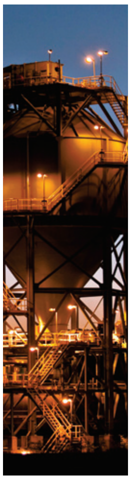

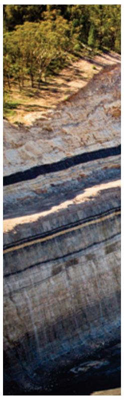

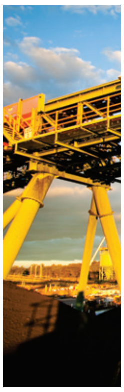

MOOLARBEN COAL

Moolarben Coal Complex
UG1 Optimisation Modification

Environmental Assessment

APPENDIX D

AIR QUALITY ASSESSMENT

AIR QUALITY ASSESSMENT

MOOLARBEN COAL COMPLEX

UG1 OPTIMISATION MODIFICATION

Moolarben Coal Operations Pty Ltd

7 May 2015

Job Number 14050318

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Air Quality Assessment Moolarben Coal Complex UG1 Optimisation Modification

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Date: 07/05/2015 — 07/05/2015

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1 INTRODUCTION

Todoroski Air Sciences has been engaged by Moolarben Coal Operations Pty Ltd (MCO) to prepare an air quality assessment for the proposed Underground 1 (UG1) Optimisation Modification (hereafter referred to as the Modification).

Previously, a detailed air quality impact assessment (**Todoroski Air Sciences, 2013**) was prepared for the Moolarben Coal Project Stage 1 Optimisation Modification (MOD9) and is attached as Appendix D to the previous MOD9 Environmental Assessment. This report utilises some of the work and data presented in the MOD9 report to assess the potential for air quality impacts associated with this Modification and to compare the predicted impacts of this Modification with the previous predictions.

A subsequent modification application for the Moolarben Coal Project was assessed in the Air Quality Assessment for the OC4 South-West Modification (OC4 South-West MOD) (**Todoroski Air Sciences, 2014**). This assessment has incorporated these modifications and has applied the same methodology for assessing the potential air quality impacts associated with this Modification. The OC4 South-West MOD was lodged in April 2015 and is currently subject to environmental assessment and approval. Therefore, the OC4 South-West MOD has been considered in the assessment of the Modification.

This report incorporates the following aspects:

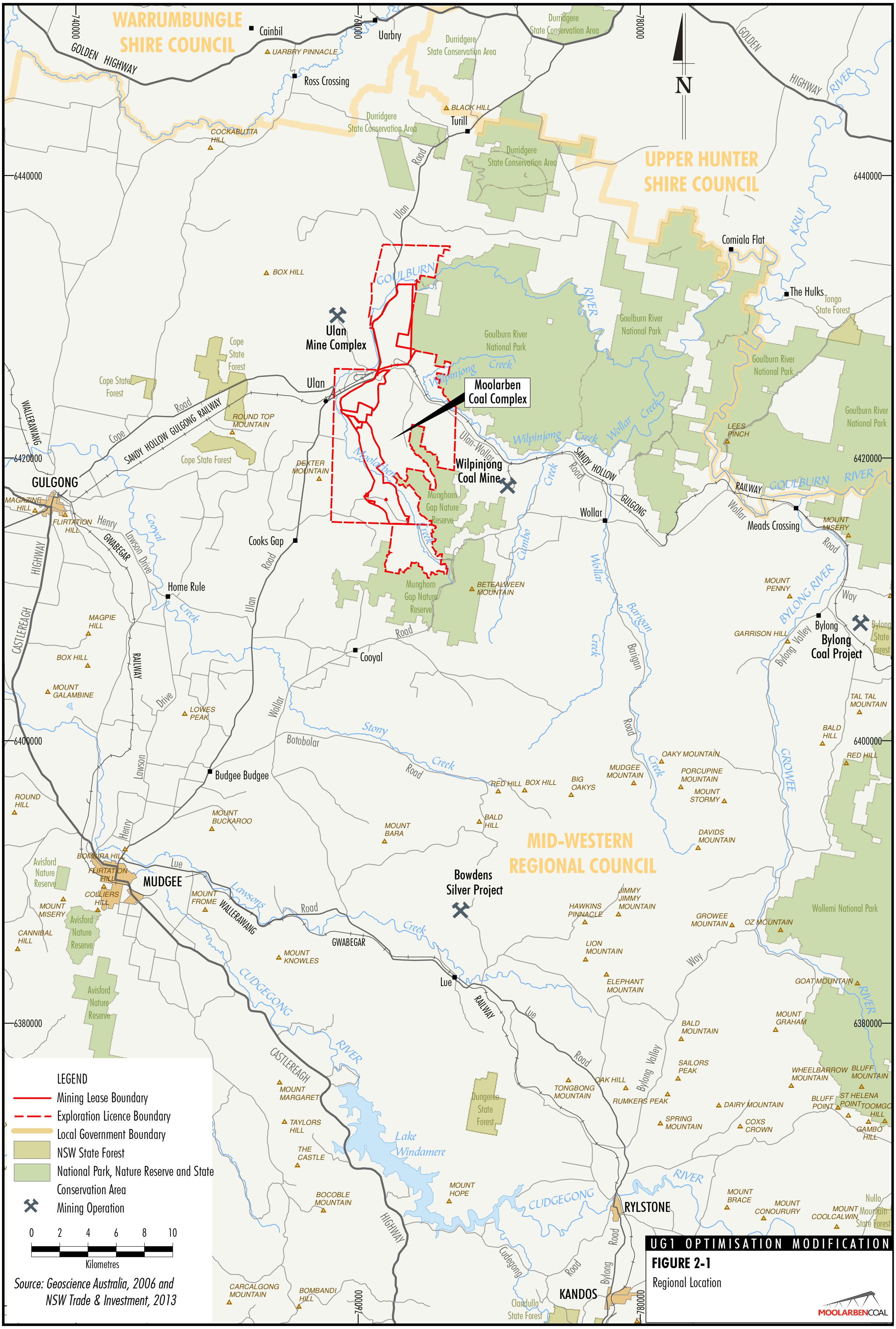
- A description of the proposed Modification;
- A summary of the dispersion modelling approach used to assess potential air quality impacts;
- Presentation of the predicted results and comparison with existing/approved predictions;
- Discussion of the potential air quality impacts as a result of the Modification and proposed management measures; and
- Amendments to the greenhouse gas emission estimates for the Moolarben Coal Complex incorporating the Modification.

2 PROJECT BACKGROUND

The Moolarben Coal Complex is located in the Western Coalfields of NSW, approximately 40km north of Mudgee (see **Figure 2-1**).

It is bordered by the Goulburn River to the northwest, Goulburn River National Park to the northeast and Munghorn Gap Nature Reserve to the south. The Ulan Coal Mine is located to the northwest and Wilpinjong Coal Mine is located to the east. Ulan settlement and Cooks Gap are located to the west and southwest, respectively.

The relevant land ownership in the vicinity of the Moolarben Coal Complex is shown in **Figure 2-2** and **Figure 2-3**.



