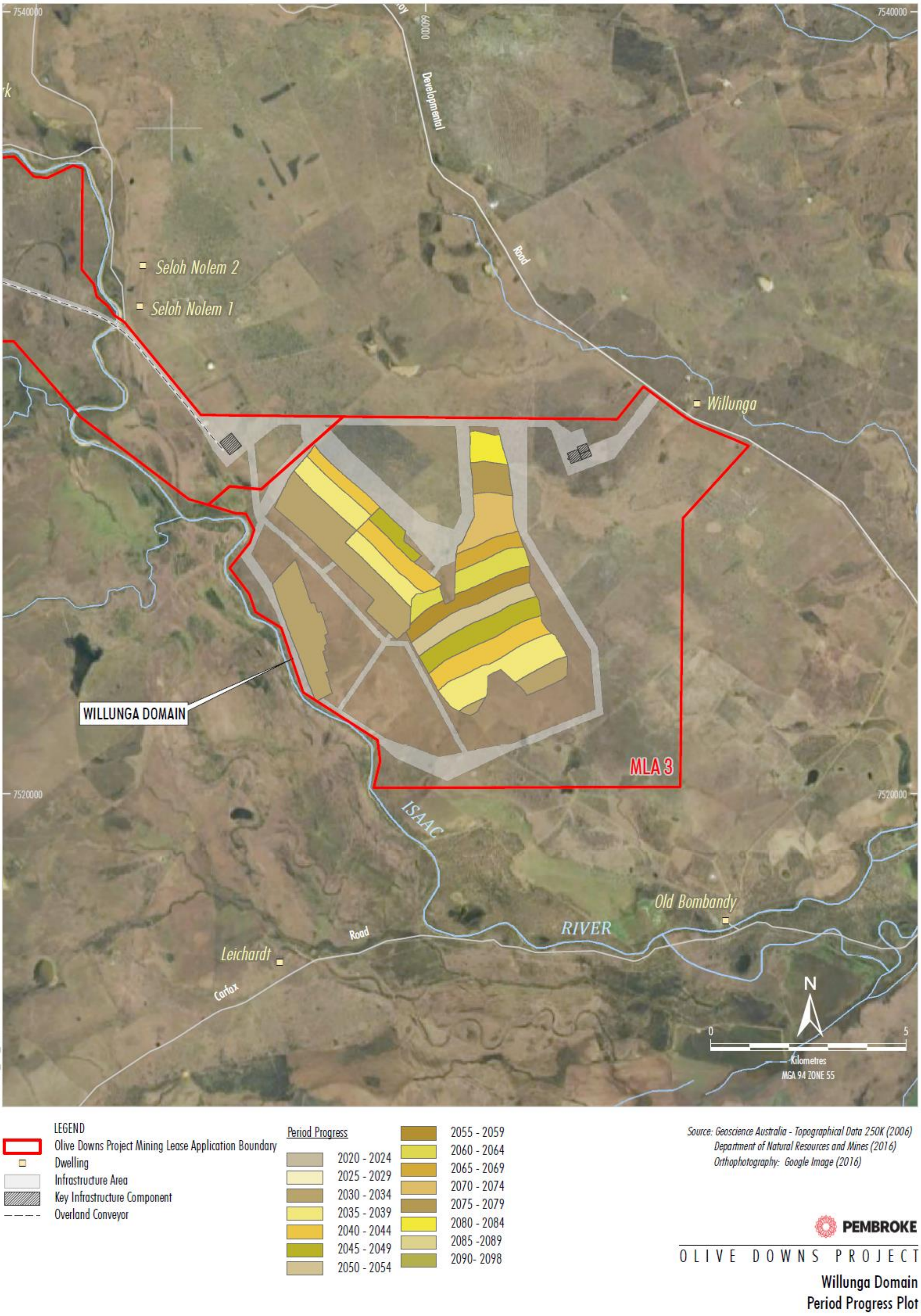


Figure 5-10 Willunga progress plot



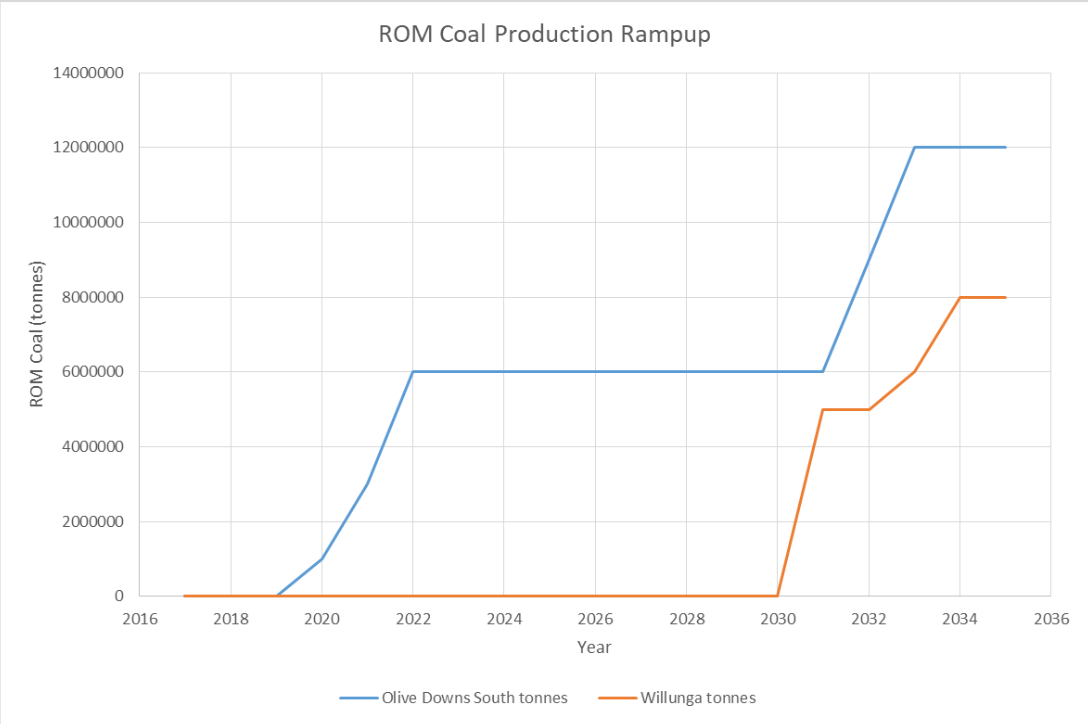
5.6.2 Mining schedule assumptions

The production ramp up for each of ODS and Willunga is shown in Figure 5-11 below.

ODS ramps up to a 6 Mtpa rate over the first 3 years, then quickly expands to 12 Mtpa over 2 years some 9 years later. Willunga has a rapid ramp up to 8 Mtpa over the first 5 years of operations.

These ramp ups require multiple working faces to be available at all times in both domains.

Figure 5-11 Production ramp up



5.6.3 Mine schedule

The mine schedule output for ODS and Willunga is shown below, from schedule start (2020 for ODS and 2030 for Willunga) until 2098.

The peak waste removal requirement for ODS is around 200MBCM/year in 2043, as the early pits progress toward their final limit. Waste removal requirement builds up through the schedule in line with increasing depth of cover and required strike length.

The peak waste removal requirement for Willunga is around 100MBCM/year, but occurs earlier in the schedule (around 2030), due in part to the synclinal nature of the deposit, but mostly for the need to ramp up waste removal in line with the production ramp up.

