ENCLOSURE 1

RESPONSES TO DPE QUERIES

Moolarben Coal Complex – Open Cut Optimisation Modification

Response to NSW Department of Planning and Environment Information Request

OVERVIEW

LIST OF ATTACHMENTS

1. *Background*

Moolarben Coal Operations Pty Ltd (MCO), a wholly owned subsidiary of Yancoal Australia Limited, is proposing to optimise open cut mining operations at the Moolarben Coal Complex. These optimisations would require MCO to modify Project Approvals for Stage 1 and Stage 2 (herein referred to as the Open Cut Optimisation Modification [the Modification]).

An Environmental Assessment (EA) for the Modification was on public exhibition between 7 November and 7 December 2017, and received submissions from NSW Government Agencies, Non-Government Organisations and members of the public.

MCO considered each submission received for the Modification and submitted a Response to Submissions (RTS) on 24 May 2018.

The NSW Department of Planning and Environment (the Department) provided additional requests for information via email correspondence on 5 June 2018. The requests for information provided by the Department are provided in Table 1, below.

Table 1
Requests for Information

Request	Relevant Section

Mining Operations
• *Provide information on the current status of mining operations, including:*
  – *the status of mining operations in each open cut and underground mining domain;*
  – *the status of operations in the Stage 2 surface facilities;*
  – *the location extracted coal from each domain is being processed (ie. Stage 1 or Stage 2 surface facilities); and*
  – *a summary of the future mining schedule.*
• *Quantify the volume increase in the annual rate of coal reject production as a result of the proposed increases in ROM coal. Confirm storage/disposal arrangements proposed for the increased volume of coal reject.*
	Section 3

Water Treatment Facility • *Provide more detailed information on the design and layout of the water treatment facility (WTF) and associated storages. It is understood that the WTF would be located within and adjacent to the rail loop, which is a relatively constrained area in close proximity to Bora Creek. Layout mapping, showing the number and area of pre-treatment and by-product storages and overflows to existing storages, should be provided. This information should be in a larger scale than that presented in Figures 4.1 to 4.5 of the WRM 2017 report (Appendix E of the EA).*	Section 4
Staged Controlled Water Release Volume Limits • *In response to discussions with the EPA, it is noted that MCO has accepted staged increase to the EPL controlled water released volume limits. These appear to be linked to the status of mining operations in UG4. It is requested that further information be provided to clarify the linkages between mining operations and predicted water release requirements. Table 6.1 of the site water balance (WRM, 2017) provides a summary of the annual simulated controlled release volumes. It would be useful if an extra column was added to this table which indicates the key mining operations modelled for each year.*	Section 5
Gilgal Property Exploration Licences • *Provide evidence of consultations with the holders of exploration authorisations over the Gilgal property (ie. Santos NSW, Hunter Gas and Bowdens Silver), and confirmation that DRG is satisfied that the proposal would not significantly impact on current or future extraction of mineral or energy resources on this land.*	Section 6

IESC Advice
• *The Department is satisfied that many of the issues raised in the IESC advice (dated 15 December 2018) have been addressed in the RTS. However, the Department requests that MCO provides a specific response to the following issues raised by the IESC:*
  – *the requirement for a sensitivity analysis of the various inputs in the water balance model (beyond just climatic inputs) (refer to point 2 of the IESC advice);*
  – *the need to improve the geomorphological and ecological (primarily in-stream assessment of potential impacts to macrophytes) impact assessment of the likely increase in mine water discharge into the Goulburn River (refer to point 6 of the IESC Advice).*
	Section 7

Site Water Balance Comparison • *A tabulated comparative summary of the key site water balance predictions made by RPS Aquaterra in 2011 and HydroSimulations in 2015 against the latest modelled predictions made by HydroSimulations in 2017.*	Section 8

2. *Changes to the Modification following Submission of RTS*

Controlled Release Limits

Following further consultation with DPE and the Environment Protection Authority (EPA) in regard to the Modification, MCO proposes the following changes to controlled release volume and salinity limits:

- **Salinity limit**:
  - Maximum proposed salinity limit of 685 microSiemens per centimetre (µS/cm) (a reduction in comparison to the currently authorised salinity limit of 900 µS/cm in MCO's EPL 12932).
  - This limit is consistent with the 80th percentile upstream salinity level of the Goulburn River (based on combined data collected from monitoring locations UMC SW01 and GS 210046).
- **Volume limits**:
  - Up to 10 ML/day (as currently authorised by EPL 12932) for the remainder of Moolarben Coal Complex mine life, with the exceptions below.
  - Up to 15 ML/day during operations in UG4.
  - As the site water balance for the Modification predicted releases greater than the proposed staged discharge limit (as set out above) would be required during prolonged wet periods, and consistent with discussions with the EPA, the ability to temporarily release greater than the staged discharge limit following prolonged wet periods would be required (to the satisfaction of the EPA and subject to the conditions of EPL 12932 as varied).

The effect of the above is that, when compared to the currently authorised limits of EPL 12932, there would be:

- A reduction in the salinity of controlled releases for the remainder of the mine life.
- A reduction in annual salt loads released to the Goulburn River for the majority of the mine life.
- No increase in the controlled release volume limit for the majority of the mine life.
- The ability for MCO to release water in a controlled manner following periods of prolonged wet weather to minimise the risk of uncontrolled release of mine water.

$PM_{2.5}$ Monitor

To enable the collection of site-specific particulate matter <2.5 micrometres (µm) ($PM_{2.5}$) concentration data, MCO proposes to install a real-time $PM_{2.5}$ monitor.

3. *Mining Operations*

Current Mining Operations

The Department requested MCO provides the following information on the current status of mining operations at the Moolarben Coal Complex:

- *the status of mining operations in each open cut and underground mining domain;*
- *the status of operations in the Stage 2 surface facilities;*
- *the location extracted coal from each domain is being processed (ie. Stage 1 or Stage 2 surface facilities); and*
- *a summary of the future mining schedule.*

Status of Mining Operations

Figure 3B from the current Moolarben Coal Complex Mining Operations Plan (MOP) is provided in Attachment 1 and provides the planned mining operations and rehabilitation to 31 December 2018. Open cut extraction is currently taking place in OC1, OC2 and OC4, with underground extraction from UG1.