UG1 OPTIMISATION MODIFICATION

FIGURE 2-1

Regional Location

MCM-14-05 UG1_OM AppAQ_201A

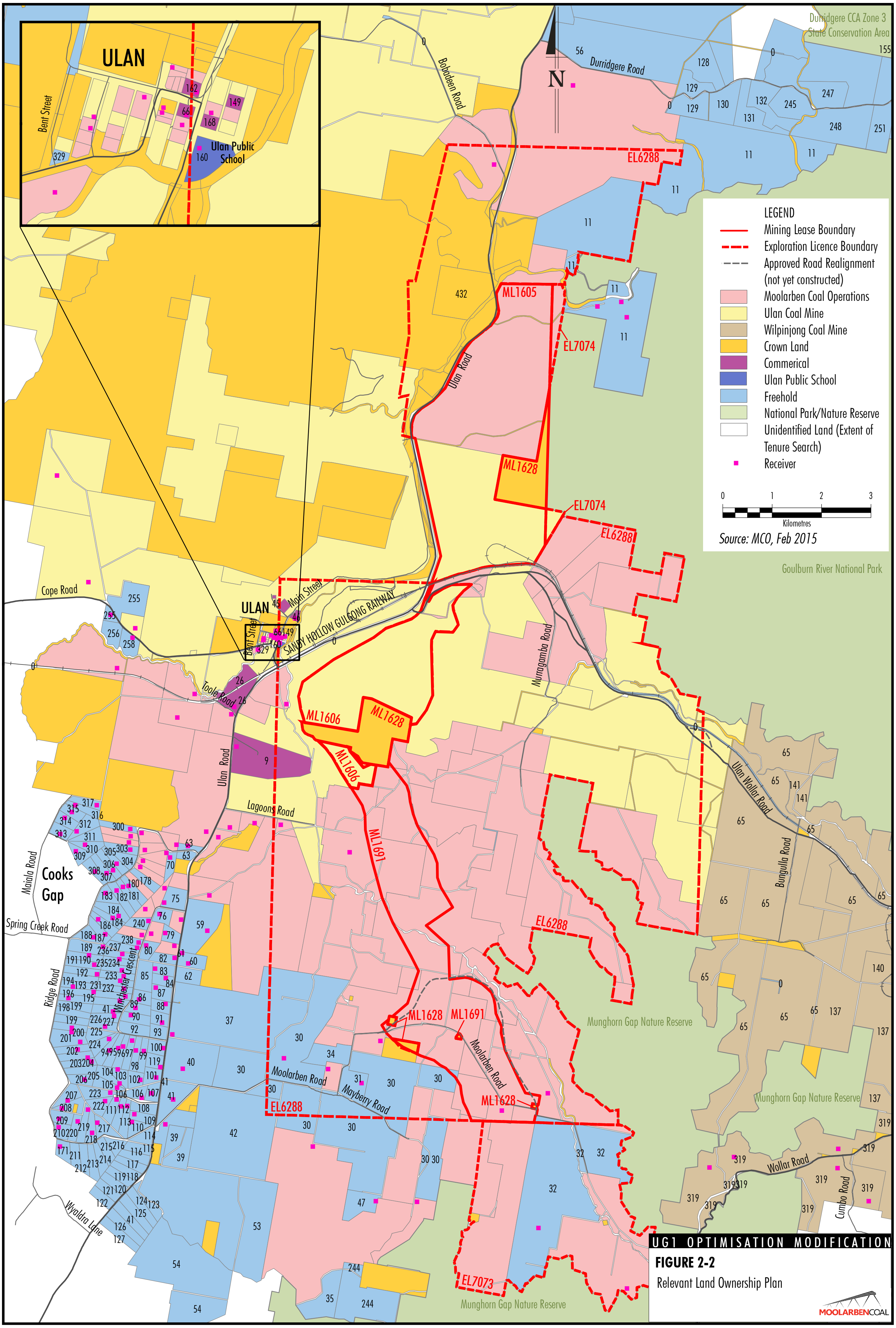


FIGURE 2-2
Relevant Land Ownership Plan

MCM-14-05 UG1_OM AppAQ_202A

Ref No	Landholder
9	Orica Australia Pty Limited
11	JE Mullins & CD Imrie
26	Forty North Pty Limited
30	RB Cox
31	MB Cox
32	DJ & JG Stokes
34	J Asztalos
37	J Szymkarczuk
39	RM & DJ Sprigg
40	JM Devenish
41	PP Libertis
42	C & L Schmidt
46	North Eastern Wiradjuri Wilpinjong Community Fund Limited
47	SF & MR Andrews
53	WD & MS Bryant
54	MA & C Harris
56	MJ & V Cundy
59	G & GM Szymkarczuk
60	CL Rayner & DM Mundey
61	MA Miller
62	R Menchin
63	BF & B Whiticker
66	Rostherne Pty Limited
70	DJ & A Coventry
75	P Ban
76	SR & PC Carbone
79	PTJ & SE Nagle
80	W & D Sebelic
82	SC Hungerford & MC Clemens
83	CF & CR Wall
84	DS Sebelic
85	J & Z Nikolovski
86	NW Harris
87	BJ & K Howe
88	BC Meyers
89	MV & HM Glover & E & BJ Tomlinson
90	SA Powell
91	HM Graham
92	VA Pullicino & J & S & G Bonnici
93	F & M Fenech
94	LK Mittemayer
95	BJ Withington
96	D Lazicic
97	DJ & MD Smith
98	ME & JJ Piper
99	DE Jenner & WB Jensen
100	A Kapista
101	RD & DMZ Hull
102	KA Roberts
103	SB Burnett & SL Grant
104	RA & LA Deeben
105	DJ & N Katsikaris
106	TB & JH Reid
107	ZJ & M & AA Raso
108	R Varga
109	DA Evans
110	JT Thompson & HT Evans
111	GJ & NJ McEwan
112	MJ & LM Croft
113	CPG Ratcliff
114	TF & K Holland
115	AK & BH Ouinn
116	DJ & SM Reid
117	JM Dick
118	A Scott
119	PJ Kearns
120	PS & DR Ord
121	EJ Cullen
122	WF Wirth
123	ND Sullivan
124	WJ & HE Bailey
125	DB McBride
126	MP Julian
127	BKT & SA Bracken
128	AW Sims
129	M Yelds
130	GP McEwen
131	GR & RA King
132	N Atkins
149	Mid-Western Regional Council
160	Minister For Education And Training
162	DM Harrison
168	PJL Constructions Pty Limited
171	AD & SA McGregor
178	PR Stone
180	CD & LL Barrett
181	SM Forster
182	J Dutoitcook
183	R & EA Steines
184	LA Stevenson
186	RW & IJ Adamson
187	BT & KM Feeney
188	KR & T Fielding
189	M, M, D & A Goggin & J, A, P & R Hyde
190	T & LK Sahyoun
191	BW & TS Lasham
192	D Williams
193	DJ Moloney
194	PM & K Potts
195	R Cottam
196	F Saxberg & M Weir
198	GR & ME Metcalfe
199	PGG & I Nielsen
200	VK Grimshaw
201	KR & GM Towerton
202	H & VF Butler
203	DJ Miller
204	RB & JE Donnan
205	DW Sparrow & M Tallan
206	CA Marshall & R Vella
207	AA & DM Smith
208	SA & CR Hasaart
209	F Mawson
210	JM & AM Tebutt
211	SA McGregor & WJ Gray
212	E & M Lepik
213	D & J Parsonage
214	RK & EG O'Neil
215	SG & PM Green
216	G Holland & FA Handicott
217	RP & JL Patterson
218	GF & GEL Soady
219	T & S Riger
220	SJ Rusten & NJ Smith
222	BJ Purtell
223	EW Palmer & JM Stewart
224	RS & PCC Dupond
225	G & RF Doualetas
226	LAA & FC Muscat
227	WP & JA Hughes
229	JJ & BA Lowe
230	DA Hoole & DT Rawlinson
231	T Morrison & SM Benny
232	L & JA Haaring
233	K & D Boal
234	D & L Gaw
235	LM & RS Wilson
236	RG & CA Donovan
237	A Puskaric
238	B Powell
240	GJ & DM Hartley
244	JT & YR Jones
245	MP & KLE Cresham
247	J & K Batshon
248	G Boustani
249	CJ & JI Eldridge
251	NF Potter & CE Selley
255	HJ & H Schmitz
256	RC Campbell
258	PM & CD Elias
300	CM Collins & CY Marshall
303	HJ Ungaro
304	G Balajan
305	L Barisic & M Aul
306	E Armstrong
307	M Chant & NK Young
308	NA Dower
309	GS Maher
310	KI Death
311	BJ & LC Williamson
312	MS & JJ Ioannou
313	NJ & BDE Pracy
314	SL Ford
315	WJ Richards & BJ Uzelac
316	CR Vassel & CM Williams
317	RJ Hore & V Bingham
325	S & T Fevale
326	AW & LM Murray
327	CA Tanner
328	Essential Energy
329	G Tuck-Lee

Source: MCO, Feb 2015

UG1 OPTIMISATION MODIFICATION

FIGURE 2-3
Relevant Landholder List

MOOLARBENCOAL

MCM-14-05 UG1_OM AppAQ_001B

3 EXISTING AIR QUALITY MONITORING AND MANAGEMENT

The existing Air Quality Management Plan (**MCO, 2013**) describes the air quality management and monitoring regime at the Moolarben Coal Complex.

The existing Air Quality Management Plan (**MCO, 2013**) describes:

- Project Approval air quality criteria;
- Dust monitoring locations and frequency, comprising:
  - Four Tapered Element Oscillating Microbalance (TEOM) measuring PM_{10} continuously (i.e. real-time monitor);
  - Two High Volume Air Samplers measuring PM_{10} on a one day in six cycle; and
  - Eleven dust deposition gauges;
- Ongoing dust management measures; and
- Performance indicators (real-time response triggers) which, if exceeded, trigger the implementation of additional dust management measures.