Figure 5-12 Olive Downs South schedule graph

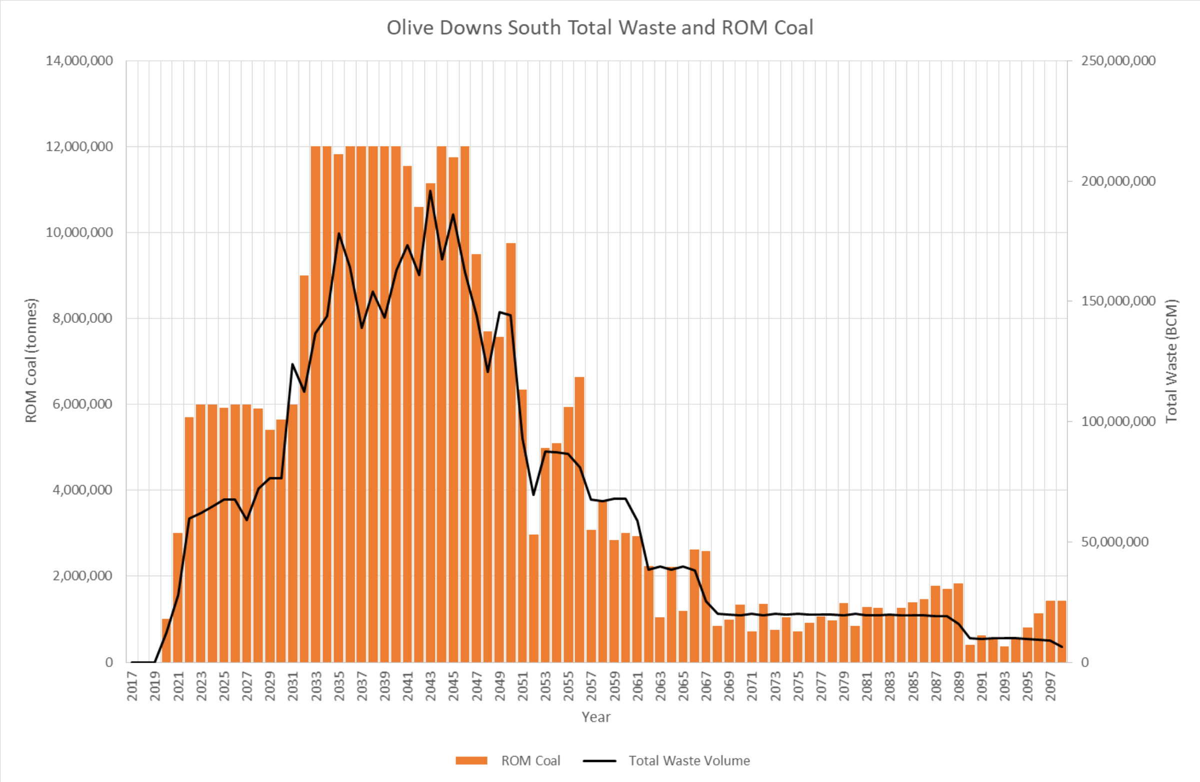


Figure 5-13 Olive Downs South product tonnes

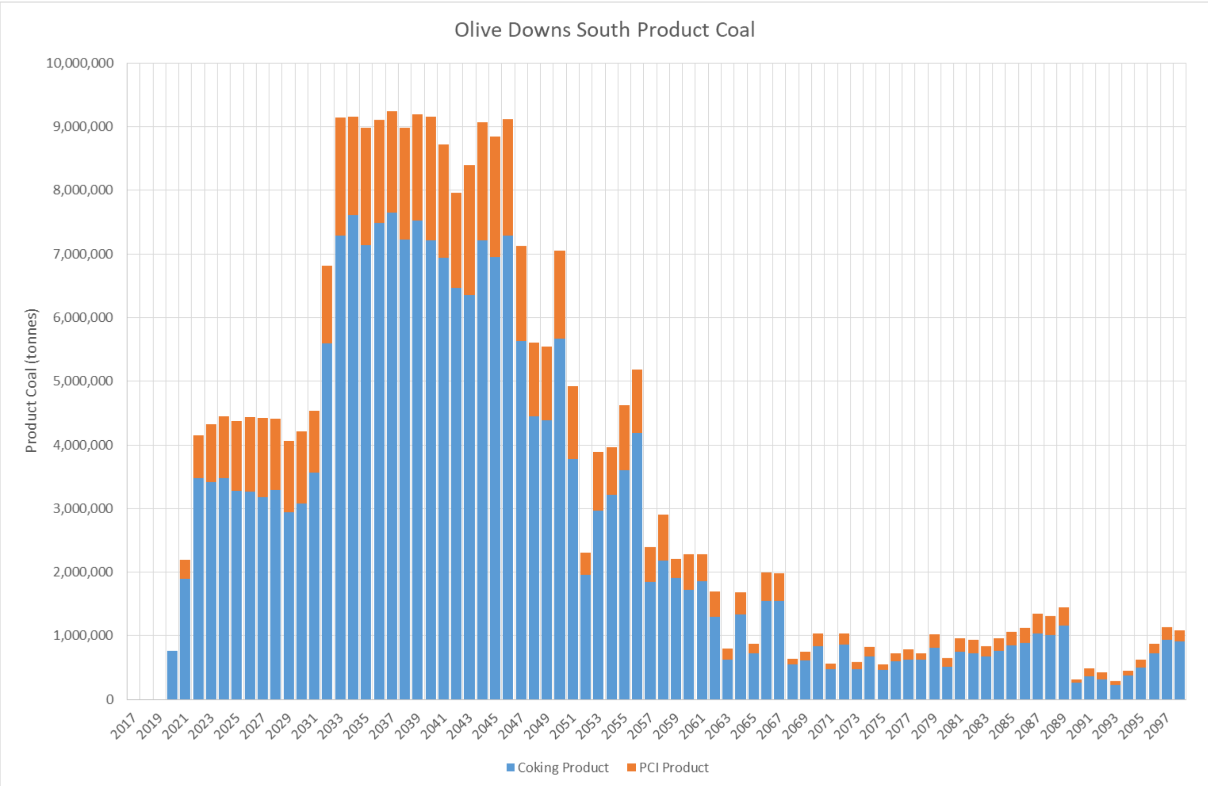


Figure 5-14 Olive Downs South product yield

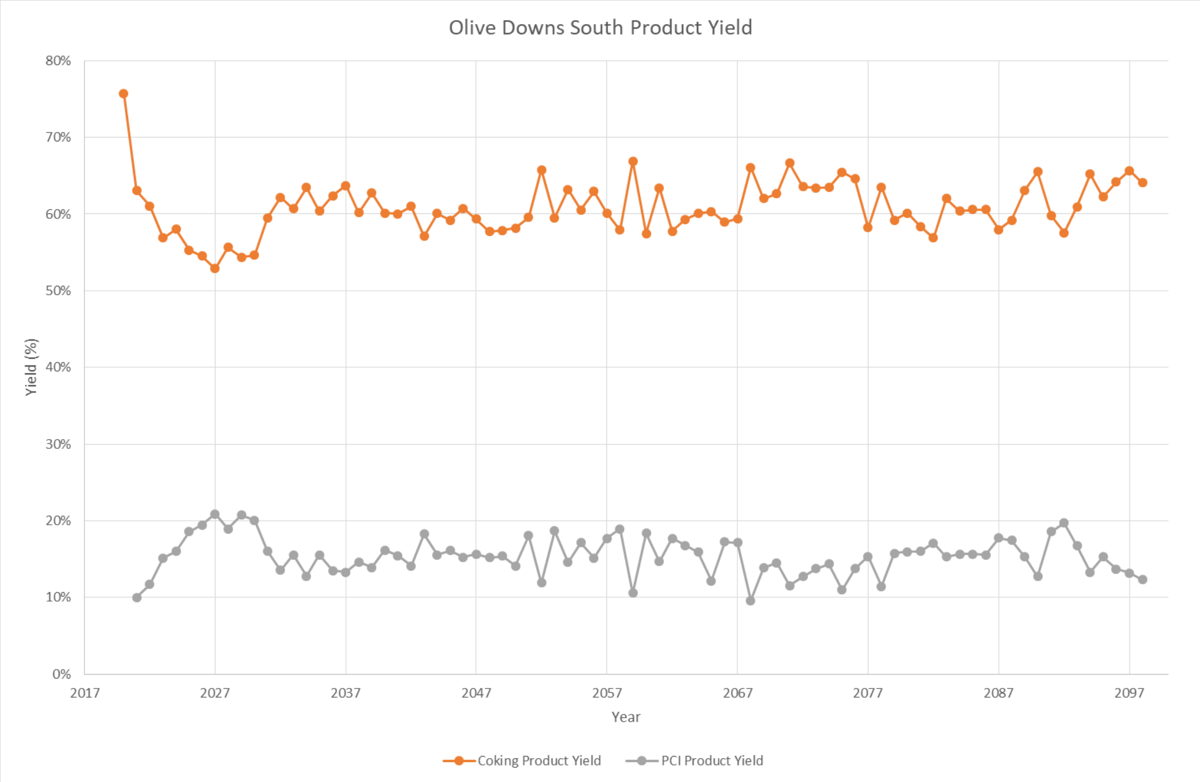


Figure 5-15 Olive Downs South product ash

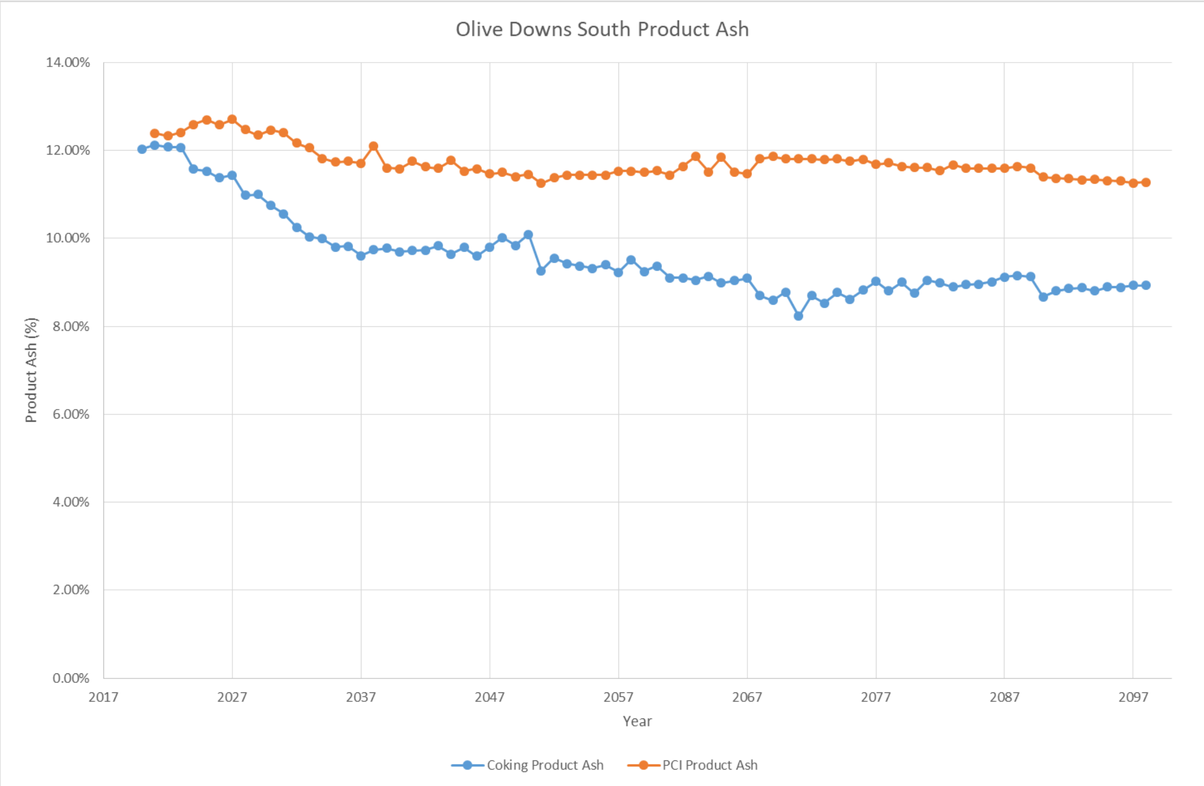


Figure 5-16 Willunga schedule graph

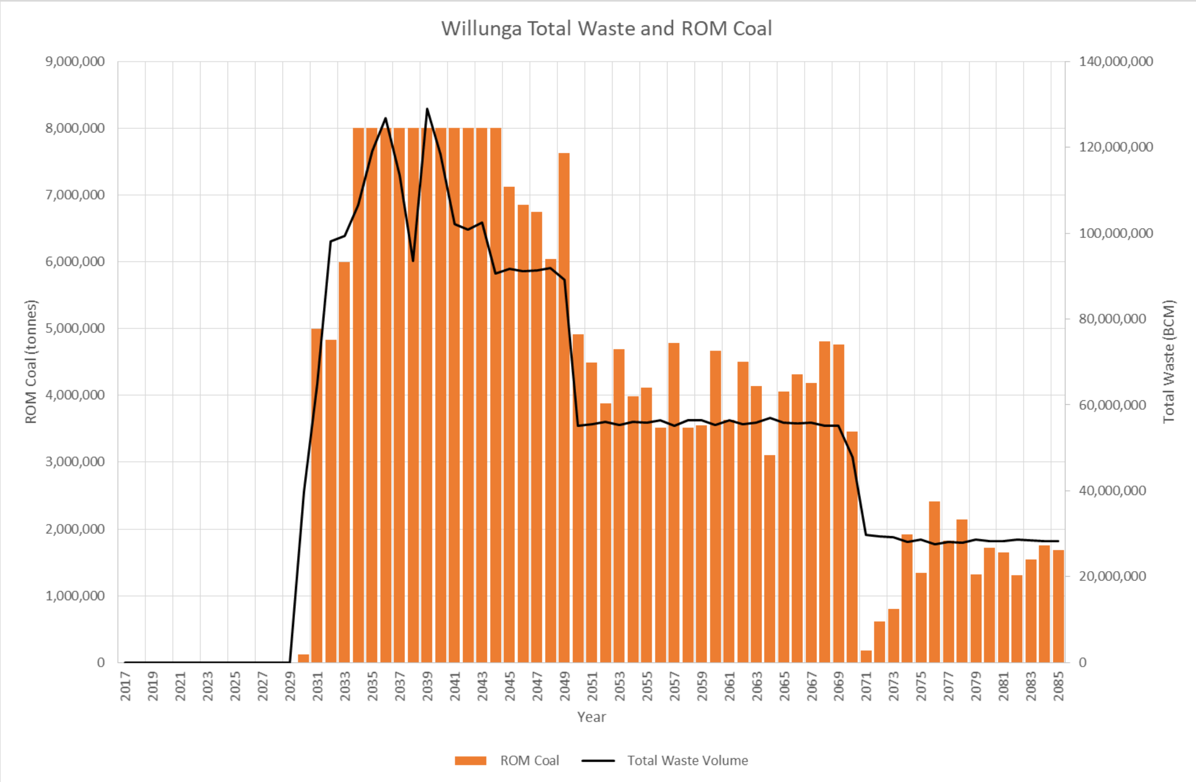


Figure 5-17 Willunga product tonnes