Status of Operations in Stage 2 Surface Facilities

The indicative layout of infrastructure for Stage 2 is shown on Figure 2.2 of Project Approval (08_0135) and is provided in Attachment 2. Construction of the majority of Stage 2 infrastructure has been undertaken, including:

- Stage 2 (OC4) mine infrastructure area (MIA);
- OC4 south-west haul road;
- Stage 2 (OC4) conveyor;
- Stage 2 (OC4) run-of-mine (ROM) coal facilities (including ROM coal stockpile, ROM coal hopper and associated infrastructure);
- OC4 site access road;
- UG1 highwall entry;
- UG1 pit top facilities (including underground MIA, ROM coal stockpile and associated infrastructure);
- UG1 remote services facilities;
- bypass coal conveyor; and
- product bypass stockpiles.

Location of Coal Processing

All ROM coal extracted from both open cut and underground operations at the Moolarben Coal Complex is transferred to the coal handling and processing plant (CHPP) (i.e. either crushed, washed and stockpiled as washed product coal, or crushed, bypassed and stockpiled as bypass product coal).

The CHPP and associated infrastructure have been revised through modifications of the Moolarben Coal Complex, with the extension of the product bypass stockpile constructed following approval of the UG1 Optimisation Modification.

ROM coal extracted from the currently operating Stage 1 open cuts (OC1 and OC2) is conveyed to the CHPP.

ROM coal extracted from the Stage 2 open cut (OC4) is transported to the Stage 2 ROM coal facility located on the north-western side of OC4, and then transferred via conveyor to the CHPP. ROM coal from OC4 is also approved to be transported by haul truck via the south-west haul road (e.g. during maintenance of the OC4 overland conveyor), then conveyed to the CHPP.

Bypass ROM coal extracted from underground operations is sent via the bypass conveyor to the product bypass stockpile.

Summary of Scheduled Mining Operations

The indicative production schedules for both the approved operations and the operations incorporating the Modification are provided in Table 2.

Coal Reject Production

The Department requested MCO provides the following information regarding the mining operations proposed by the Modification:

> *Quantify the volume increase in the annual rate of coal reject production as a result of the proposed increases in ROM coal. Confirm storage/disposal arrangements proposed for the increased volume of coal reject.*

While the Modification proposes an increase in annual ROM coal production, there is no significant increase (< 3 million tonnes [Mt]) in ROM coal produced over the life of the mine for the Modification (Table 2). In addition, due to the increase in bypass (i.e. unwashed) coal proposed as part of the Modification, the volume of rejects over the life-of-mine **would be reduced** (Table 2) by 14 Mt (i.e. from 50 Mt to 36 Mt).

Due to the overall decrease in rejects, no additional storage/disposal arrangements to manage coal rejects are required due to the Modification.

4. *Water Treatment Facility*

The Department requested MCO provides the following information regarding the proposed water treatment facility:

> *Provide more detailed information on the design and layout of the water treatment facility (WTF) and associated storages. It is understood that the WTF would be located within and adjacent to the rail loop, which is a relatively constrained area in close proximity to Bora Creek. Layout mapping, showing the number and area of pre-treatment and by-product storages and overflows to existing storages, should be provided. This information should be in a larger scale than that presented in Figures 4.1 to 4.5 of the WRM 2017 report (Appendix E of the EA).*

Figure 1 presents the general design and layout of the proposed water treatment facility.

Table 2
Indicative Forecast Moolarben Coal Complex Production Schedules (Mt)