The existing Air Quality Management Plan is currently being reviewed and updated.

Operational air quality management measures that would be implemented for underground mining operations at the Moolarben Coal Complex include:

- Employing appropriate dust suppression methods at the coal handling facilities;
- Use of water carts on all trafficked areas to minimise dust generation as necessary and practicable;
- Use of constructed roads only, minimisation of access roads and removal of obsolete access roads;
- Maintaining coal handling areas and stockpiles in a moist condition using water carts and/or water sprays;
- Relocation, modification and/or temporarily ceasing mining operations in adverse meteorological conditions to minimise the short term air quality impacts;
- Partial enclosure of coal conveyors where possible;

MCO has recently implemented new software that assists in pro-active management of dust emissions. The system provides daily reports and predictions of upcoming meteorological conditions and potential dust risks. Based on prevailing wind conditions, MCO can strategically alter its operations to reduce these impacts.

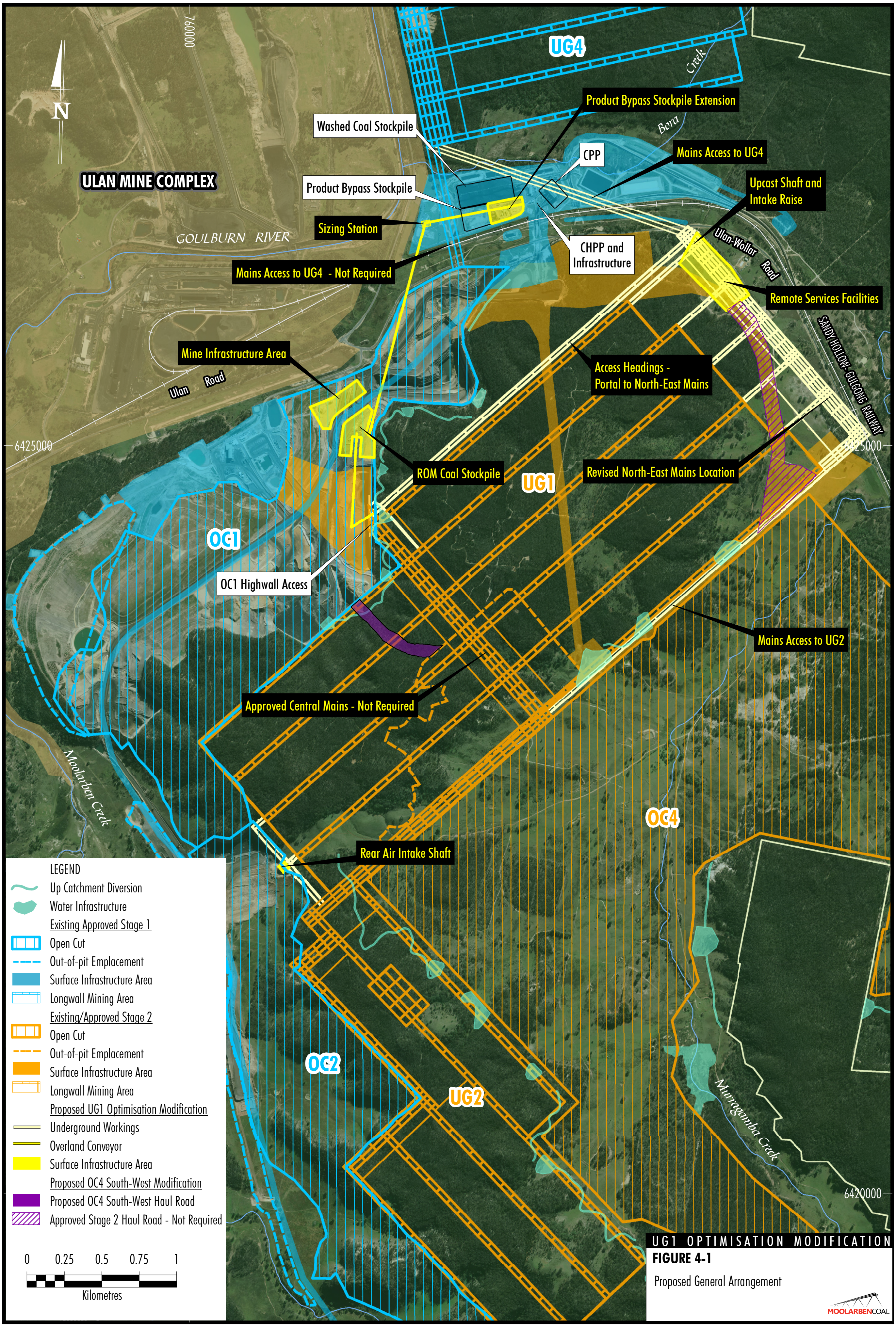
A predictive system would reduce the peak periods of elevated dust effects due to the mining activities and the operation of an effective predictive system has been applied in the modelling results presented in this assessment.

4 PROPOSED MODIFICATION

MCO are proposing to revise the mining and infrastructure configurations associated with UG1. This includes elements such as construction of rear air intake shaft and associated ventilation fan (where required), construction of Remote Services Facilities, relocation of the underground Mine Infrastructure Area, modifications to the underground mining layout and construction of a conveyor system to deliver underground run-of-mine (ROM) coal to the coal handling and preparation plant (CHPP) (see **Figure 4-1**).

The Modification assumes the features associated with the OC4 South-West MOD are in operation and includes the following key Modification components (**Figure 4-1**):

- Recovery of approximately 3.7 million tonnes (Mt) of additional ROM coal over the life of the mine;
- An extension of UG1 longwall panels in the north-east by approximately 150 to 500 metres (m);
- An extension of two UG1 longwall panels in the south-west by approximately 75 m;
- Relocation of the approved UG1 central main headings to the north-east;
- Relocation of underground access to UG2 and UG4;
- Longwall extraction of the portion of coal that form the approved (central) main headings;
- An increase in the coal seam extraction height by approximately 300 millimetres (mm) to a maximum extraction thickness of 3.5 m;
- An increase to longwall panel void width from approximately 305 to 311 m;
- Construction of a ROM coal conveyor and associated transfer points between the UG1 pit top facilities in OC1 and the CHPP to transport underground ROM coal;
- Extension to the underground product coal stockpile in the CHPP area and relocation and expansion of the underground ROM coal stockpile at the UG1 pit top facilities;
- An increase in the maximum underground ROM coal production rate up to 8 million tonnes per annum (Mtpa) from UG1 , UG2 and UG4 (combined);
- An increase in the maximum total site ROM coal rate to 21Mtpa (i.e. 13Mtpa from open cuts and 8Mtpa from undergrounds);
- An increase in average daily rail departures from five to seven and increase in peak daily rail departures to nine;



UG1 OPTIMISATION MODIFICATION

FIGURE 4-1

Proposed General Arrangement

MOOLARBENCOAL

MCM-14-05 UG1_OM AppAQ_203A

- Construction of Remote Services Facilities and rear intake shaft and associated fans above the extended UG1 longwall panels; and
- Relocation of the underground Mine Infrastructure Area and site administration offices.

4.1 Modelling scenario

This assessment has considered a single mine plan year to represent the proposed Modification. The assessed scenario incorporated the proposed transfer of underground coal by conveyor, stockpile extensions, additional dozers on the underground ROM coal stockpile and increased annual underground ROM coal production into the previously assessed worst-case year for potential air quality impacts at the Moolarben Coal Complex.

Relevant to potential air quality impacts, 2016 was chosen for the air quality modelling scenario as this year included the maximum ROM coal and overburden removal production with the maximum fleet using the proposed OC4 South-West MOD (**Todoroski Air Sciences, 2014**).

This represents a conservative modelling approach as the key elements of the Modification with the potential to contribute to air quality emissions (i.e. transfer of underground coal between the UG1 pit top and CHPP area) would not be fully underway until later in the mine life, when operations in the open cut pits will have progressed further south and/or west, increasing the distance between key dust sources and receptors.

Potential wind erosion emissions associated with the inactive OC2 pit have been included in the air quality model.

The 2016 scenario is considered to be representative of a scenario equivalent to MOD9 Year 6 (which included the early development of the OC4 pit and UG1 operating at maximum production) and therefore allows for a comparison to be made between the existing/approved Moolarben Coal Complex and the Modification.

The indicative year 2016 mine plan scenario is provided in **Appendix A**.

The investigation of adverse meteorological conditions and associated requirements to implement mitigation measures conducted for the OC4 South-West MOD 2016 scenario were incorporated into the modelling for this Modification.