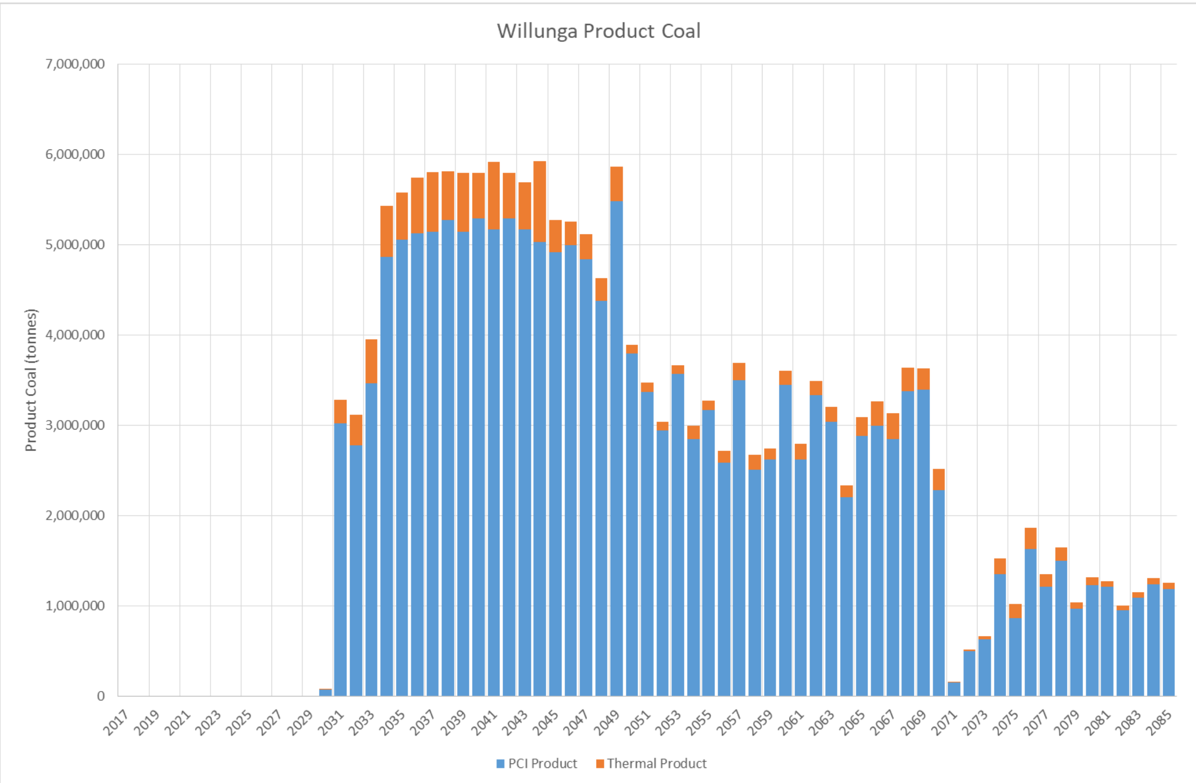


Figure 5-18 Willunga product yield

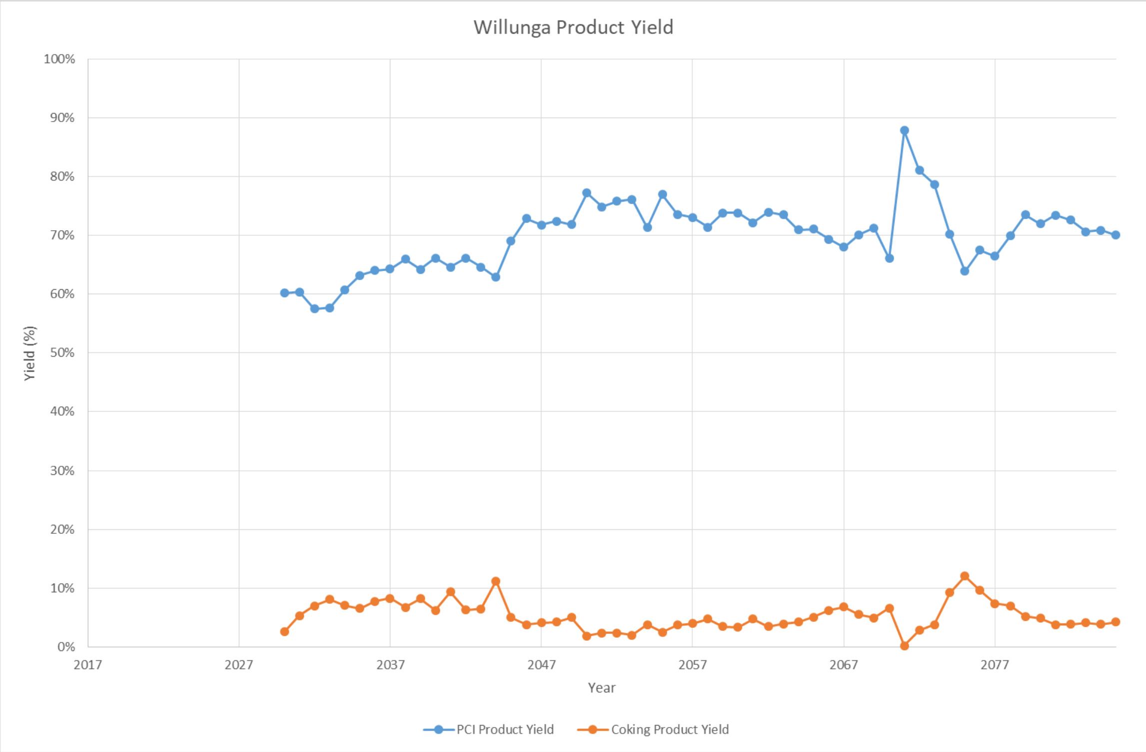
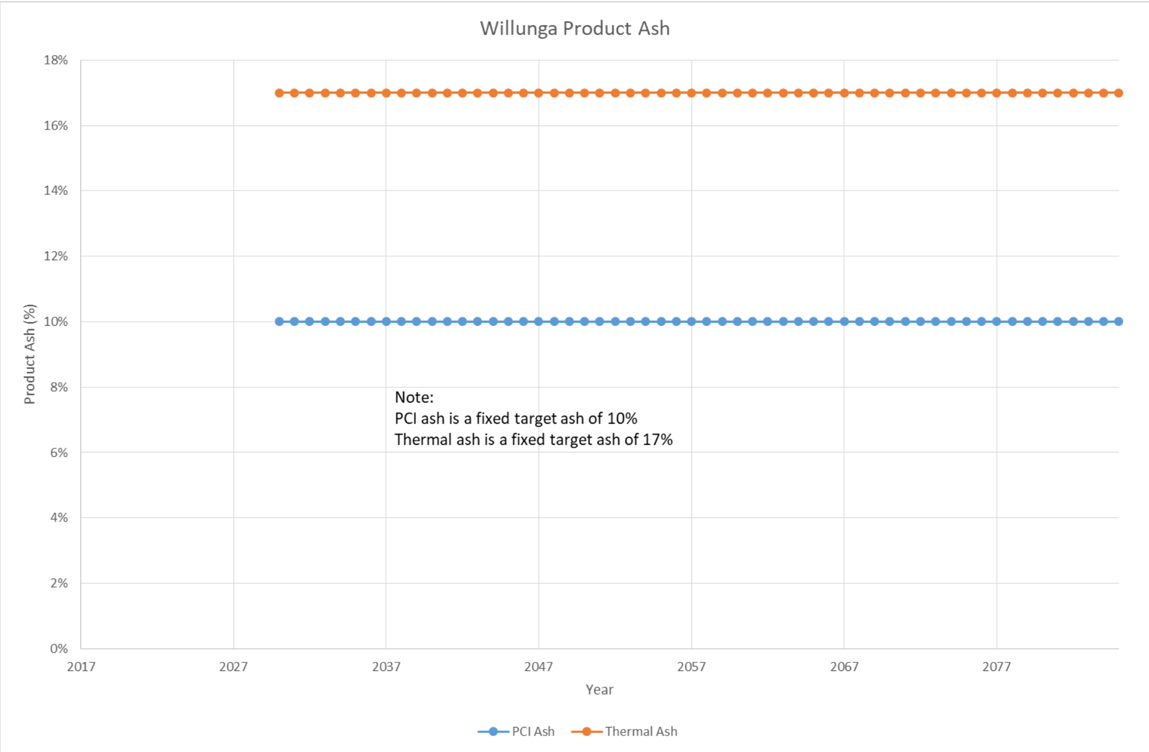


Figure 5-19 Willunga product ash



6. Coal handling & processing

6.1 Overall plan layout

The ODS conceptual materials handling and processing plant layout can be seen in Figure 6-1. The physical infrastructure layout for the Olive Downs Complex is provided in **Error! Reference source not found.**, Figure 6- and 6-4 for Willunga.