Modification Production Schedule

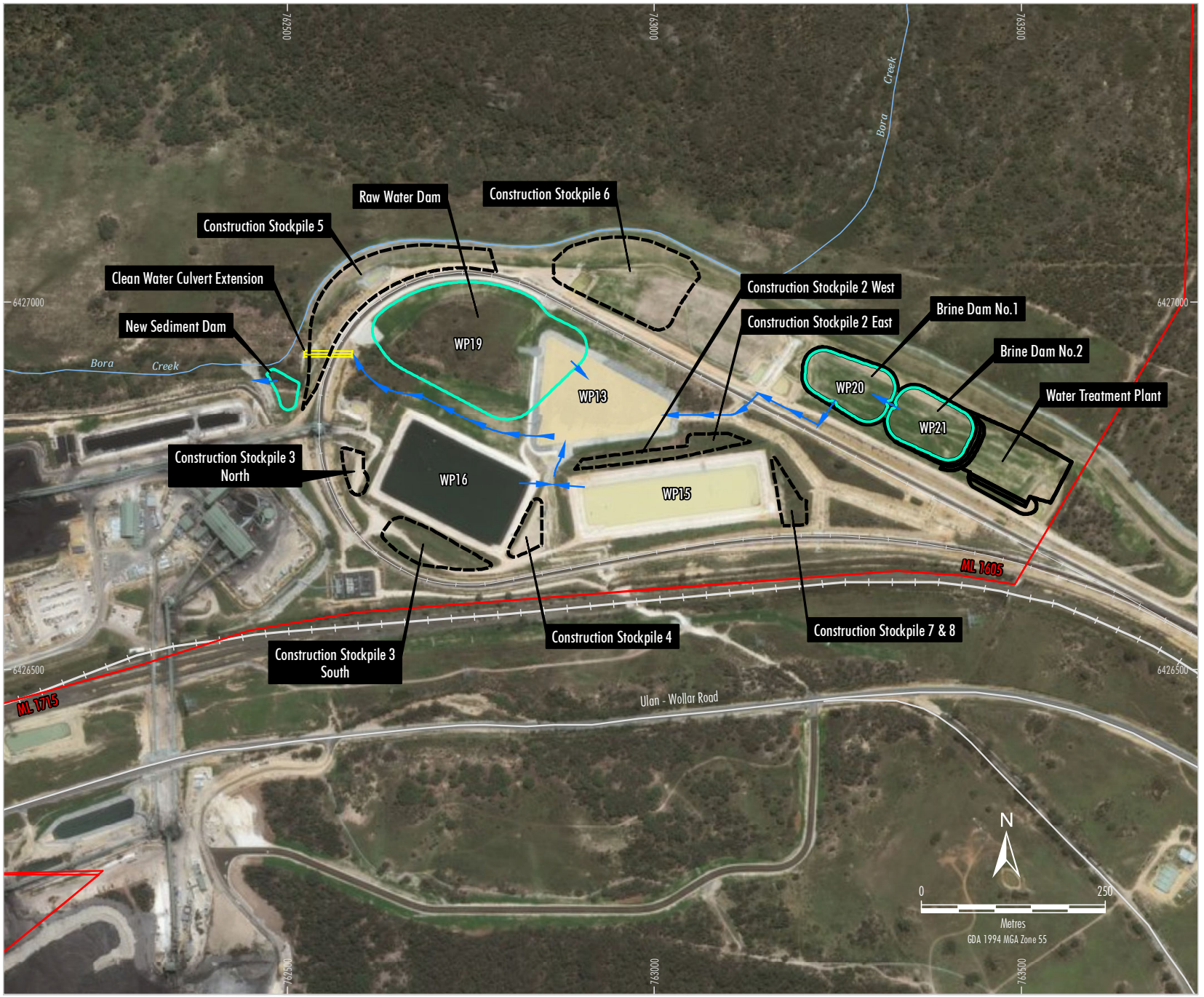
Year	ROM Coal Production								CHPP Washing	Bypass	Reject	Total Product
	Open Cut						Underground	Total				
	Stage 1				Stage 2							
	OC1	OC2	OC3	Total	OC4	Total Open Cut ROM						
2018	-	4.4	2.4	6.9	8	14.9	4.5	19.4	14.9	4.5	3.1	16.3
2019	1.3	3.5	3.1	7.9	8.1	16	6.1	22.1	16	6.1	3.5	18.6
2020	5.7	0.8	3.6	10	5.7	15.7	8	23.7	13.4	10.3	3	20.7
2021	2.7	-	7.3	10	5.9	15.9	8	23.9	13.6	10.2	2.9	21
2022	-	-	7.4	7.4	7.7	15.1	6.8	21.9	15.1	6.8	3.3	18.5
2023	-	-	-	-	12.8	12.8	6.1	18.9	7.6	11.3	2	17
2024	-	-	-	-	10.6	10.6	6.5	17.1	6.1	11	1.5	15.7
2025	-	-	-	-	16	16	8	24	9.5	14.5	2.2	21.8
2026	-	-	-	-	16	16	5.9	21.9	9.4	12.5	2.1	19.8
2027	-	-	-	-	13	13	4	17	7.8	9.1	1.8	15.2
2028	-	-	-	-	11.9	11.9	4	15.9	7.3	8.6	1.7	14.2
2029	-	-	-	-	11.5	11.5	1.8	13.3	7	6.3	1.6	11.7
2030	-	-	-	-	11.3	11.3	-	11.3	6.9	4.5	1.6	9.8
2031	-	-	-	-	9.8	9.8	-	9.8	5.9	3.9	1.4	8.4
2032	-	-	-	-	8	8	-	8	4.7	3.3	1.1	6.9
2033	-	-	-	-	7	7	-	7	4.2	2.8	1	6
2034	-	-	-	-	6	6	-	6	3.6	2.4	0.8	5.2
2035	-	-	-	-	4	4	-	4	2.4	1.6	0.5	3.5
2036	-	-	-	-	3.5	3.5	-	3.5	2.1	1.4	0.5	3
2037	-	-	-	-	3	3	-	3	1.8	1.2	0.4	2.6
2038	-	-	-	-	1	1	-	1	0.6	0.4	0.1	0.9
Total	**9.7**	**8.7**	**23.7**	**42.1**	**180.8**	**222.9**	**69.7**	**292.6**	**159.8**	**132.8**	**36.1**	**256.5**

Approved Production Schedule

Year	ROM Coal Production			CHPP Washing	Bypass	Reject	Total Product
	Open Cut						
	Total Open Cut ROM	Underground	Total				
2018	12.4	4.5	16.9	12.4	4.5	2.57	14.3
2019	12.9	6.1	19.0	12.9	6.1	2.79	16.2
2020	12.9	8	20.9	12.9	8	2.90	18.0
2021	13	8	21.0	13.0	8	2.74	18.3
2022	12.8	6.8	19.6	12.8	6.8	2.84	16.8
2023	13	6.1	19.1	13.0	6.1	3.35	15.7
2024	12.8	6.5	19.3	12.8	6.5	3.08	16.2
2025	12.9	8	20.9	12.9	8	3.00	17.9
2026	12.9	5.9	18.8	12.9	5.9	2.95	15.8
2027	13	4	17.0	13.0	4	3.02	14.0
2028	13	4	17.0	13.0	4	3.03	14.0
2029	13	1.8	14.8	13.0	1.8	3.03	11.8
2030	12.3	0	12.3	12.3	0	2.83	9.5
2031	12.6	0	12.6	12.6	0	2.94	9.7
2032	12.8	0	12.8	12.8	0	2.94	9.9
2033	8.7	0	8.7	8.7	0	2.00	6.7
2034	6.3	0	6.3	6.3	0	1.45	4.9
2035	3.8	0	3.8	3.8	0	0.87	2.9
2036	3.3	0	3.3	3.3	0	0.76	2.5
2037	3.3	0	3.3	3.3	0	0.76	2.5
2038	2.60	0	2.6	2.6	0	0.60	2.0
Total	**220.3**	**69.7**	**290**	**220.3**	**69.7**	**50.5**	**239.5**

Variance (+ve indicates Modificaiton greater than Approved	
Total ROM Coal	Total Product
2.5	2.0
3.1	2.4
2.8	2.7
2.9	2.7
2.3	1.7
-0.2	1.3
-2.2	-0.5
3.1	3.9
3.1	4.0
0	1.2
-1.1	0.2
-1.5	-0.1
-1	0.3
-2.8	-1.3
-4.8	-3.0
-1.7	-0.7
-0.3	0.3
0.2	0.6
0.2	0.5
-0.3	0.1
-1.6	-1.1
2.7	**17.3**

Note: the above indicative production schedules may change in response to market conditions or other considerations. Further details would be in the MOP.



LEGEND

- Mining Lease Boundary
- Construction Stockpile
- Water Storage
- Overflow Path from Water Storage

Source: MCO (2018); NSW Dept of Industry (2016)
Orthophoto: Esri Basemap (2017)

MOOLARBENCOAL

MOOLARBEN COAL COMPLEX

Water Treatment Facility

Figure 1

MCM-16-14 _OC Opt Mod_MT_RtS_204E

5. *Staged Controlled Water Release Volume Limits*

The Department requested MCO provides the following information regarding the staged controlled water release volume limits:

> *In response to discussions with the EPA, it is noted that MCO has accepted staged increase to the EPL controlled water released volume limits. These appear to be linked to the status of mining operations in UG4. It is requested that further information be provided to clarify the linkages between mining operations and predicted water release requirements. Table 6.1 of the site water balance (WRM, 2017) provides a summary of the annual simulated controlled release volumes. It would be useful if an extra column was added to this table which indicates the key mining operations modelled for each year.*

Please note that revised controlled water release volume limits are proposed, as described in Section 2 (i.e. revised when compared to the RTS).