4.2 Emission estimation

The rate of dust emission arising from the worst case scenario selected for modelling has been calculated by analysing the various dust generating activities and applying appropriate emission factors.

The emission factors applied are considered the most applicable and representative factors available for calculating the dust generation rates for the proposed activities. The emission factors were sourced mainly from studies supported by the **United States Environmental Protection Authority (1985 and updates)** and from local studies where possible. The emissions inventory for the Modification has been based on the emissions inventory developed for the MOD9 assessment (**Todoroski Air Sciences, 2013**).

The maximum annual ROM coal and overburden production rates and total dust emissions from all significant dust generating activities for the Moolarben Coal Complex incorporating the proposed Modification are presented in **Table 4-1**. A detailed emission inventory for the modelled scenario is presented in **Appendix B**.

Table 4-1: Summary of estimated annual quantities of material and emissions for the Modification

Activity	MOD9 Year 6	Modification	Percent Change (%)
ROM Coal – OC (tonnes)	12,382,041	13,000,000	5.0%
ROM Coal – UG (tonnes)	4,000,000	8,000,000	100.0%
Overburden (tonnes)	111,600,000	112,576,506	0.9%
TSP emission (kg)	5,930,324	4,256,468	-28.2%

The estimated dust emissions for the Modification presented in **Table 4-1** and **Appendix B** reflect the application of best practice dust mitigation currently being implemented at Moolarben Coal Complex in accordance with its Air Quality Management Plan and Pollution Reduction Program (PRP) for wheel generated dust.

The net reduction in dust emissions relative to the MOD 9 Year 6 emissions arises due to some increased efficiencies in the mine design, the application of the MCO's current control measures and due to the use of a conveyor to transport underground ROM as opposed to haul trucks.

Similarly, the annual TSP dust emission for the Modification is marginally lower than those for the proposed OC4 South-West MOD due to increased efficiencies in the handling of coal from UG1 (e.g. use of conveyor for UG1 coal and reduced rehandling requirements at the CHPP).

4.3 Modelling methodology

The dispersion modelling methodology applied in this assessment is the same as that applied in the MOD9 and OC4 South-West MOD assessments using the CALPUFF modelling suite. Further specific detail regarding the approach used can be found in the MOD9 air quality impact assessment (**Todoroski Air Sciences, 2013**).

The CALMET meteorological modelling has been revised to incorporate the changes to the local mine terrain for the proposed modelling scenario which affect the local wind flows of the area (e.g. to account for the updated sequencing of the open cut pits). This assessment used the same meteorological conditions assessed in the MOD9 assessment which were based on data for January 2011 to December 2011 from six surrounding monitoring sites.

Dust emissions from each activity were represented by a series of volume sources and included in the CALPUFF model via an hourly varying emission file. Meteorological conditions associated with dust generation (such as wind speed) and levels of dust generating activity were considered in calculating the hourly varying emission rate for each source.

It should be noted that as a conservative measure, the effect of the precipitation rate (rainfall) in reducing dust emissions has not been considered in this assessment.

5 DISPERSION MODELLING RESULTS

The incremental dispersion modelling results for the Moolarben Coal Complex incorporating the Modification are presented in **Figure 5-1** and **Figure 5-2** showing the predicted maximum 24-hour average PM_{10} and annual average PM_{10}, respectively.

The predicted maximum 24-hour average PM_{10} 50 µg/m^3 contour is separately overlaid with the previous predictions for MOD9 Year 6 (**Todoroski Air Sciences, 2013**), which is considered to be representative of a scenario equivalent to the Year 2016 scenario modelled for the proposed Modification, and the previously modelled scenario presented in the OC4 South-West MOD (**Todoroski Air Sciences, 2014**) in **Figure 5-3** to examine the potential change resulting from the proposed Modification. The results for this assessment and the OC4 South-West MOD incorporate the effects of predictive/ reactive management and mitigation, however the results for the approved MOD9 assessment do not.

The comparison shows that dust levels for the Modification are generally lower when compared to the approved Moolarben Coal Complex (MOD9), however effects occur in somewhat different positions, as would be expected due to the different mine layout and different mine topography used in the contemporary modelling.

With the implementation of the air quality management measures and real-time response triggers described in the existing Air Quality Management Plan, the results indicate that the predicted dust levels would not exceed the 24-hour average PM_{10} criteria at any sensitive receptor as a result of the proposed Moolarben Coal Complex incorporating the Modification.

Dispersion modelling results for $PM_{2.5}$, TSP and dust deposition arising from the Moolarben Coal Complex incorporating the Modification are presented in **Appendix C**. The results indicate that the Modification would result in negligible change to the extent of the predicted levels in the MOD9 assessment. The modelling also shows that there would be a slight reduction in air quality emissions when the Modification components are incorporated into the current mine plans (i.e. including the proposed in the OC4 South-West MOD).

The modifications to the Wilpinjong Coal Mine since the MOD9 assessment (i.e. Wilpinjong Modifications 5 and 6) would not materially impact on the cumulative air quality of receptors in the vicinity of the Moolarben Coal Complex due to spatial displacement of activities occurring at these operations and the Ulan Coal Mine has not been modified since the MOD9 assessment. Air quality impacts associated with the current proposed Ulan West Modification are expected to be similar to the existing approved Ulan Coal Mine (**Umwelt [Australia] Pty Limited, 2015**). Therefore, as there is no change in compliance limits for the Moolarben Coal Complex incorporating the Modification, it is unlikely that there would be any increase in potential cumulative air quality impacts expected.

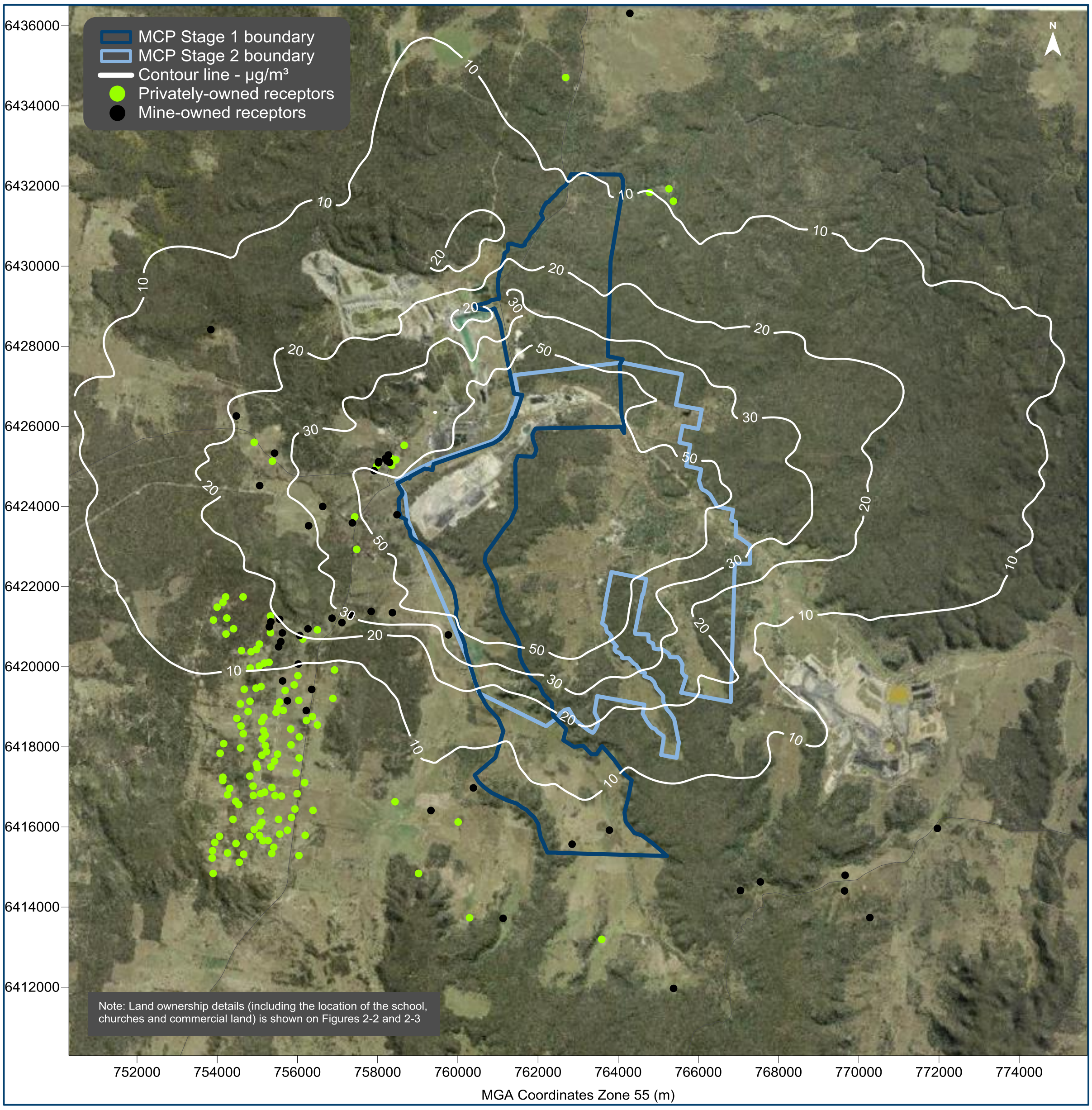


Figure 5-1: Predicted maximum 24-hour average PM_{10} concentrations due to emissions from the Modification