Figure 6-1 Complex Development Plan – ODS – Infrastructure Layout Plan

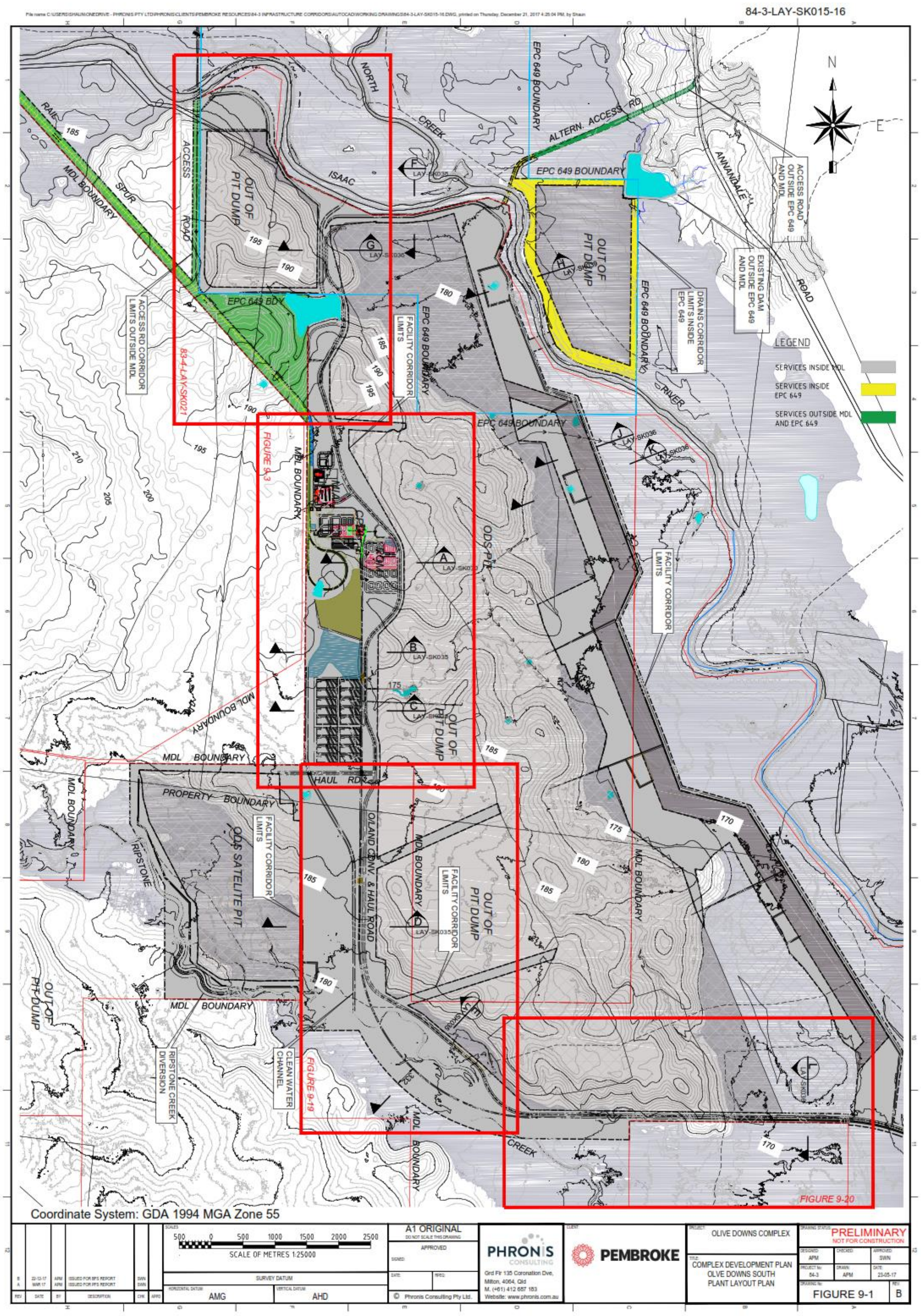


Figure 6-2 Complex Development Plan – ODS – CHPP Detailed Layout Plan

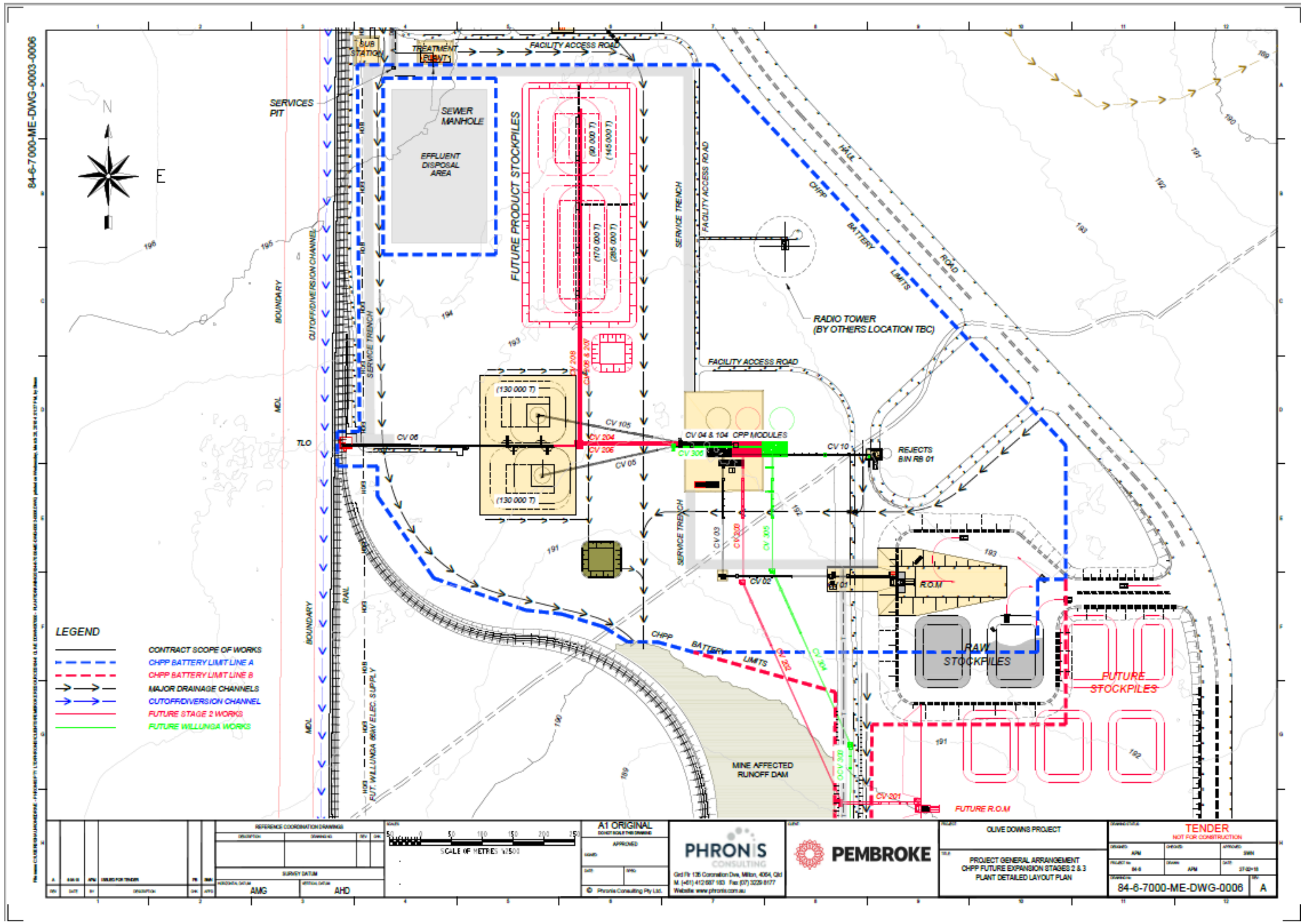


Figure 6-3 Complex Development Plan – ODS – Infrastructure Detailed Layout Plan

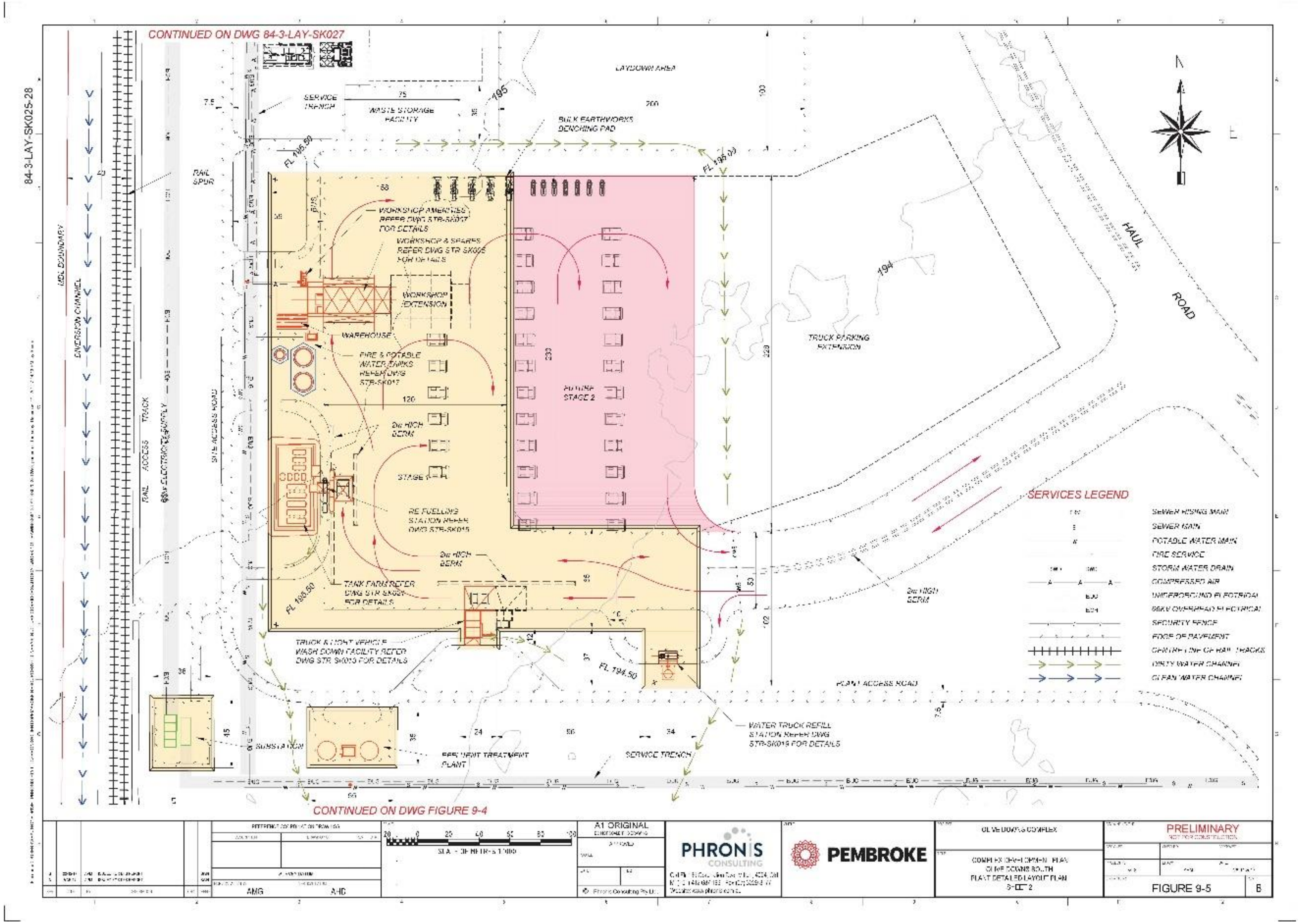


Figure 6-4 Complex Development Plan - Willunga ROM Layout

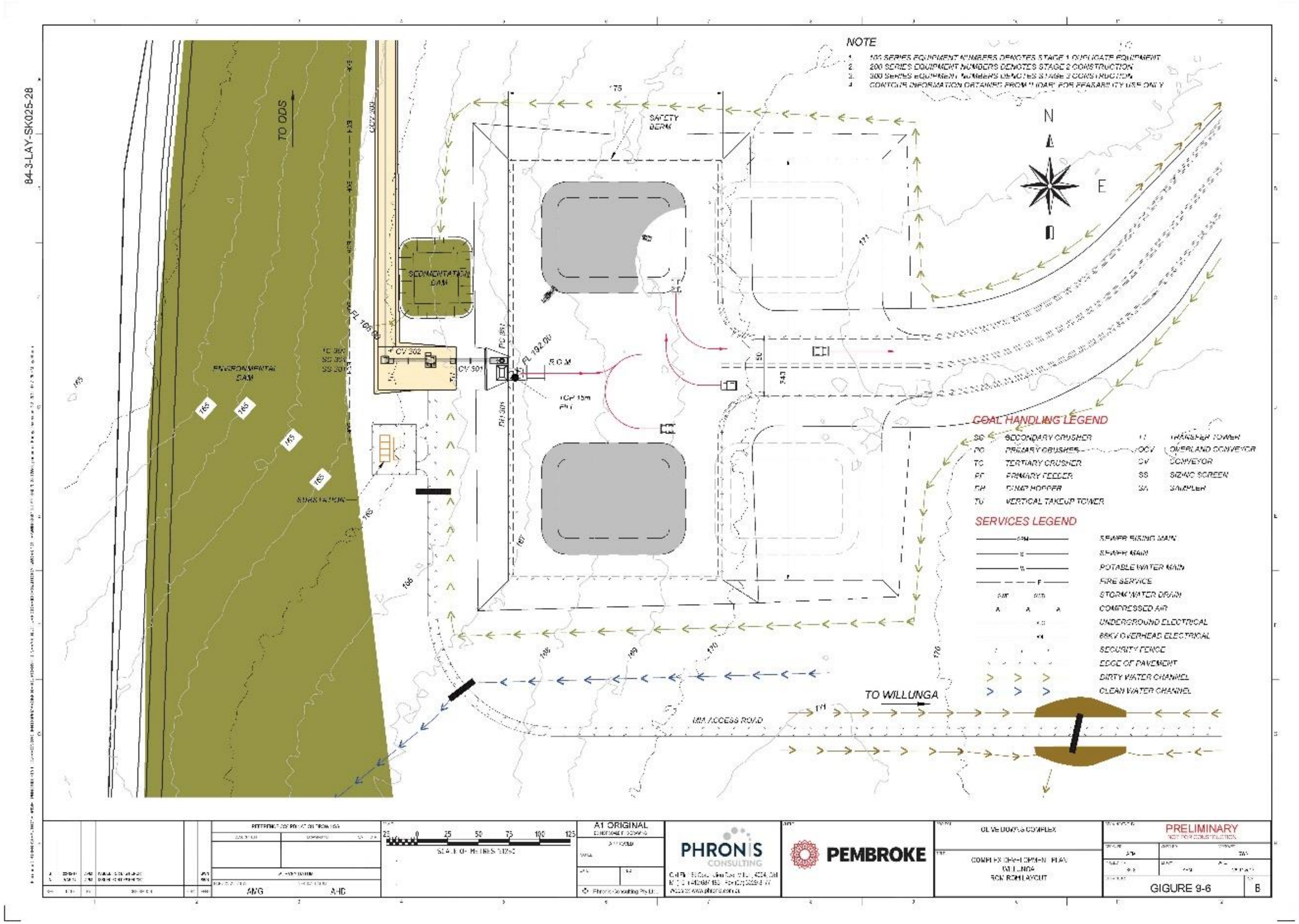
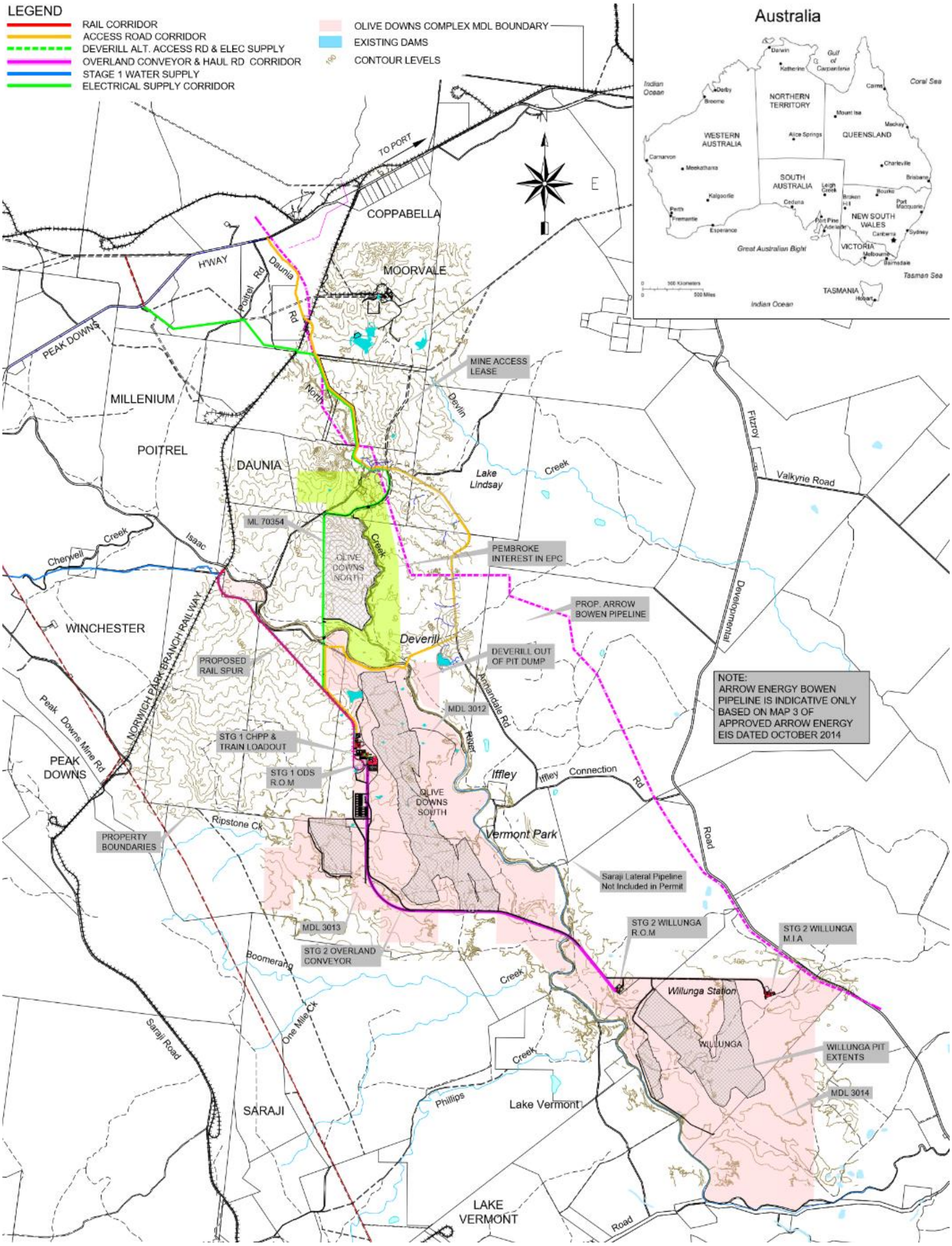


Figure 6-5 Complex Development Plan – Conveyor Connection Layout



6.2 Process design

A ROM coal crushing facility will be built at both ODS and Willunga with one large processing plant at ODS. The two sites will be connected by an overland conveyor.

6.3 Plant operating capacity

The annual ROM coal output from the Project is annual ROM coal output from the Olive Downs Complex is intended to be 12 Mtpa for ODS and 8 Mtpa for Willunga totalling approximately 20 Mtpa at full capacity for the ODS and Willunga Complex.

It is intended that the processing plant will be built in three stages. The first stage will be capable of processing up to 6 Mtpa ROM with second stage being a duplication of the stage one plant to increase ODS coal processing capacity to 12 Mtpa. The third stage will be a further module to process Willunga coal and increase processing capacity to 20 Mtpa.

Based on processing industry advice, modern preparation plants can reasonably achieve availability of 7,500 hrs per annum. This is based on the following operational assumptions:

- the plant will be shut down for Christmas and boxing day (2 days);
- scheduled maintenance of a 12 hr shift every 3 weeks;
- a major plant shutdown of 4 days every year;
- unplanned maintenance delays of 6% or less of available time per annum; and
- operational delays of 5% of available time or less per annum.

Based on these parameters the required processing capacities of the coal preparation plants have been calculated as:

- Stage 1 – 800 tph;
- Stage 2 – 800 tph; and
- Stage 3 – 1,100 tph.

Stockpile capacities are aimed at achieving up to approximately 10% of annual product coal capacity as a total between ROM, Raw, Product and Port stockpiles. Stockpile Break down at full 20 Mtpa production would be as per Table 22.

Table 22 Stockpile breakdown

Stockpile type	Capacity
ROM stockpile	1 week 400,000 t - spread 60/40 between Olive Downs South and Willunga ROMs (this is available space rather than regular use).
Raw stockpile	3 days 150,000 t - at Olive Downs delivered in 2 stages over the life of mine. ROM stockpiles at ODS & Willunga easily accessible.
Product stockpile	2 weeks

Stockpile type	Capacity
	550,000 t - at Olive Downs delivered in 3 stages over the life of mine (including doze-out space allocation). Additional emergency capacity can be created as required with loaders and stockpile trucks.
Port stockpile	3 days 120,000 t - Dalrymple coal terminal.
Total stockpile capacity	1.22 Mt - (approximately 8% of 15 Mtpa Product).

6.4 ROM dump station

It is anticipated that coal will be hauled from the pits in large rear dump trucks similar in size to a CAT 793 truck. The most efficient mode of operation is for the trucks to tip directly into a ROM hopper but it will not always be possible to schedule the digging of coal with the availability and/or capacity of the crushing plant. It is therefore proposed that pads of 150,000 t capacity be established adjacent to the ROM hopper. Coal dumped in this ROM stockpile will be reclaimed as required by a front-end loader and/or truck.

6.5 Crushing and screening plants

The plants have been sized for the full flow rates of up to 20 Mtpa with a 60/40 split between ODS and Willunga. Based on a 24/7 operation and allowing 7,500 operating hours during the year and other inefficiencies such as wet weather, a nominal plant through put of 1,600 tph to match the CPP capacity is required for ODS and 1,100 tph for Willunga.

6.6 Coal processing plant

"A" Type processing is to be adopted for the ODS resource, subject to further exploration data becoming available.

6.7 Tailings and reject facilities