Notwithstanding, Table 3 provides a comparison of the annual controlled release requirements predicted by WRM Water & Environment (WRM) (2017) (i.e. Table 6.1 from WRM [2017]), the indicative ROM coal production schedule for the Modification, and the proposed controlled release volume limits.

6. *Gilgal Property Exploration Licences*

The Department requested MCO provides the following information regarding the Gilgal Property:

> *Provide evidence of consultations with the holders of exploration authorisations over the Gilgal property (ie. Santos NSW, Hunter Gas and Bowdens Silver), and confirmation that DRG is satisfied that the proposal would not significantly impact on current or future extraction of mineral or energy resources on this land.*

Evidence of correspondence with Santos NSW, Hunter Gas and Bowdens Silver is provided in Attachment 3. All three exploration licence holders indicated no objections to the inclusion of the Gilgal property in the Biodiversity Offset Strategy for the Modification.

7. *IESC Advice*

Sensitivity Analysis of Site Water Balance

The Department requested MCO provides a specific response to the following issue raised by the Independent Expert Scientific Committee on Coal Seam Gas and Large Coal Mining Development (IESC):

> *the requirement for a sensitivity analysis of the various inputs in the water balance model (beyond just climatic inputs) (refer to point 2 of the IESC advice);*

Climatic variability (e.g. daily and annual rainfall) has the largest variability on the performance of the water management system for the Moolarben Coal Complex.

The other inputs that have the most material impact on the site water balance are rainfall runoff characteristics and groundwater inflows.

Table 3
Comparison of Annual Controlled Release Requirements and Indicative ROM Coal Production

Proposed Staged Discharge Limit	Year	Annual Controlled Releases (ML/year) (WRM, 2017)[1]					ROM Coal Production (Mt)[1]						
		1%ile	10%ile	50%ile	90%ile	99%ile	Open Cut	Underground					Total
							Total Open Cut	Stage 1	Stage 2			Total Underground	
								UG4	UG1	UG2	Total		
10 ML/day	2018	4,080	2,425	614	-	-	14.9	-	4.5	-	4.5	4.5	19.4
	2019	4,717	3,048	1,259	469	130	16.0	0.1	6.0	-	6.0	6.1	22.1
	2020	6,177	3,935	2,253	1,539	1,198	15.7	0.1	7.9	-	7.9	8.0	23.7
	2021	6,697	4,748	3,048	2,369	2,059	15.9	0.3	7.7	-	7.7	8.0	23.9
15 ML/day	2022	6,749	4,726	3,010	2,347	2,033	15.1	4.0	2.8	-	2.8	6.8	21.9
	2023	6,893	5,338	3,476	2,815	2,515	12.8	6.1	-	-	-	6.1	18.9
	2024	6,981	5,363	3,620	2,973	2,631	10.6	6.5	-	-	-	6.5	17.1
	2025	7,079	5,707	4,019	3,328	2,959	16.0	7.8	-	0.2	0.2	8.0	24.0
	2026	7,300	5,784	4,134	3,385	2,952	16.0	5.5	-	0.4	0.4	5.9	21.9
	2027	5,260	3,070	705	21	11	13.0	1.0	-	3.0	3.0	4.0	17.0
10 ML/day	2028	4,808	3,011	551	-	-	11.9	-	-	4.0	4.0	4.0	15.9
	2029	5,361	3,500	1,020	207	-	11.5	-	-	1.8	1.8	1.8	13.3
	2030	5,531	3,447	565	-	-	11.3	-	-	-	-	-	11.3
	2031	5,649	3,449	582	-	-	9.8	-	-	-	-	-	9.8
	2032	5,002	2,946	130	-	-	8.0	-	-	-	-	-	8.0
	2033	5,015	2,660	-	-	-	7.0	-	-	-	-	-	7.0
	2034	5,133	2,654	-	-	-	6.0	-	-	-	-	-	6.0
	2035	5,078	2,716	-	-	-	4.0	-	-	-	-	-	4.0
	2036	5,379	3,005	100	-	-	3.5	-	-	-	-	-	3.5
	2037	5,300	3,078	127	-	-	3.0	-	-	-	-	-	3.0
	2038	5,346	2,956	60	-	-	1.0	-	-	-	-	-	1.0

[1] Timing for coal extraction is indicative only. The actual timing for the discharge volume limits would be dependent on mining operations progress and other factors (e.g. climate).

Note: Temporary releases greater than the staged discharge limit may be required during periods of prolonged wet weather.

The Australian Water Balance Model (AWBM) rainfall runoff parameters adopted by WRM (2017) for the Modification were based on previous modelling and calibration of the OPSIM model for the Moolarben Coal Complex. WRM (2013) undertook the original calibration of the model, and the model has been calibrated against subsequent site observations and as part of periodic reviews of the site water balance conducted by WRM. As the rainfall runoff parameters adopted for WRM (2017) have been calibrated, the parameters provide a good representation of the rainfall runoff characteristics of the Moolarben Coal Complex.

Groundwater inflows adopted by WRM (2017) were based on modelling by HydroSimulations (2017). Groundwater inflow volumes predicted by HydroSimulations (2017) were based on a revised groundwater model that was calibrated using recent groundwater observations, in particular observed drawdown effect from existing mining operations and inflows to UG1 following its commencement.

In consideration of the above, additional sensitivity analysis of other parameters that would have significantly less effect on the site water balance than climate is not considered to be required.