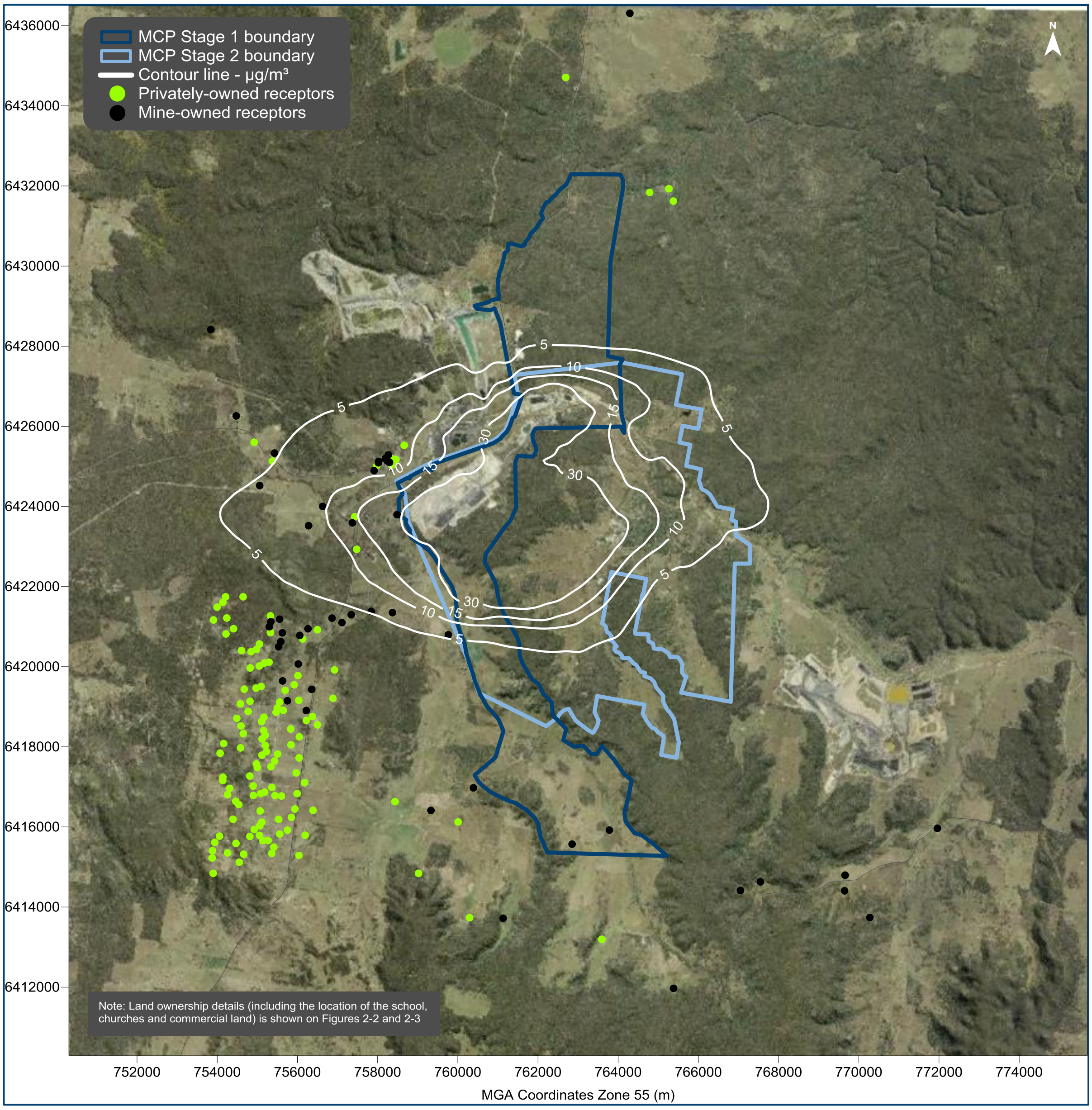


Figure 5-2: Predicted annual average PM_{10} concentrations due to emissions from the Modification

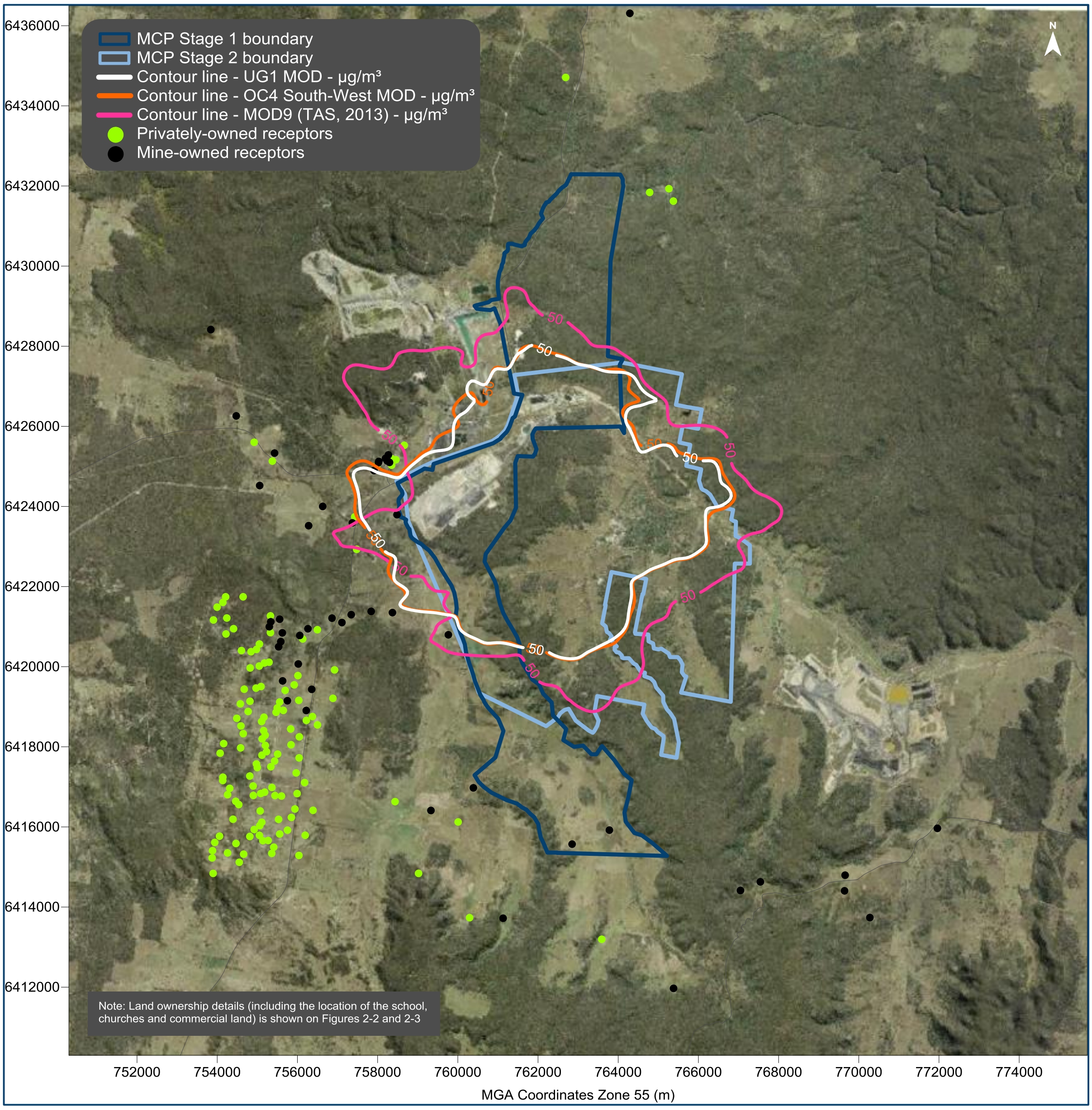


Figure 5-3: Comparison of predicted maximum 24-hour average PM_{10} concentrations

6 GREENHOUSE GAS ASSESSMENT

The changes associated with the proposed Modification are likely to affect the overall amount of greenhouse gas emissions generated at the site. While there is an increase in underground ROM coal extracted annually (i.e. from 4Mtpa to 8Mtpa), the total life of mine ROM coal would only increase by approximately 3.7Mt as a result of the Modification. The increase in the annual coal extraction rate would result in an increase in the annual greenhouse gas emissions by increasing the intensity of mining activities, while the small increase in the total resource mined would result in a minor increase in the generation of fugitive greenhouse gas emissions over the life of the mine.