A re-flocculated tailings disposal facility system will be implemented. This involves constructing purpose built tailings drying cells whereby fine tailings, dosed with additional flocculant post coal washing, are placed in small tailings cells and left for a period whilst the water drains away leaving a highly solidified residual product that can be disposed of similar to coarse tailings. Typical solid contents achieved are in the range of 70% by weight. This enables the tailings to be reclaimed from the tailings cell with an excavator and loaded onto a dump truck with a consistency of moist sand. Disposal is achieved by mixing with overburden by placing the tailings on the slopes of the low wall and fringes of the open pits which are subsequently covered by further overburden. A traditional coarse tailing reject facility is required at the CHPP to enable the disposal of coarse rejects in a typical manner.

Initial Stage Year 1 to 2

During this initial stage whilst inpit storage for dried reject is available, the fine tailings material will be held within the drying cells, as there is more than sufficient storage capacity for the first 2 to 3 years of stage 1 plant tailings production.

The coarse reject also needs to be stored during this time and it is proposed to place a permanent coarse reject storage emplacement immediately to the south of the ODS ROM storage area. The concept involves placing coarse reject in layers to a total depth of 10 metres and caped by 5 metres of spoil once inpit storage volume is available for the coarse reject. Any seepage from this location will report to the MIA environmental dam. The reject storage cell will later be used as an extension of the ROM dump facilities for the 12Mtpa expansion of the ODS pit.

Stage 1 Year 2 to 10

During this stage of operations in the initial ramp up period, fine failings would be pumped to below/above ground tailings drying cells as shown on **Error! Reference source not found.**. At least five cells will be required during this period during stage 1. Coarse rejects will be disposed to in-pit spoil dumps and also recycled for use as road construction materials if appropriate. Road construction materials will be in limited supply on site due to the deep layers of clay overlaying the coal seams.

Tailing facilities will be constructed from homogeneous clay embankments with twin pipe outlet facilities at one end of the cells to encourage beaching and water flow to the opposite end of the cell. Three intermediate 'weir' walls are to be built from coarse reject material during operations to assist the natural filtration of the water. Two weirs are built from coarse tailings alone and the final weir built from suitable permeable soil/shale from the mining operations. This system has been developed over time in a neighbouring mine and results in naturally filtered water of good quality that can be pumped back into the mine water system for reuse in the plant.

Tailing facilities will be designed to the appropriate regulations including freeboard for extreme events. The dams will have no catchment other than the dam surface itself.

Coarse rejects are placed in a separate area, built in layers for a height of 10 metres and covered with 5 metre thick clay for initial two to three years until inpit spoil dump space is available. Similarly, fine rejects will be left in drying cells and moved into inpit soil dump when available.

Stage 2 and 3 to the end of the mine life

From approximately 10 years onward as additional mining areas are opened up, additional tailings cells will be required to ensure there is sufficient capacity to cope with the additional mine output. Sufficient space has been allocated to cope with the additional mine output.

6.8 Coal handling and processing

Stage 1

The target scope of stage 1 is sufficient plant and equipment to get the mine started and allow it to ramp up to a capacity of 6 Mtpa ROM. In the first period of mining, coal is extracted from the ODS domain at the northern end of the deposit. The coal handling facilities scope for this stage focuses on this level of operation with consideration that a second stage from the same domain and Willunga deposit will place additional demand on the system in the following 10 years.

Stage 2

The target scope of stage 2 is sufficient plant and equipment upgrades for the ODS plant site to increase production capacity up to 12 Mtpa and covers the period from 2032 onwards. This stage involves the construction of a duplicate CPP module from stage 1 and also the ability to feed the CPP with an automated raw coal storage and reclaim system.

Stage 3

The target scope of stage 3 is to take the facility production capacity from 12 Mtpa to the full capacity of 20 Mtpa. This requires the construction of the Willunga ROM facilities and connecting overland conveyor as well as an additional CPP module.

Table 23 describes the scope of works of the stage 1, 2 and 3 coal handling infrastructure.