Geomorphology and Aquatic Ecology

The Department requested MCO provides a specific response to the following issue raised by the IESC:

> *the need to improve the geomorphological and ecological (primarily in-stream assessment of potential impacts to macrophytes) impact assessment of the likely increase in mine water discharge into the Goulburn River (refer to point 6 of the IESC Advice).*

Point 6 of the IESC's advice stated the following:

> *The proponent needs to assess the potential impacts of up to 20 ML/day sustained discharge on the Goulburn River (including the diversion channel), addressing:*
>
> *a. the identification of the in-stream macrophytes in the diversion channel;*
>
> *b. risks to the persistence and health of macrophyte beds, including their capacity to survive sustained higher flows;*
>
> *c. potential consequences of sediment mobilisation should macrophyte cover be reduced;*
>
> *d. the metal and other contaminant content of sediment within the channel and potential bio-concentration of metals and other contaminants in the macrophytes;*
>
> *e. the capacity of the macrophyte beds to reduce turbidity of mine water discharge;*
>
> *f. the potential geomorphological impacts (to sediment composition and depth) of up to 50 ML/day of cumulative mine discharge (from both Moolarben and Ulan mines) to the Goulburn River downstream of the diversion channel;*
>
> *g. potential ecological effects of a reduction in low flows, changes to flow variability and geomorphology in the Goulburn River (as discussed in paragraph 5); and*
>
> *h. avoidance and mitigation measures for potential hydrological, water quality and ecological impacts.*

As stated in Section 2, MCO now proposes to retain the currently authorised volume limit of 10 ML/day for the majority of the mine life. As such, there would no longer be "20 ML/day sustained discharge".

IESC Points 6a, 6b and 6c

Plate 1: Goulburn River Diversion (looking downstream from proposed relocated discharge point)

The Goulburn River Diversion at the point of discharge has a well-established, thick reed lined bed (Plate 1).

Advisian (2017) assessed the potential impacts of the 20 ML/day discharges proposed in the Modification EA.

During low flow periods, the 20 ML/day discharges would increase river height by 0.07 m immediately downstream of the proposed discharge point (at chainage 2000 in Advisian [2017]) and by 0.02 m when compared to the approved discharge limit of 10 ML/day.

These increases would be minor compared to the height of reeds that currently line the Diversion bed (refer Plate 1).

During low flow periods, the 20 ML/day discharges would result in an estimated stream velocity within the range expected to result in minimal scour, even on a bare sandy surface (Advisian, 2017). Given that the Goulburn River Diversion consist of well vegetated channels, the estimated average velocity for all flows modelled is not expected to result in any scour.

As described in Section 2, MCO proposes a reduced discharge limit in comparison to what was assessed in the Modification EA, with discharge volume limits to be unchanged from what is currently approved by EPL 12932 except during operations in UG4 and during periods of prolonged wet weather. Potential impacts of the increased discharge volumes would therefore be less than those predicted by Advisian (2017).

Based on the above, it is considered that the proposed discharges would not adversely affect the reed beds in the Diversion such that significant sediment mobilisation occurs.

IESC Point 6d

The existing metal and other contaminant concentrations of sediment within the Diversion channel is not considered to be relevant to the Modification or the Moolarben Coal Complex, given that to date discharges have occurred infrequently, as noted by the IESC.

The potential for sediment mobilisation as result of the proposed 20 ML/day controlled releases was assessed by Advisian (2017) through hydrological modelling, which indicates that the risk of sediment mobilisation is low, when conservatively compared to a bare sandy surface, and that this risk is further reduced for the actual Goulburn River Diversion Channel due to the presence of the existing thick reed bed.

As described in Section 2, MCO proposes a reduced discharge limit in comparison to what was assessed in the Modification EA, with discharges volumes proposed to be unchanged from what is currently approved by EPL 12932 except during operations in UG4 and during periods of prolonged wet weather. Potential impacts of the increased discharge volumes would therefore be less than those predicted by Advisian (2017).

IESC Point 6e

Further assessment of turbidity is not considered to be required. The water treatment facility would remove sediment prior to treatment through reverse osmosis such that turbidity would be controlled to the turbidity and total suspended solids (TSS) discharge limits at the point of discharge.

In addition, the proposed relocation of the existing EPL discharge point would reduce turbidity and TSS (compared to the currently authorised discharge point) as potential erosion along Bora Creek would be avoided.

IESC Point 6f

It should be noted that of the 50 ML/day referred to by the IESC, 40 ML/day is currently licensed (30 ML/day from the Ulan Mine Complex and 10 ML/day from the Moolarben Coal Complex).

The currently authorised cumulative controlled release limit of 40 ML/day would be unchanged for the majority of Moolarben Coal Complex mine life based on the revised limits in Section 2.

Potential geomorphic impacts were considered by Advisian (2017) with respect to river height, flow velocity and associated potential risks to channel stability from scour. It was concluded that a discharge of 20 ML/day from the Moolarben Coal Complex would not be expected to lead to scour at or downstream of the proposed discharge point (including in consideration of cumulative discharges from the Ulan Mine Complex) given the following:

- increases in flow would be well within historic flow variability;
- increases in river height would be minor;
- stream velocity would be within the range expected to result in minimal scour, even on a bare sandy surface; and
- controlled release volumes would be well within the carrying capacity of the Goulburn River.

Potential impacts of the revised limits proposed in Section 2 would therefore be less than those predicted by Advisian (2017).

IESC Point 6g

Marine Pollution Research (MPR) (2017) notes that periods of prolonged low flow typically result in poorer water quality in the Goulburn River. This is illustrated in Attachment A of the IESC's comments, which shows an electrical conductivity (EC) increasing with lower flows in the Goulburn River at the Coggan gauging station. On this basis, MPR (2017) concluded that the potential loss of low flow periods would be beneficial (i.e. from a water quality perspective) and would offset reduced low flow variation.

Notwithstanding, as described in Section 2, MCO proposes a reduced discharge limit in comparison to what was assessed in the Modification EA, with discharge volumes proposed to be unchanged from what is currently approved by EPL 12932 except during operations in UG4 and during periods of prolonged wet weather.

IESC Point 6f

Avoidance and mitigation measures for potential hydrological, water quality and ecological impacts are summarised as follows:

- MCO proposes to reduce the salinity limit of controlled releases from 900 to 685 µS/cm.
- MCO would maximise the use of water on-site to avoid/minimise, as far as possible, the requirement to release. The site water balance (WRM, 2017) demonstrates that during periods where the requirement to discharge significant volumes of water is required, the external water demand (to meet operational demands) is 0 ML.
- To mitigate potential downstream water quality and aquatic ecology impacts, MCO would install a water treatment facility to treat water prior to discharge. Discharge concentration limits would be specified in EPL 12932, and in addition, dissolved metals would be treated to the ANZECC Guideline limits at the point of discharge.
- To avoid potential erosion along Bora Creek, the existing EPL 12932 discharge point (EPL ID1) would be relocated to the confluence of Bora Creek and Goulburn River Diversion.
- To mitigate potential downstream hydrological impacts, a spreader/diffuser would be installed at the proposed relocated discharge point to avoid scouring.