To assess the potential change in greenhouse gas emissions for the Modification, the methodology used in the MOD9 assessment (**Todoroski Air Sciences, 2013**) has been applied. The quantities of materials that have the potential to emit greenhouse gas emissions associated with the site are estimated from the projected production schedule.

A comparison of the estimated emissions over the life of the approved Moolarben Coal Complex (i.e. for MOD9) and the proposed Modification is presented in **Table 6-1**.

Table 6-1: Comparison of Total (Life of Mine) CO_2-e emissions (Mt CO_2-e)

	Scope 1	Scope 2
MOD 9 Total (life of mine)	1.83	1.51
Modification Total (life of mine)	1.85	1.52
Change (%)	1.1 (%)	0.7 (%)

The expected increase in annual CO_2-e emissions is predominately associated with the proposed increase in underground ROM coal extracted. It can also be expected that on an annual basis greenhouse gas emissions from the site would vary at times; increasing during those periods when additional underground ROM coal is extracted and decreasing as the underground ROM coal resource is exhausted.

It should be noted that the approach applied to estimate the increase in greenhouse gas emissions is an approximation based on the projected production rates which can vary depending on the conditions. However it provides a reasonable estimation of the potential change over the life of the mine for the purpose of this assessment.

The operation of the proposed conveyor system to transport underground ROM coal from the UG1 to the CHPP has not been considered in this assessment. It is likely that the additional electricity usage for the conveyor system in place of the diesel consumption required for haul trucks to deliver the material would generate less greenhouse gas emissions.

Overall, as the total underground ROM coal resource extracted would increase by approximately 3.7Mt, the total greenhouse gas emissions over the life of the mine would only increase by approximately 1.1% and 0.7% for Scope 1 and Scope 2, respectively, due to the proposed Modification.

7 SUMMARY AND CONCLUSIONS

This assessment has examined the likely air quality effects resulting from the proposed Modification.

Air dispersion modelling has been conducted for a single mine plan year conservatively selected to demonstrate a worst-case operational scenario based on full operation of the Modification at a time when the Moolarben Coal Complex reaches maximum ROM coal and overburden removal production with the maximum fleet using the proposed OC4 South-West haul road realignment (prepared as a separate modification application). Overall the proposed Modification would reduce the total dust emissions for the site by effectively removing the use of haul trucks between the UG1 ROM stockpile and Stage 1 ROM coal facility with the use of a conveyor system to transport ROM coal from the UG1 to the CHPP.

The assessment estimated that activities associated with the proposed Modification would be generally within the existing envelope of impact approved for MOD9 (**Todoroski Air Sciences, 2013**), noting that in this (proposed Modification) assessment the effects of the existing air quality management strategies are more fully considered.

The reactive dust mitigation measures have a positive effect in minimising potential air quality impacts in the local area. It is expected that MCO would continue to implement these measures and ensure best practice dust management measures are in place at the Moolarben Coal Complex.

Therefore it is reasonable to conclude that the proposed Modification is unlikely to cause any exceedance or additional impact at any surrounding sensitive receptor locations.

The estimated greenhouse gas emissions for the site are not expected to increase significantly as a result of the proposed Modification. The total emissions for the site would remain generally the same with reduced diesel usage required for ROM coal haulage and an increase in electricity usage for the operation of the conveyor. Nevertheless, MCO would continue to manage greenhouse gas emissions generated for the site to minimise the overall generation of these emissions.

8 REFERENCES

Moolarben Coal Operations (2013)

"Air Quality Management Plan", prepared by Moolarben Coal Operations Pty Ltd, 2013.

Todoroski Air Sciences (2013)

"Moolarben Coal Project Stage 1 Optimisation Modification Air Quality and Greenhouse Gas Assessment", prepared for EMGA Mitchell McLennan by Todoroski Air Sciences, May 2013.

Todoroski Air Sciences (2014)

"Air Quality Assessment Moolarben Coal Project OC4 South-West Modification", prepared by Todoroski Air Sciences, November 2014.

Umwelt (Australia) Pty Limited (2015)

"Ulan West Modification Environmental Assessment", prepared by Umwelt (Australia) Pty Limited, March 2015.

United States Environmental Protection Authority (1985 and updates)

"Compilation of Air Pollutant Emission Factors", AP-42, Fourth Edition United States Environmental Protection Agency, Office of Air and Radiation Office of Air Quality Planning and Standards, Research Triangle Park, North Carolina 27711.