Table 23 Stage 1, 2 and 3 coal handling infrastructure

Stage 1 infrastructure	Stage 2 infrastructure	Stage 3 infrastructure
▪ ROM dump wall and the engineered soil and strap zone immediately behind the ROM dump wall; ▪ ROM dump bin and feeder; ▪ Primary crusher; ▪ Conveyor CV01 – 1,400 mm wide belt and 68 m long; ▪ Sizing and screening station SS01; ▪ Tramp magnet; ▪ Secondary and Tertiary crushers; ▪ Roll screen; ▪ Conveyor CV02 – 1,600 tph – 265 m long; ▪ 500t Feed Bin FB01; ▪ Coal Processing Plant ("CPP") – 800 tph Module A and thickener ▪ Rejects Conveyor CV12 – 129 m; ▪ Rejects Bin RB01; ▪ Product Conveyor CV06 – 556738 m; ▪ Conveyor CV106 – 738436 m; ▪ Reclaim Conveyor CV10 – Stage 1 – 448 m; ▪ Reclaim Tunnel Stage 1 – 315 m; ▪ Train Loadout bin – 500t; ▪ Plant civil works and environmental control systems; and ▪ Electrical and Control systems.	▪ Tripper and chute on CV02; ▪ Additional vibrating feeder on FB01 feeding CV107; ▪ Plant feed Conveyor CV 107 – 800 tph; ▪ Reclaim Tunnel Extension – Stage 2 – 285 m; ▪ Plant civil works and environmental control systems upgrades; and ▪ Electrical and Control systems additions.	ODS upgrades: ▪ Conveyor CV211 – 225 m ▪ Third CPP module – 1,100 tph ▪ Conveyor CV307 – 280 m Willunga: ▪ Willunga primary crushing station PC201; ▪ Conveyor CV301 – 68 m ▪ Sizing screen 301; ▪ Secondary crushing station SC301; ▪ Conveyor CV302 – 45 m; ▪ 100t surge bin SB301; ▪ 25km long overland conveyor OCV 303 – 1,450 tph.

6.9 Overland conveyor

A high speed overland conveyor will be used to transport the raw coal from Willunga to the ODS CPP site. The total length of the conveyor is approximately 24 kms which can be achieved with a single conventional conveyor flight utilising horizontal curves to navigate the direction changes in the allocated corridor.

The conveyor design capacity is 1,500 tph running at a conservative speed of 5.6 m/s. Belt width is relatively narrow at 1050mm. The layout consists of two head end drives, two intermediate drives with ripper and a tail drive. The intermediate drives are powered from the 66 KV power line via pad mounted transformers. Belt tension will be maintained via an active winch controlled take up system.

The overland conveyor will be fed by the Willunga ROM dump and crushing station shown in Figure 6-. The coal will be crushed to final coal product size prior to the overland conveyor feed to minimise the overland conveyor belt width and prevent the risk of larger lumps of coal leaving the conveyor at high speed. The head of the conveyor will discharge into the preparation plant feed bin conveyor keeping the amount of elevated structure, at the head end of the overland conveyor, to a minimum.

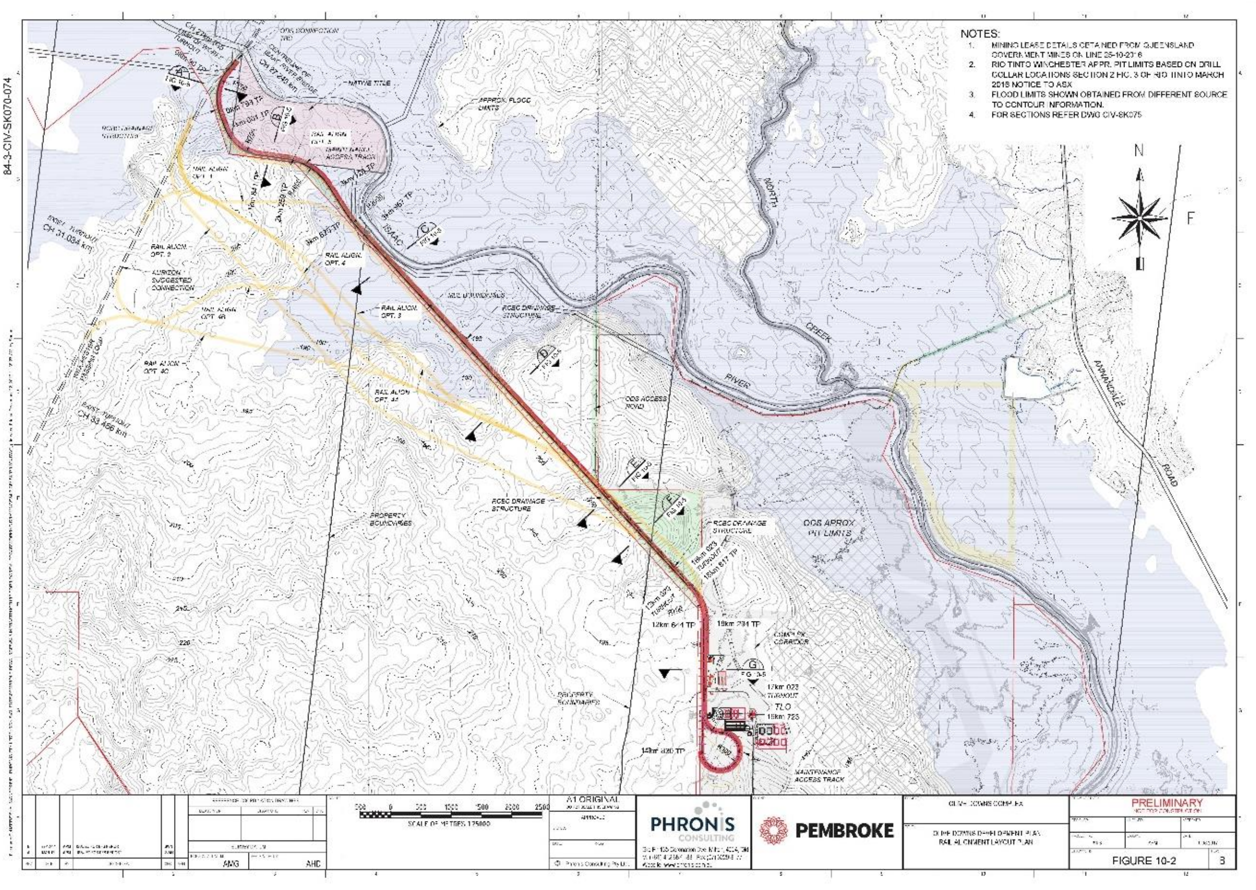
7. Infrastructure

7.1 Rail

The Project requires approximately 18kms of private rail infrastructure, including spur and loop which are proposed to be connected to the Norwich Park Branch Railway (“**NPBR**”) where coal will be hauled approximately 195kms from ODS to the port of Hay Point – Dalrymple Bay Coal Terminal (“**DBCT**”). Figure 7-1 shows the connection from the ODS facilities to the existing NPBR, including the topography and cross sections along the rail alignment.

No upgrading of the existing NPBR facilities is necessary.

Figure 7-1 Rail alignment layout plan



The direction of travel for the balloon loop has been reversed to avoid rail track outside the MDL boundaries and encroaching on MDL 183. The spur line is mainly designed to accommodate two trains with a provision for the second train to enter the loop while the first train is being fully loaded. The track can accommodate up to six trains per day and it is sufficient to handle peak product coal production of 14 -15 Mtpa.

The typical cycle time for a train between the ODS mine site and DBCT is approximately 15 hours. The trains are loaded at the rate of 4,000 to 4,500 t/hr at TLO with an unloading rate at the DBCT port of approximately 5027t/hr.

7.2 Port

The coal export facility for the Project is located at the Port of Hay Point, approximately 40kms south of Mackay. North Queensland Bulk Ports is the relevant authority managing the Port of Hay Point. Dalrymple Bay Coal Terminal Pty Ltd operates and maintains the terminal on a daily basis. Port capacity has been secured from 2020 onwards.

7.3 Haul Roads

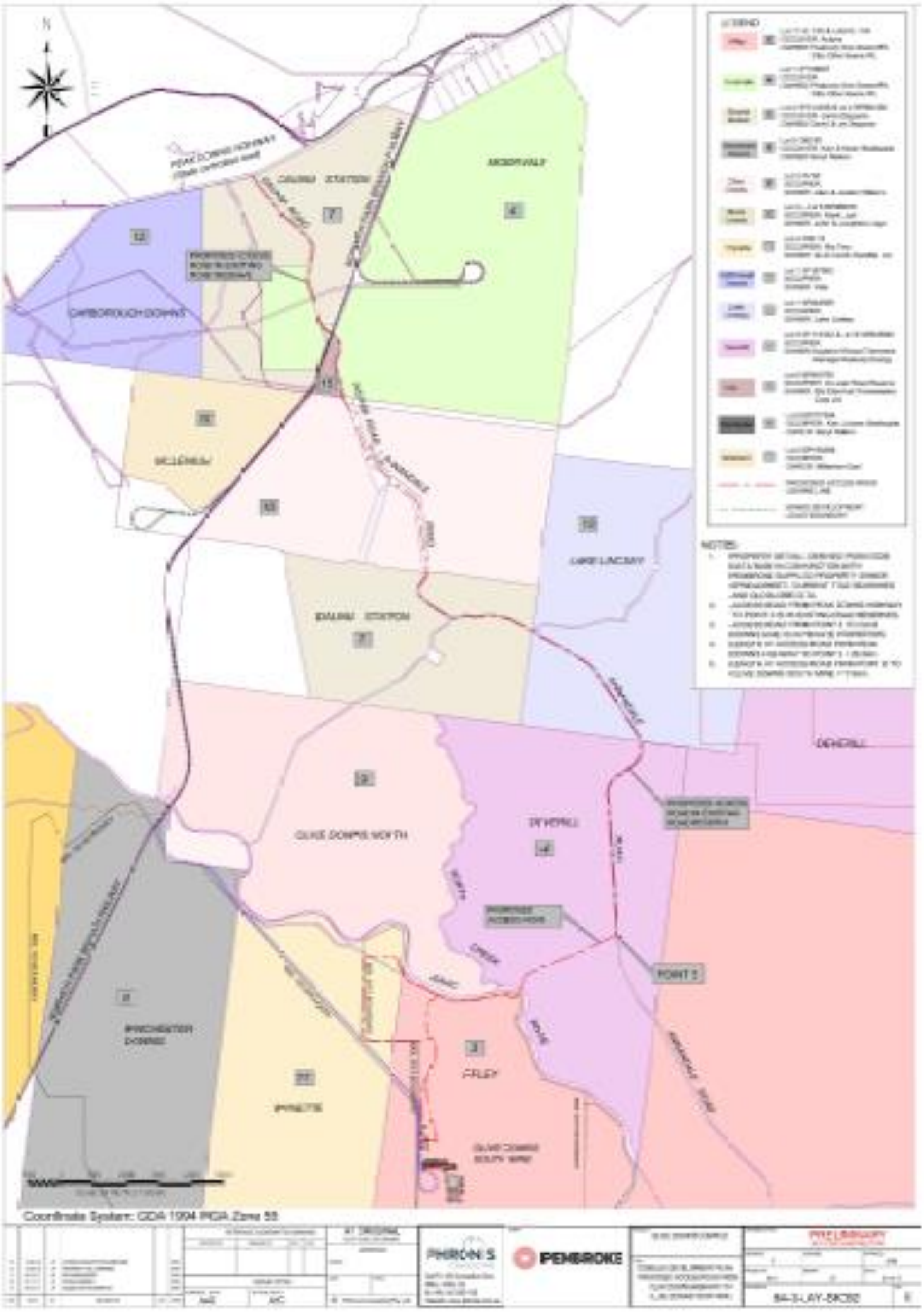
Haul roads from the pit ramps to the MIA will be constructed. The formation widths for the haul roads will be approximately 3.5 times the width of the largest vehicle operating as required by the *Coal Mining Safety and Health Regulation 2017* (Qld). At this stage, it is planned that a CAT 793 or Ultra Class will be used which gives a minimum road width of 30.5 metres plus shoulders and centre berms. Haul road construction and the hardstand in the MIA will consist of 200 mm of ridge gravel or crushed/blended hard rock and 400 mm of select overburden sub-base compacted by the mining fleet.