8. *Site Water Balance Comparison*

The Department requested MCO provides the following information regarding site water balances modelled for the Moolarben Coal Complex:

> *A tabulated comparative summary of the key site water balance predictions made by RPS Aquaterra in 2011 and HydroSimulations in 2015 against the latest modelled predictions made by HydroSimulations in 2017.*

The key input driving the requirement for an increase to controlled release limits for the Modification is the volume of groundwater inflows predicted by HydroSimulations (2017), which were adopted by WRM (2017) for the Modification site water balance. A summary of adopted groundwater inflows for site water balances modelled for the Moolarben Coal Complex is provided below, with a comparison of adopted inflow values provided in Table 4.

Stage 2 Preferred Project Report

WorleyParsons (2011) conducted the site water balance for the Moolarben Coal Project Stage 2 Preferred Project Report (PPR). The groundwater inflow volumes adopted by WorleyParsons (2011) were based on predictions made by RPS Aquaterra (2011). Groundwater inflow predictions were based on the groundwater model developed by RPS Aquaterra (2011), which was calibrated using groundwater observations to 2008.

Table 4 presents the total groundwater inflows, as well as and borefield inflows, adopted by WorleyParsons (2011) for 24 operational years.

UG1 Optimisation Modification

WRM (2015) assessed the incremental impact of the UG1 Optimisation Modification on the performance of the site water balance for the Moolarben Coal Complex, based on the peak increase of inflows into UG1 predicted by HydroSimulations (2015).

HydroSimulations (2015) did not re-assess the total mine inflows, but rather focussed on the incremental impacts of the UG1 Optimisation Modification using the groundwater model developed by RPS Aquaterra (2011).

As the UG1 Optimisation Modification only considered incremental impacts and did not re-assess total mine inflows, a direct comparison with the groundwater inflows adopted for the Stage 2 PPR and this Modification (i.e. the Open Cut Optimisation Modification) cannot be made.

Open Cut Optimisation Modification

WRM (2017) conducted a site water balance for the Modification, adopting the groundwater inflow volumes predicted by HydroSimulations (2017). Groundwater inflow volumes predicted by HydroSimulations (2017) were based on a revised groundwater model, which was calibrated using current and historic groundwater observations.

Table 4
Comparison of Adopted Groundwater Inflow Volumes

WorleyParsons (2011)				WRM (2017)			
Year of Operation	Volume Pumped from Borefield (ML/year)	Total Groundwater Inflow (ML/year)	Total Inflow	Calendar Year	Volume Pumped from Borefield (ML/year)	Total Groundwater Inflow (ML/year)	Total Inflow (ML/year)
1	1,101.0	280.3	1,381.3	-	-	-	-
2	1,146.1	203.5	1,349.6	-	-	-	-
3	1,037.4	259.7	1,297.1	-	-	-	-
4	1,038.3	320.2	1,358.5	*2018*	788.0	2,118.0	2,906.0
5	932.4	367.4	1,299.8	*2019*	788.0	2,424.0	3,212.0
6	926.3	357.5	1,283.8	*2020*	788.0	3,859.0	4,647.0
7	870.6	568.8	1,439.4	*2021*	788.0	5,040.0	5,828.0
8	845.4	553.7	1,399.1	*2022*	631.0	5,007.0	5,638.0
9	849.7	750.6	1,600.3	*2023*	473.0	5,141.0	5,614.0
10	815.7	893.0	1,708.7	*2024*	315.0	5,316.0	5,631.0
11	930.5	880.6	1,811.1	*2025*	-	6,307.0	6,307.0
12	1,032.3	741.3	1,773.6	*2026*	-	6,113.0	6,113.0
13	1,104.8	734.6	1,839.4	*2027*	-	886.0	886.0
14	1,062.9	804.4	1,867.3	*2028*	-	1,332.0	1,332.0
15	1,128.8	604.9	1,733.7	*2029*	-	1,848.0	1,848.0
16	1,135.0	598.2	1,733.2	*2030*	-	1,318.0	1,318.0
17	1,135.4	858.5	1,993.9	*2031*	-	1,444.0	1,444.0
18	1,112.3	773.5	1,885.8	*2032*	-	221.0	221.0
19	1,100.4	753.0	1,853.4	*2033*	-	253.0	253.0
20	1,106.9	868.1	1,975.0	*2034*	-	301.0	301.0
21	1,135.3	544.1	1,679.4	*2035*	-	245.0	245.0
22	945.4	716.6	1,662.0	*2036*	-	699.0	699.0
23	274.1	1,245.9	1,520.0	*2037*	-	239.0	239.0
24	856.5	1,036.7	1,893.2	*2038*	-	220.0	220.0
Average (ML/year)			**1,639.1**	**Average (ML/year)**			**2,614.4**

Note: orange highlight indicates years during which mining from UG4 was modelled for the respective assessments.

Comparison of Adopted Groundwater Inflow Volumes

Table 4 presents a comparison of the total groundwater inflows, as well as borefield inflows, adopted for site water balances modelled by WorleyParsons (2011) (based on inflows predicted by RPS Aquaterra [2011]) and WRM (2017) (based on inflows predicted by HydroSimulations [2017]).

As shown in Table 4, the two assessments used different naming conventions for the model years and assessed different durations: WorleyParsons (2011) assessed operational Years 1 to 24 of Stage 2, whereas WRM (2017) assessed calendar years 2018 to 2038.

For comparison between the two assessments, calendar year 2038 (i.e. the final year of mining operations at the Moolarben Coal Complex) from WRM (2017) was compared with Year 24 from WorleyParsons (2011), and so on.

As shown in Table 4, the groundwater inflows adopted by WRM (2017) (based on predictions made by HydroSimulations [2017]) for the Modification were greater than those previously adopted by WorleyParsons (2011) (based on predictions made by RPS Aquaterra [2011]).

HydroSimulations (2017) concluded that the groundwater inflows for the Modification are greater than previous assessments due to the following:

- Model revision and recalibration using current and historic groundwater observations, in particular observed drawdown effect from existing mining operations and inflows to UG1 following its commencement.
- Changes related to the Modification:
  - increased mining rate in the open cuts;
  - minor extensions of the open cut pit limits; and
  - revised timing of mining for OC4 and OC3.
- Changes unrelated to the Modification:
  - changes to the sequencing of the approved underground mining areas (including the requirement to continue to dewater UG1 for the life of UG4 to maintain safe access to the UG4 workings);
  - approved underground mining rate of 8 million tonnes per annum as a result of the UG1 Optimisation Modification;
  - differences in the timing of advanced dewatering of the UG4 area via the approved borefield; and
  - water stored in the Ulan East Pit providing potential recharge to down-dip workings in the Ulan Seam.