Appendix A
Indicative Mine Plan Scenario

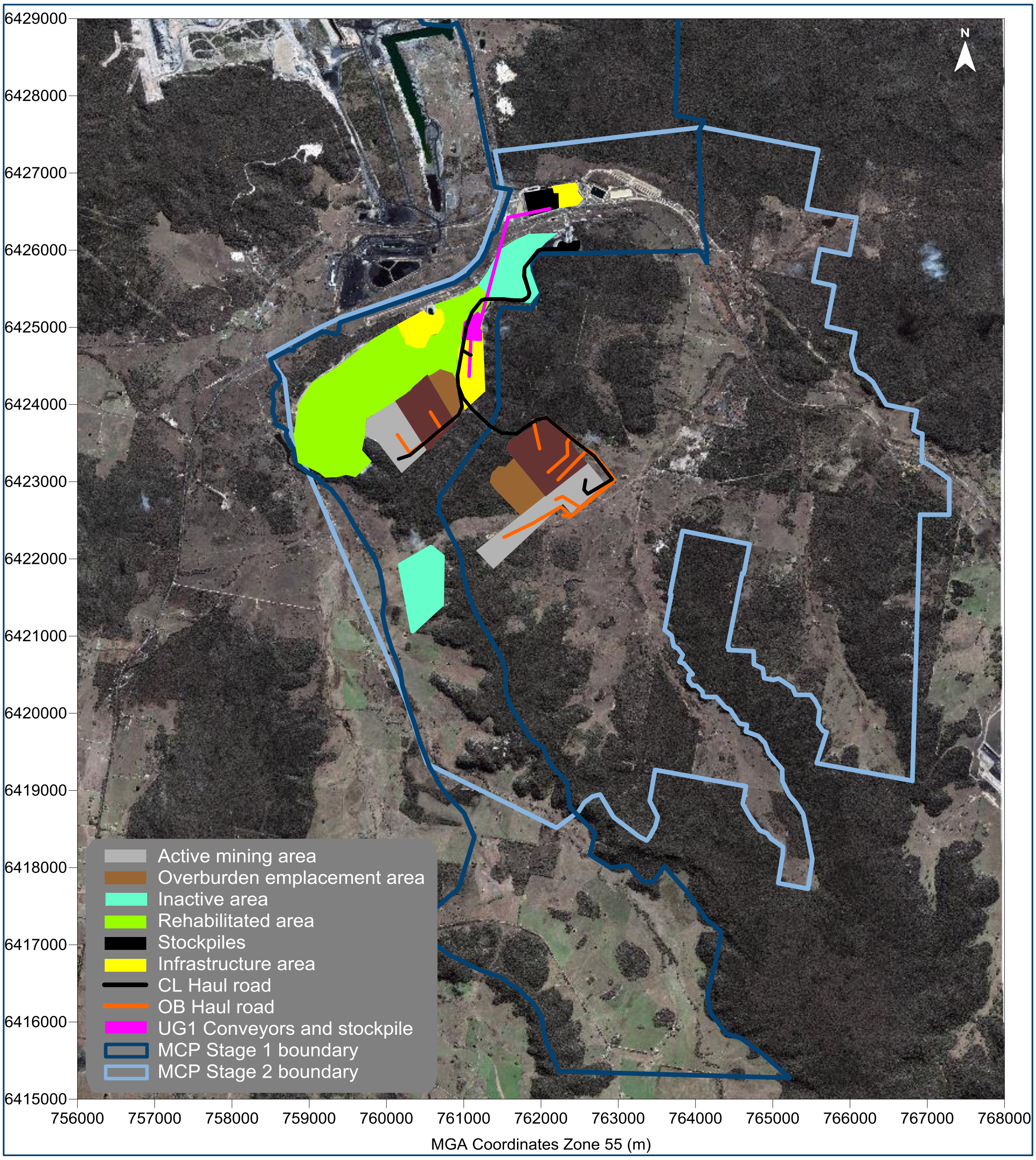


Figure A-1: Indicative mine plan scenario for year 2016

Appendix B

Emissions Inventory

Table B-1: Emission Inventory

ACTIVITY	TSP emission (kg/y)	Intensity	Units	Emission Factor	Units	Variable 1	Units	Variable 2	Units	Variable 3	Units	Variable 4	Units	Variable 5	Units	Variable 6	Units
OB - Stripping Topsoil - OC1	1,050	75	hours/year	14.0	kg/h												
OB - Stripping Topsoil - OC4	5,250	375	hours/year	14.0	kg/h												
OB - Drilling - OC1	963	5,438	holes/year	0.59	kg/hole											70	% Control
OB - Drilling - OC4	2,409	13,611	holes/year	0.59	kg/hole											70	% Control
OB - Blasting - OC1	20,099	107	blasts/year	188	kg/blast	9,000	Area of blast in square metres										
OB - Blasting - OC4	50,341	268	blasts/year	188	kg/blast	9,000	Area of blast in square metres										
OB - Excavator loading OB to haul truck - OC1	26,356	22,968,763	tonnes/year	0.001	kg/t	0.969	average of (wind speed/2.2)^1.3 in m/s	2	moisture content in %								
OB - Excavator loading OB to haul truck - OC4	102,822	89,607,742	tonnes/year	0.001	kg/t	0.969	average of (wind speed/2.2)^1.3 in m/s	2	moisture content in %								
OB - Hauling to dump - OC1	106,520	22,968,763	tonnes/year	0.046	kg/t	240	tonnes/load	2.1	km/return trip	5.2	kg/VKT	4.2	% silt content	266	Ave GMV (tonnes)	90	% Control
OB - Hauling to dump - OC4	729,665	89,607,742	tonnes/year	0.081	kg/t	240	tonnes/load	3.8	km/return trip	5.2	kg/VKT	4.2	% silt content	266	Ave GMV (tonnes)	90	% Control
OB - Emplacing at dump - OC1	26,356	22,968,763	tonnes/year	0.001	kg/t	0.969	average of (wind speed/2.2)^1.3 in m/s	2	moisture content in %								
OB - Emplacing at dump - OC4	102,822	89,607,742	tonnes/year	0.001	kg/t	0.969	average of (wind speed/2.2)^1.3 in m/s	2	moisture content in %								
OB - Dozers on OB at dump - OC1	91,635	5,476	hours/year	16.7	kg/h	10	silt content in %	2	moisture content in %								
OB - Dozers on OB at dump - OC4	358,898	21,446	hours/year	16.7	kg/h	10	silt content in %	2	moisture content in %								
OB - Dozers on OB in pit - OC1	77,166	4,611	hours/year	16.7	kg/h	10	silt content in %	2	moisture content in %								
OB - Dozers on OB in pit - OC4	358,898	21,446	hours/year	16.7	kg/h	10	silt content in %	2	moisture content in %								
CL - Drilling - OC1	626	3,535	holes/year	0.59	kg/hole											70	% Control
CL - Drilling - OC4	1,532	8,654	holes/year	0.59	kg/hole											70	% Control
CL - Blasting - OC1	5,072	27	blasts / year	188	kg/blast	9,000	Area of blast in square metres										
CL - Blasting - OC4	12,397	66	blasts / year	188	kg/blast	9,000	Area of blast in square metres										
CL - Dozers ripping/pushing/clean-up - OC1	40,802	5,476	hours/year	14.9	kg/h	5	silt content in %	7.4	moisture content in %							50	% Control
CL - Dozers ripping/pushing/clean-up - OC4	75,162	10,087	hours/year	14.9	kg/h	5	silt content in %	7.4	moisture content in %							50	% Control
CL - Loading ROM coal to haul truck - OC1	132,933	2,530,951	tonnes/year	0.053	kg/t	7.4	moisture content in %										
CL - Loading ROM coal to haul truck - OC4	560,047	10,662,888	tonnes/year	0.053	kg/t	7.4	moisture content in %										
CL - Conveying from UG1 portal	202	0.19	ha	0.40	kg/ha/hour	8,760	hours									70	% Control
CL - Unloading to stockpile at UG1	1,470	8,000,000	tonnes/year	0.00018	kg/t	0.969	average of (wind speed/2.2)^1.3 in m/s	7.4	moisture content in %								
CL - Handling ROM at stockpile	147	800,000	tonnes/year	0.00018	kg/t	0.969	average of (wind speed/2.2)^1.3 in m/s	7.4	moisture content in %								
CL - Conveying from UG1 to CHPP	639	0.61	ha	0.40	kg/ha/hour	8,760	hours									70	% Control
CL - Hauling ROM to hopper - OC1	51,148	2,530,951	tonnes/year	0.202	kg/t	200	tonnes/load	8.4	km/return trip	4.8	kg/VKT	4.2	% silt content	224	Ave GMV (tonnes)	90	% Control
CL - Hauling ROM to hopper - OC4	312,618	10,662,888	tonnes/year	0.293	kg/t	200	tonnes/load	12.2	km/return trip	4.8	kg/VKT	4.2	% silt content	224	Ave GMV (tonnes)	90	% Control
CHPP - Unloading ROM to hopper - OC1	19,940	2,530,951	tonnes/year	0.053	kg/t	7.4	moisture content in %									85	% Control
CHPP - Unloading ROM to hopper - OC4	84,007	10,662,888	tonnes/year	0.053	kg/t	7.4	moisture content in %									85	% Control
CL - Unloading to UG1 ROM to CHPP stockpile	1,470	8,000,000	tonnes/year	0.00018	kg/t	0.969	average of (wind speed/2.2)^1.3 in m/s	7.4	moisture content in %								
CHPP - Rehandle ROM at hopper	10,395	1,319,384	tonnes/year	0.053	kg/t	7.4	moisture content in %									85	% Control
CHPP - Conveying from hopper to CHPP	183	0.17	ha	0.40	kg/ha/hour	8,760	hours									70	% Control
CHPP - Handling coal at CHPP	2,555	21,193,839	tonnes/year	0.00012	kg/t	0.969	average of (wind speed/2.2)^1.3 in m/s	10	moisture content in %								
CHPP - Dozer pushing ROM coal at UG1	71,805	9,636	hours/year	14.9	kg/h	5	silt content in %	7.4	moisture content in %							50	% Control
CHPP - Dozer pushing ROM coal	23,451	4,797	hours/year	9.8	kg/h	5	silt content in %	10	moisture content in %							50	% Control
CHPP - Dozer pushing Product coal	53,825	14,391	hours/year	7.5	kg/h	4	silt content in %	10	moisture content in %							50	% Control
CHPP - Conveying from CHPP to stockpile	208	0.20	ha	0.40	kg/ha/hour	8,760	hours									70	% Control
CHPP - Loading Product coal to stockpile	2,170	18,000,000	tonnes/year	0.000	kg/t	0.969	average of (wind speed/2.2)^1.3 in m/s	10	moisture content in %								
CHPP - Conveying from stockpile to train	247	0.24	ha	0.40	kg/ha/hour	8,760	hours									70	% Control
CHPP - Loading Product coal to trains	542	18,000,000	tonnes/year	0.000	kg/t	0.969	average of (wind speed/2.2)^1.3 in m/s	10	moisture content in %							75	% Control
CHPP - Conveying rejects from CHPP to loadout	183	0.17	ha	0.40	kg/ha/hour	8,760	hours									70	% Control
CHPP - Hauling rejects	38,154	3,166,521	tonnes/year	0.120	kg/t	200	tonnes/load	5.0	km/return trip	4.8	kg/VKT	4.2	% silt content	224	Ave GMV (tonnes)	90	% Control
WE - Overburden emplacement areas	144,003	82.2	ha	0.40	kg/ha/hour	8,760	hours									50	% Control
WE - Inactive areas	52,102	74.3	ha	0.40	kg/ha/hour	8,760	hours									80	% Control
WE - Open pit	325,798	93.0	ha	0.40	kg/ha/hour	8,760	hours										
WE - ROM stockpiles	5,471	3.1	ha	0.40	kg/ha/hour	8,760	hours									50	% Control
WE - ROM stockpile at UG1	8,614	4.9	ha	0.40	kg/ha/hour	8,760	hours									50	% Control
WE - Product stockpiles	21,843	12.5	ha	0.40	kg/ha/hour	8,760	hours									50	% Control
Grading roads	133,454	216,835	km	0.62	kg/VKT	8	speed of graders in km/h										
Total TSP emissions (kg/yr)	**4,256,468**																