7.4 Access Roads

7.4.1 Olive Downs South access road

Access to ODS will start at the intersection of Peak Downs Highway and Daunia Road. Approximately 10km from Peak Downs Highway, Daunia Road becomes Annandale Road. A further twenty kilometres along Annandale Road, a new intersection and access road will be constructed (see Figure 7-2) on the Deverill property heading in a westerly direction to the northern end of ODS and then internally to the Mine Infrastructure Area (**MIA**). Pembroke is currently in the process of purchasing the Deverill property. A new crossing will be constructed across the Isaac River as part of the access road construction.

Figure 7-2 Proposed access road from peak downs highway to ODS mine



Both Daunia Road and Annandale Road are unsealed gravel roads approximately 5 metres wide. These roads will need to be widened and the pavement upgraded to cater for the design loading of vehicles using the access road and in compliance with Isaac Regional Council requirements.

The ODS access road is proposed to be constructed in two stages as follows:

Stage 1 - Initial roadworks to be provided at the mine construction phase and early operational phase:

- Upgrade and widening of Daunia Road and Annandale Road from the existing intersection with Peak Downs Highway up to the proposed new access road intersection, Point B, at Deverill.

- For Daunia Road and Annandale Road, the construction access roadworks entails the widening (where required) of the existing formation to 8.0 metres and the addition of 150 mm of unbound flexible gravel pavement over the existing pavement (where required) and widening. The widening on both sides of the existing pavement shall have a subbase layer of up to 500 mm of selected materials. Allowance has also been made for 5kms of sprayed seal for critical areas, during stages 2 and 3 of the project.

- The new construction access road from Annandale Road (Point B) at Deverill to the MIA shall consist of an initial base gravel pavement of 150 mm thick gravel. A temporary crossing of the Isaac River shall be constructed using selected materials for the pavement with low flow culverts laid under the pavement at the lowest point in the river bed to convey minor river flows under the access road. In large flood events, the crossing will be damaged and require reconstruction.

Stage 2 - Upgrade of access roads at operational phase of mine:

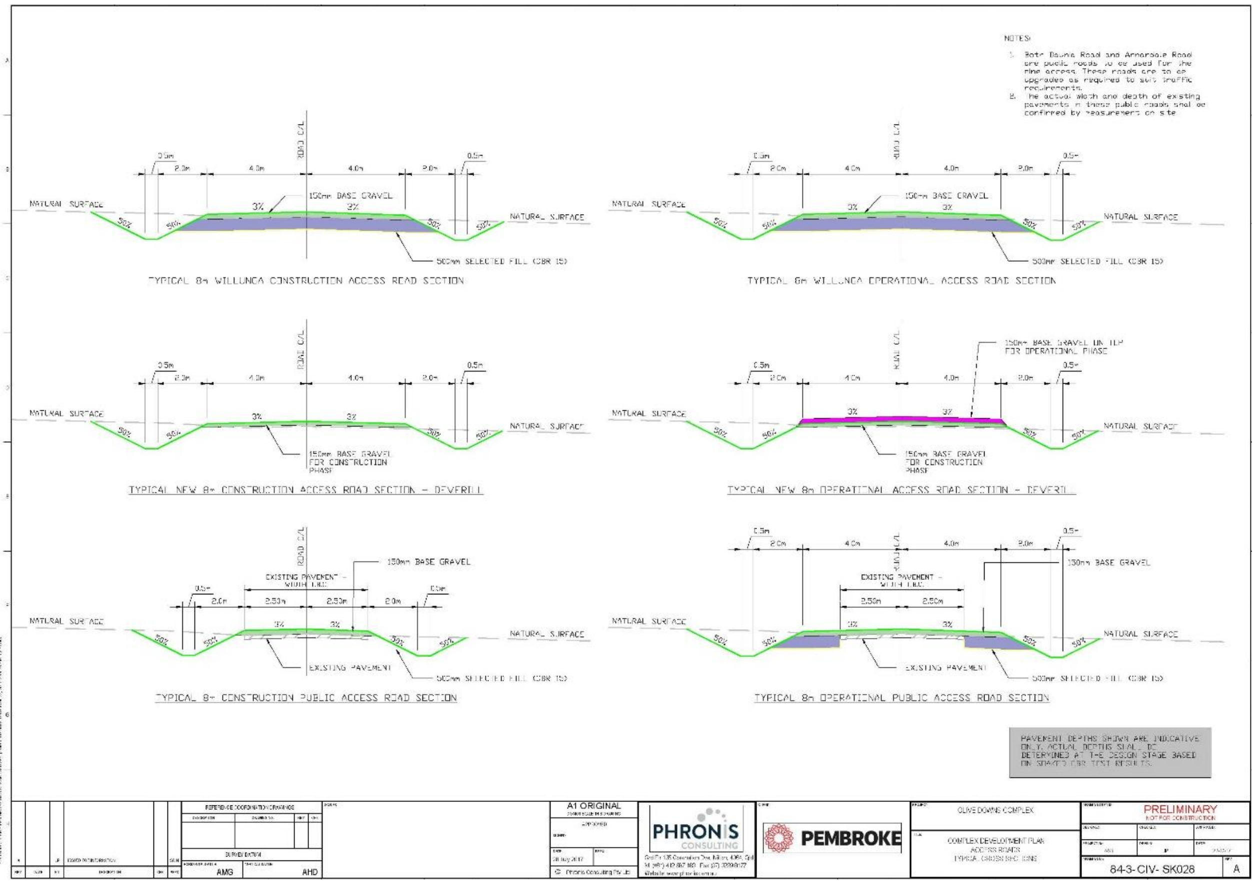
- Daunia Road and Annandale Road shall be rehabilitated as required including repair and reinstatement of gravel surface and the sealing of pavement in specified locations. The new access road via Deverill will be rehabilitated and another 150mm of gravel added to the pavement to achieve a mine access road with a design life extension of approximately 20 years with regular maintenance. The Isaac River crossing shall be upgraded to provide a 50% AEP (two-year ARI) flood immunity.

- Permanent access to the mine administration building and car park for all public traffic is proposed via this access road. This includes employees, visitors and deliveries reporting to the Mine. Authorised mine traffic may continue into the MIA, CHA and Mine pits via the internal roads to the facilities.

- The alignment geometry of the access roads is shown in Figure 7-2 above.

Typical cross sections of the access road configurations are shown in Figure 7-3 below.

Figure 7-3 Access roads cross sections



7.4.2 Willunga access road

The Willunga Access Road will provided access to the Willunga site off the Fitzroy Development Road. Fitzroy Development Road is a high quality rural highway that will provide good access to the Willunga site.

7.4.3 Internal access roads

Internal access roads will be provided to access the sewage treatment plant ("**STP**"), raw/potable water storages and potable water treatment plant ("**PWTP**") and environmental dam.

All the internal access roads will be designed to a lower design speed and service standard than that of the major access roads. They will generally be gravel-surfaced with at least a 150 mm depth of unbound flexible pavement with sub-base constructed from selected overburden material.

Internal access roads have a pavement width of 8 metres with table drains and cross drains provided where necessary to accommodate the two-year ARI event. These are typically accepted standards for serviceability and safety at Queensland coal mines.

The car park area adjacent to the administration building will be sized for around 100 cars for ODS and 50 cars for Willunga. The pavement will be a 250 mm thick unbound flexible pavement with a possible two coat spray seal for stage 2 of the project. All these car parks were proposed to be covered, however, this was deferred indefinitely to minimise capital costs.

7.5 Power

The Project is located in an area within 30 km radius of the Broadlea Ergon Energy substation and a Powerlink transmission line, east of the Peak Downs mine. The preliminary suitability of the existing power systems infrastructure to accommodate the load imposed by the mine requires that a connection be made to the Broadlea Substation near Coppabella to the north.

Onsite power will be supplied from Ergon Energy at 66 kV and distributed to substations servicing the mine infrastructure area, overland conveyor, coal handling area and train loadout area at 11 kV. All equipment will be supplied at either 400 V or 600 V for distant and relatively large loads.

All mining excavation and dewater equipment will be powered by diesel so no allowance has been made in the site power supply infrastructure for the supply of in pit equipment including shovels and dewatering pumping equipment.

7.6 Mine industrial facilities

The mine industrial facilities will be constructed on both the ODS and Willunga areas. The MIA for ODS will be located to the west of the mine pits on the western side of MLA 1. The facility layout plans is shown in **Error! Reference source not found.** and **Error! Reference source not found.**. The MIA for Willunga will be a satellite operation from the main facilities at ODS. The MIA is proposed to be located to the east of the Mine pit adjacent to the Fitzroy Development Road as shown in Figure 2-2 and Figure 7-6.