9. References

Advisian (2017). *Controlled Water Release Impact Assessment for the Goulburn River*.

HydroSimulations (2015). *Moolarben Coal Complex UG1 Optimisation Modification, Groundwater Modelling Assessment for Moolarben Coal Operations Pty Ltd*.

HydroSimulations (2017). *Moolarben Coal Open Cut Optimisation Modification Groundwater Assessment*.

Marine Pollution Research (2017). *Moolarben Open Cut Optimisation Modification Aquatic Ecology Assessment*.

RPS Aquaterra (2011). *Moolarben Coal Complex Stage 2 Preferred Project Report Groundwater Impact Assessment November 2011*.

WorleyParsons (2011). *Moolarben Coal Project Stage 2 Preferred Project Supplementary Surface Water Investigations Including Water Balance Modelling.*

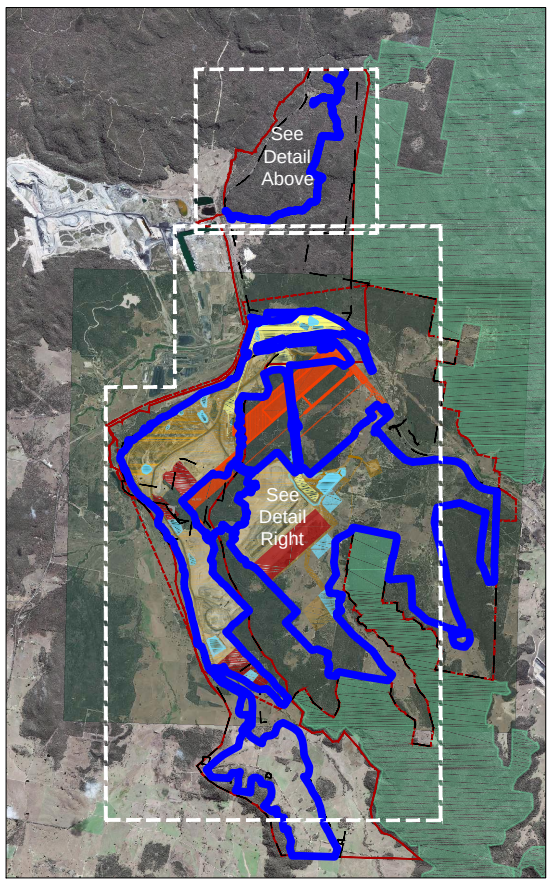
WRM Water & Environment (2013). *Moolarben Coal Project, Stage 1 Optimisation Modification, Surface Water Impact Assessment.*

WRM Water & Environment (2015). *Moolarben Coal Complex UG1 Optimisation Modification Surface Water Assessment Review*.

WRM Water & Environment (2017). *Moolarben Coal Complex Open Cut Optimisation Modification Site Water Balance and Surface Water Assessment*.

ATTACHMENT 1

MOOLARBEN COAL COMPLEX MINING OPERATIONS PLAN – PLAN 3B



LEGEND

- Stage 1 Project Approval Boundary
- Stage 2 Project Approval Boundary
- Surface Disturbance Boundary (Life of Mine)
- Mining Lease Boundary
- Roads
- Rail
- Watercourses
- Drainage Line
- Contours (5m)
- POWERLINE 66KV
- POWERLINE 330KV
- National Parks and Reserves

Primary Domains

1. Active Mining (Open Cut)
1. Active Mining (Underground / Previous Workings)
2. Operational Water Management Area
3. Coal Processing and Handling Facilities
4. General Infrastructure
5. Overburden Emplacement Area
6. Subsidence Limit

Secondary Domains

- A. Rehabilitation Area - Woodland
- B. Rehabilitation Area - Forest
- C. Rehabilitation Area - Grassy Woodland
- D. Rehabilitation Area - Agricultural
- E. Post Mining Water Management Area
- F. Final Void

Rehabilitation Phases

- Landform Establishment
- Growth Medium Development
- Ecosystem and Land Use Establishment
- Temporary Rehabilitation

0 250 500 750 1000 m

N S W E

GOULBURN RIVER NATIONAL PARK
MUNGHORN GAP NATURE RESERVE
MUNGHORN GAP NATURE RESERVE
ULAN COAL MINE
OC1
OC2
OC3
OC4
Ulan Village
Goulburn River
Moolarben Dam
Moolarben Creek
Lagoon Creek
Murragamba Creek
Sandy Hollow Gulgong Rail Line
Wilpinjong Creek
Eastern Creek
Ulan Wollar Road
ML1628
ML1605
ML1606
ML1691
ML1628
ML1628
ML1628
ML1628

I, Steve Archinal, the General Manager, Moolarben Coal Operations, certify that the information on this plan is a true indication of the proposed development.

General Manager ..... Date .....

MOOLARBENCOAL
PART OF THE YANCOAL AUSTRALIA GROUP

4250 Ulan Road
Ulan NSW 2850

Phone: 02 6376 1500
Fax: 02 6376 1599

Moolarben Coal Complex Mining Operations Plan
Mining and Rehabilitation (Dec 2018)
Plan 3B

Drawing No.	Revision No.
MOP-2017-003B.C	0

Date	Scale:	Drawn	Checked	Coordinate System	Sheet Size
28/03/2018	1:12,000	CH	GC	MGA Zone 55	A0

ATTACHMENT 2

FIGURE 2.2 OF PROJECT APPROVAL (08_0135) – INDICATIVE INFRASTRUCTURE ARRANGEMENT

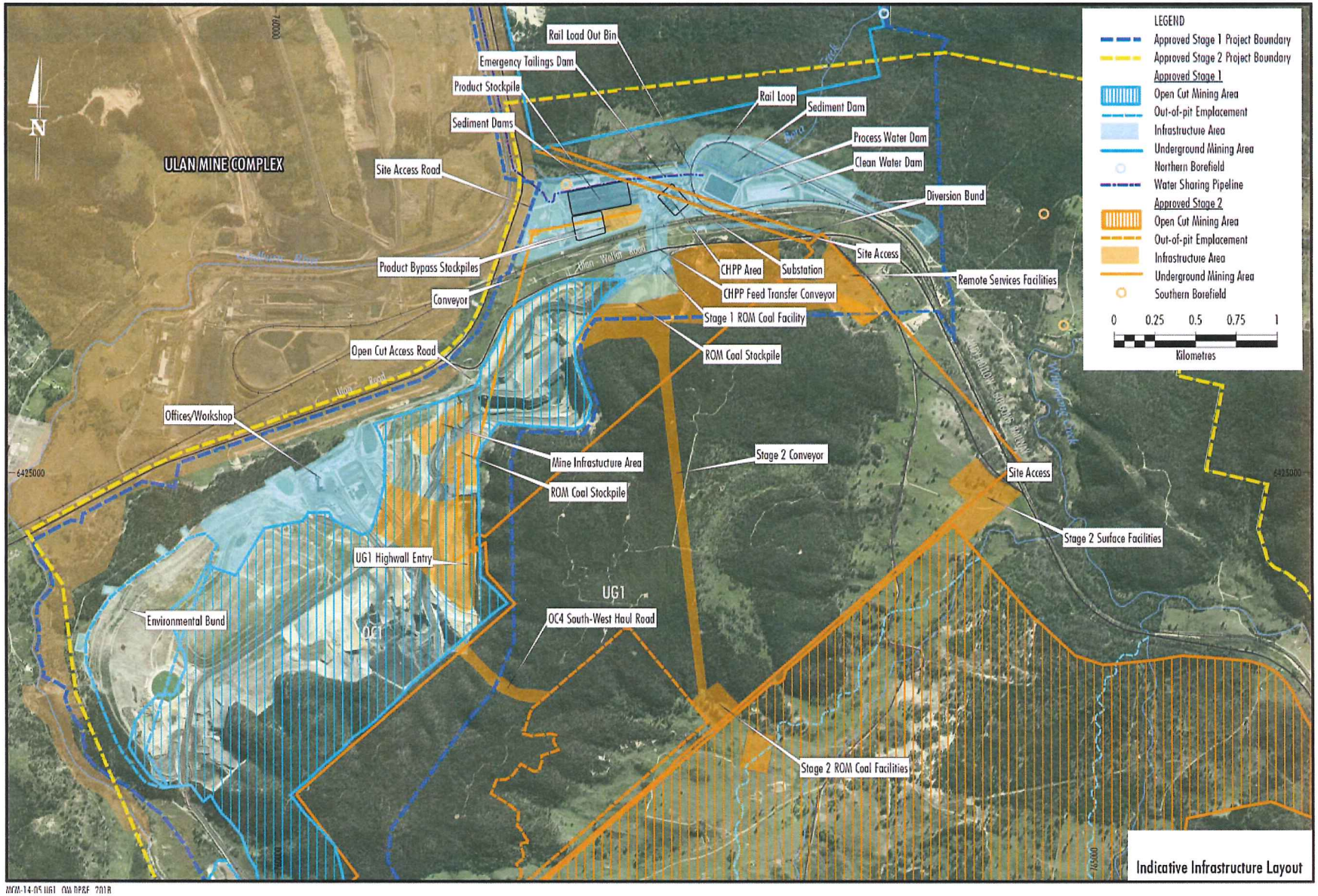


Figure 2.2 – Indicative Infrastructure Arrangement

ATTACHMENT 3

CORRESPONDENCE WITH EXLORATION LICENCE HOLDERS OVER THE GILGAL PROPERTY

Santos Ltd
ACN 007 550 923
PO Box 859
NARRABRI NSW 2390
Telephone: 61 2 6792 9035
www.santos.com

1 March 2018

Mr Graham Chase
Environmental & Community Manager
Moolarben Coal Operations Pty Ltd
Locked Bag 2003
MUDGEE NSW 2850
RICHMOND VIC 3121

Dear Graham

Re: Moolarben Coal Complex Open Cut Optimisation Modification – Offset Property Within PEL 456

Thank you for your letter of 12 February 2018 in relation to Moolarben Coal Operation's proposal to modify existing project approvals and the proposed inclusion of the MCO-owned "Gilgal" property (which is partially located within PEL456) as a biodiversity offset.

The licence for PEL456 is held jointly between Santos QNT Pty Ltd and Hunter Gas Pty Ltd. As previously advised, Hunter Gas Pty Ltd is not a Santos owned company and they should be contacted directly as a co-titleholder of PEL 456.

Santos has reviewed the Environmental Assessment that accompanied the request for SEARS for this project in relation to our operations in this area. It is unlikely that the project as described would conflict with prospecting activities that we may undertake in PEL 456 and we have no objection to the proposed inclusion of MCO property "Gilgal" as a biodiversity offset.

Thank you for advising us of this proposed modification and providing an opportunity to comment.

Yours sincerely

Annie Moody
Team Leader, Community and Land

HUNTER GAS PTY LIMITED
ACN 113 972 473

PO Box 378
EDGECLIFF NSW 2027

5 April 2018

Mr Graham Chase
Environmental & Community Manager
Moolarben Coal Operations Pty Ltd
Locked Bag 2003
MUDGEE NSW 2850
~~RICHMOND VIC 3121~~

Dear Graham,

RE: MOOLARBEN COAL COMPLEX OPEN CUT OPTIMISATION MODIFICATION – OFFSET PROPERTY WITHIN PEL 456

Thank you for your letter dated 5 March 2018.

We consider it unlikely that your project would impact our activities in PEL 456 so we have no objection to your proposal.

Should you have any questions or wish to discuss this matter further, please contact me at +61 2 8036 5570.

Kind regards,

Andrew Purcell
Director

Graham Chase

From: Jane Munro <janemunro@bowdenssilver.com.au>
Sent: Tuesday, 6 March 2018 3:16 PM
To: Graham Chase
Cc: Anthony McClure
Subject: EL8159 overlapping tenement with MCO Mod 14 proposed biodiversity offset area

Hi Graham
Further to previous correspondence in relation to the above, I confirm that Bowdens Silver P/L has no issues with MCO's proposal to establish the Mod 14 biodiversity offset area which overlaps Bowdens Silver P/L's EL 8159.
In the event that MCO proposes any future developments or modifications affecting tenement areas held by Bowdens Silver P/L, we would appreciate your early advice.

Kind regards,

Jane Munro
Public and Government Liaison and Compliance Officer

BOWDENS SILVER

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