Figure 7-5 Complex Development Plan – ODS – Operations Playout Plan

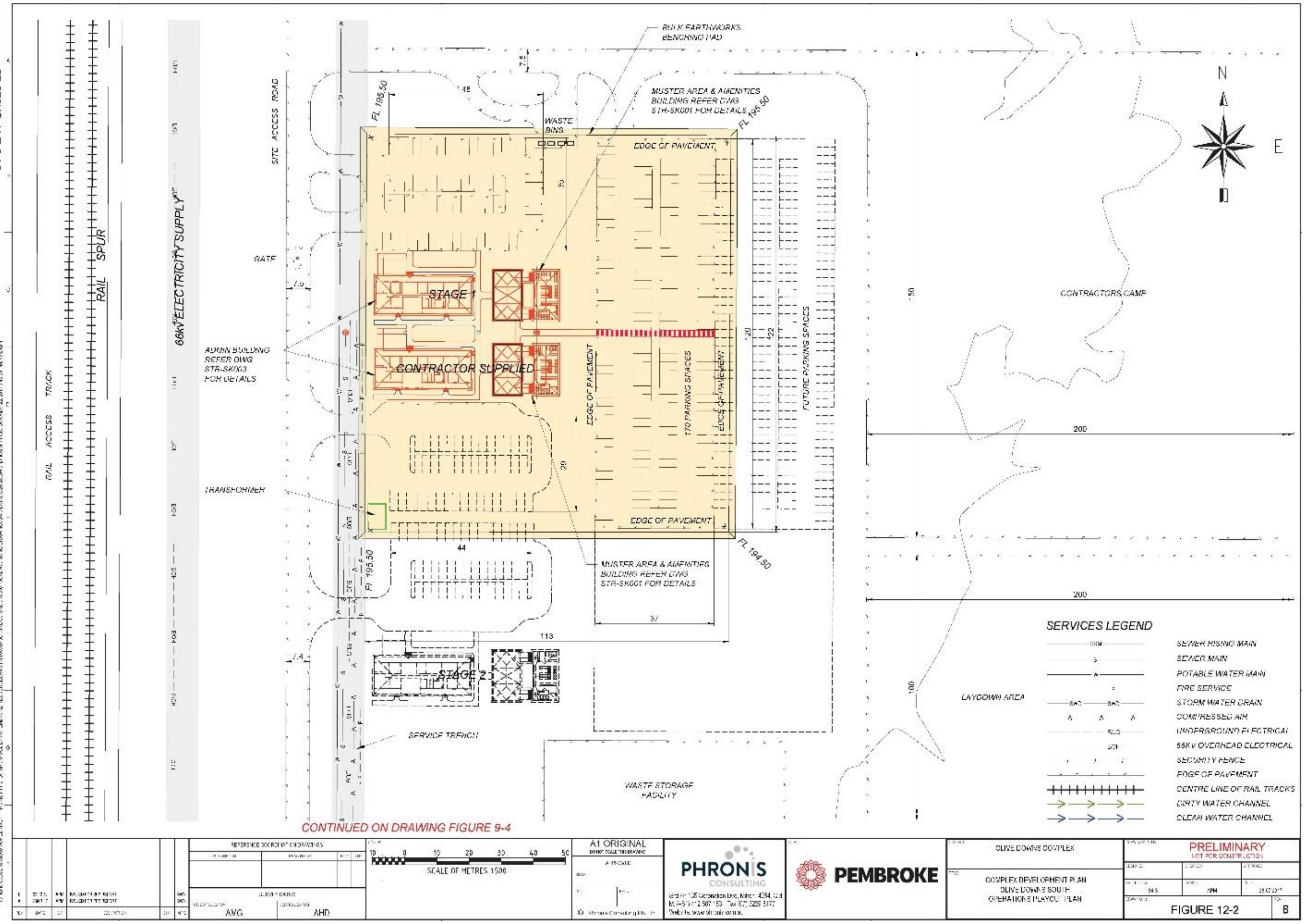
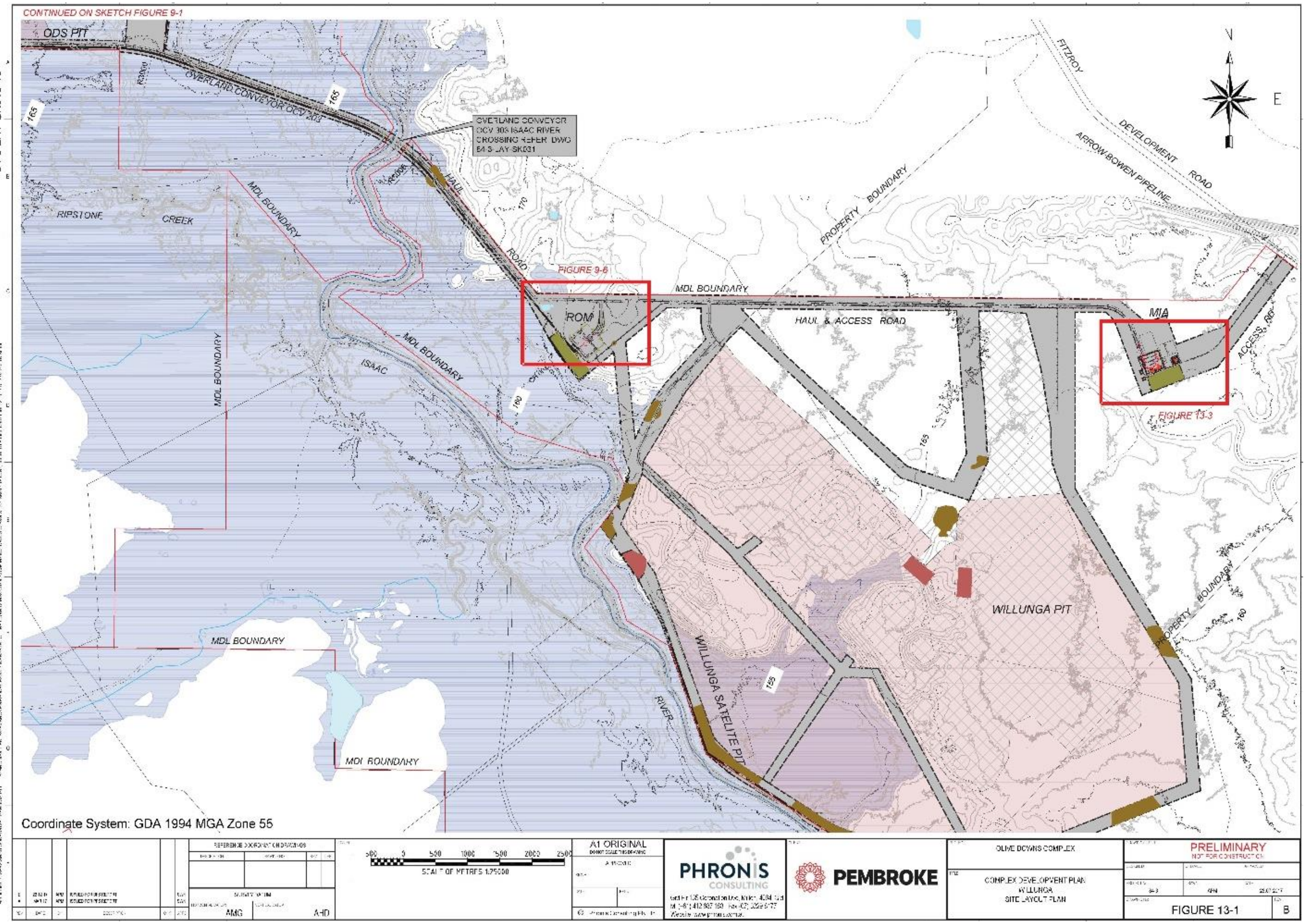


Figure 7-6 Complex Development Plan – Willunga – Site Layout Plan



The facilities for both ODS and Willunga include:

- access roads and car parking
- haul roads adjacent to the MIA
- initial hardstand areas
- MIA facilities include – earthworks, drainage, buildings, first aid facilities, services, muster area, bathhouse, workshops vehicle wash down facilities, fuel facilities, fire/raw water supply/treatment, potable water, sewerage treatment, waste storage area
- operational laydown area for items not affected by the weather such as shipping containers, equipment spare parts such as buckets/chains/tracks, conveyor components, cable drums, storage drum and concrete components
- raw water supply infrastructure system for Eungella Dam, Bowen Broken Water Supply Scheme, including a water supply pipeline spur and duplication of the existing Eungella south extension water supply pipeline
- mine water management structures including clean/dirty water drains, raw water dams, sedimentation dams and environmental dams
- overland flow diversions
- CHA including ROM dump infrastructure at ODS and Willunga
- CPP consisting of three individual plants delivered over three stages
- TLO
- high voltage power supply and reticulation
- site telecommunications including high speed data communications
- site security infrastructure such as a boom gates and fences
- explosive magazines

7.7 Water

The estimated water demands for infrastructure construction and initial mining operations are based on the following assumptions:

- 2-year construction period;
- approximately up to 700 person construction workforce;
- the PWTP being constructed prior to the major infrastructure construction;
- construction period dust suppression on the MIA area only;
- dam embankment construction includes sedimentation, environmental and raw water dams;
- commissioning tailings storage;
- commissioning allows for filling tanks; and
- drainage construction including bund and levee.

The full production water demands are based on the assumption that the average total length of haul and access roads requiring watering will be 28 km each. This is based on at least two pits being open at one time in both ODS and Willunga.

This CPP water demands were derived from these independent sources, with the most likely water consumption of 1000 Ml per annum per 6 Mtpa of ROM coal and utilising a flocculated tailing dewatering system. This generates a most likely water consumption of 3,500 Mlpa for the CPP at full production.

The estimated water demand for the Project is summarised in Table 24.

Table 24 Total mine water demand

Total Mine Water Demand	Infrastructure Construction Mlpa	Full Production 20 Mtpa Production Mlpa
Raw Water		
CPP makeup water – most likely	-	3,500
Coal Crushing Dust Suppression	-	400
Haul and Access Roads Watering	-	600
Miscellaneous Raw Water	10	80
Mine Infrastructure	5	40
Haul Road Construction	-	1
Construction Dust Suppression	250	-
Dam Construction	2	-
Access Road Construction	2	-
Site Road Construction	2	-
Commissioning	300	-
Sub Total	**571**	**4,621**
Potable		
Ablutions	8	28
Wash down	2	4
Firefighting allowance	1	2
Miscellaneous Potable	-	2
Commissioning	0.5	-
Sub-total	11.5	36
Wastage	4.6	13.6
Sub Total	**16**	**50**
Total Water Demand	**587**	**54,671**

7.7.1 Raw water services

Pembroke is negotiating an agreement with SunWater for an annual water allocation from the Bowen River Weir. The water will be drawn from the Eungella Dam, which is situated on Broken River, approximately 40 km west of the township of Eungella. The dam supplies water to several mines under the Bowen Water Supply Scheme System as well as the township of Moranbah.

In addition to the Eungella dam and pipeline system, raw water will be supplemented by surface water captured in the mine water management system, captured overland flow and ground water. Raw water used by the CPP will be augmented by recycled pit water; this water will also be used by the CPP dust suppression system along with haul road dust suppression.

Raw water from the Eungella system and surface water are of a sufficiently high quality to preclude pre-treatment prior to use in the CPP and the Potable Water Plant.

To connect the mine site to the Eungella pipeline system water supply, a 22.3 km long new duplicate Eungella pipeline southern extension will be constructed from Moranbah Terminal Storage to ODS offtake point, and a 29.0 km long ODS spur water pipeline from offtake point to ODS MIA location.

7.7.2 Raw water storage

Raw water from the Eungella system will be pumped directly to the CPP Process Water storage tanks. This system will also feed the raw water storage tank upstream of the Potable Water Treatment Plant and Fire System.

The raw water dam, which provides a minimum of 10 days storage capacity (250Ml), will form part of the raw water storage system. Surface water, captured overland flow and ground water from the locality of the mine will be pumped and stored in this reservoir along with a facility to mix and store raw water from the Eungella system. A raw water pumping station will be built to pump the raw water to the mine complex in the event of prolonged loss of the Eungella pumped system.

The CPP Process Water storage tanks will be located in a suitable position adjacent to the MIA. These tanks have been designed for an initial production rate of 6 Mtpa and will each have a capacity of 500 kl. This allows for approximately four hours of mine operating capacity.

Raw water will also be stored in potable water feed tank located in a suitable location within the MIA. The tank has been designed for an initial production rate of 12 Mtpa and will have a capacity of 250 kl, which allows for approximately four hours of mine operating capacity and firefighting.

7.7.3 Potable water

Potable water is normally sourced from the Eungella pipeline connection as this water is of a high quality. An alternate source from the Raw Water Dam will be utilised in the event of loss of the Eungella pumped system. The Potable Water Plant will therefore be designed to treat a range of water quality from all sources which will be pumped from the Raw Water Dam.

7.7.4 Potable water treatment plant

An automatically operating potable water treatment plant and potable water tank for storage are proposed to service the MIA and also supply the fire water system. The plant will include backwash disposal, pumps, alarms, and chemical and safety works/equipment as necessary.

The plant will be designed for ablutions, wash down and firefighting potable water requirements for 12 Mtpa coal production. The PWTP will accommodate a maximum daily volume of approximately 100 kl, and a maximum volume of 36 Ml (million litres) per year. The potable water flow is expected to range from between 0 L/s during shutdowns and maintenance shifts to 20 L/s during showering at shift changes. Flow rates will vary considerably throughout the day, and the potable water storage tank has been sized to balance these variations.

The anticipated daily workforce for 12 Mtpa coal production is 400 persons on site.

7.7.5 Potable water storage

A potable water tank of 250 kL capacity will be located adjacent to the PWTP in the MIA, the tank should be galvanised steel with PVC lining and will contain logic, in the form of level switches or an ultrasonic level meter, to report pump off, pump on, standby pump on, firefighting reserve level alarm and pump override to prevent running dry.