Appendix C

Dispersion Modelling Results for $PM_{2.5}$, TSP and Dust Deposition

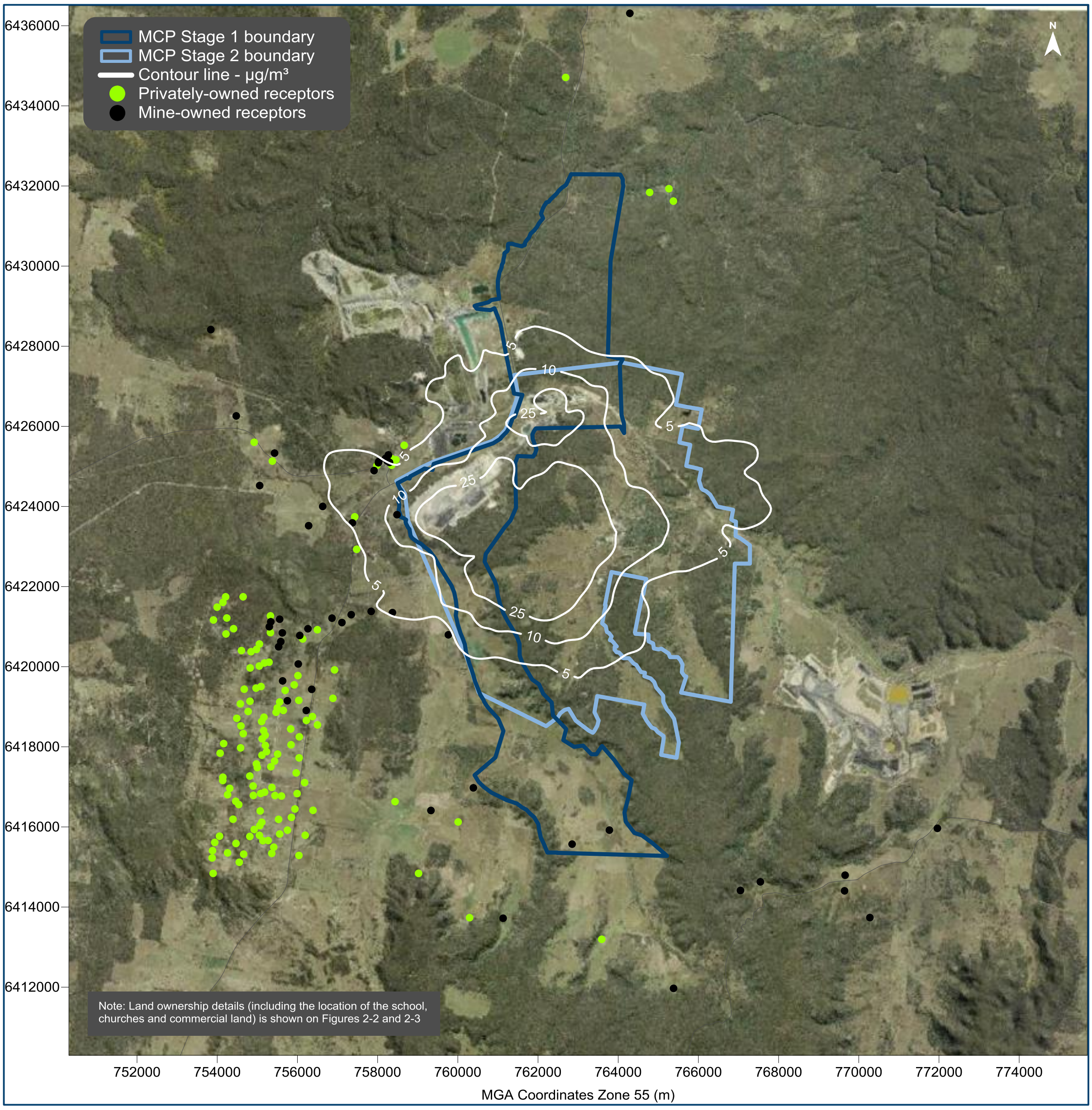


Figure C-1: Predicted maximum 24-hour average $PM_{2.5}$ concentrations due to emissions from the Modification

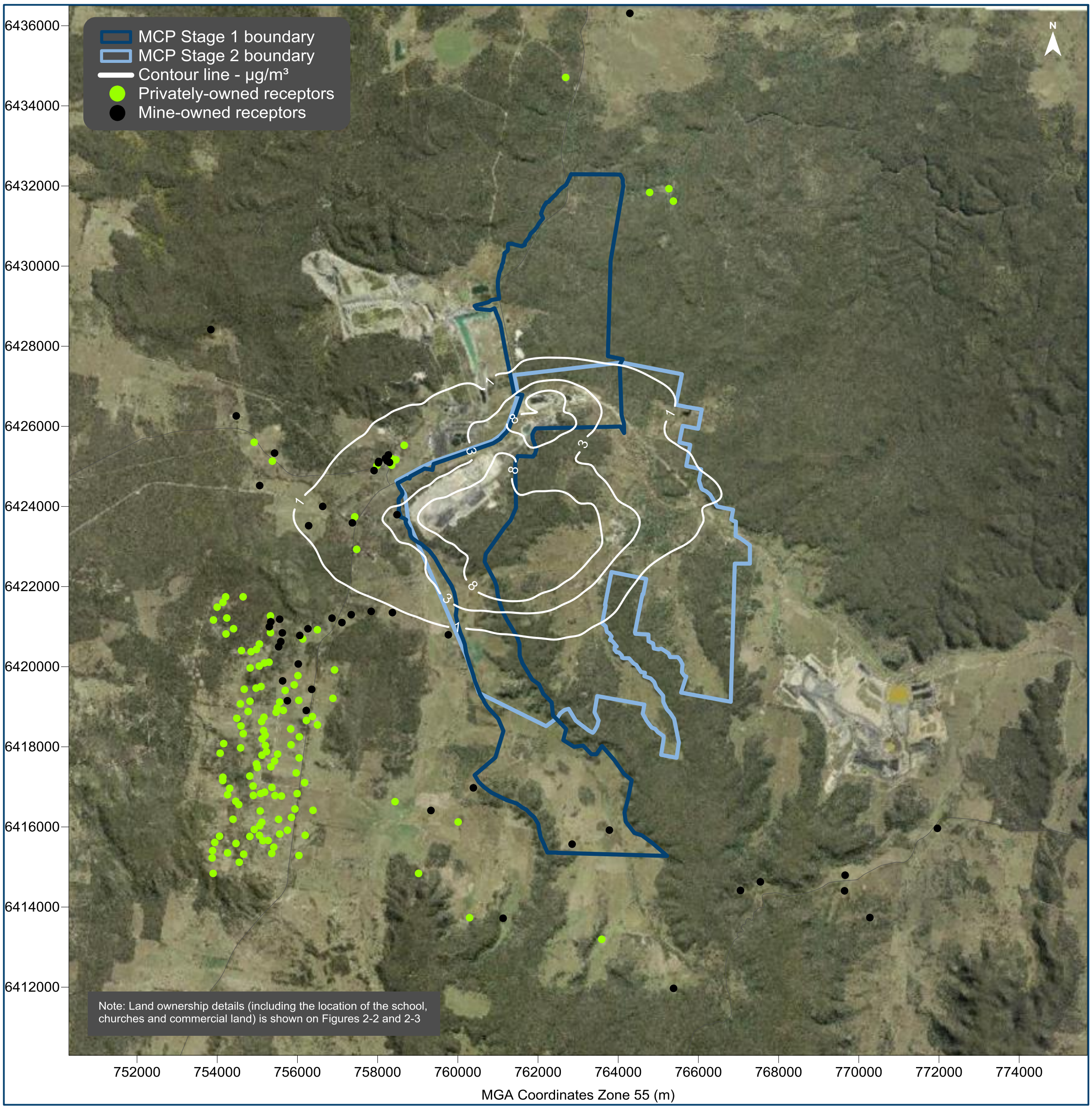


Figure C-2: Predicted annual average $PM_{2.5}$ concentrations due to emissions from the Modification

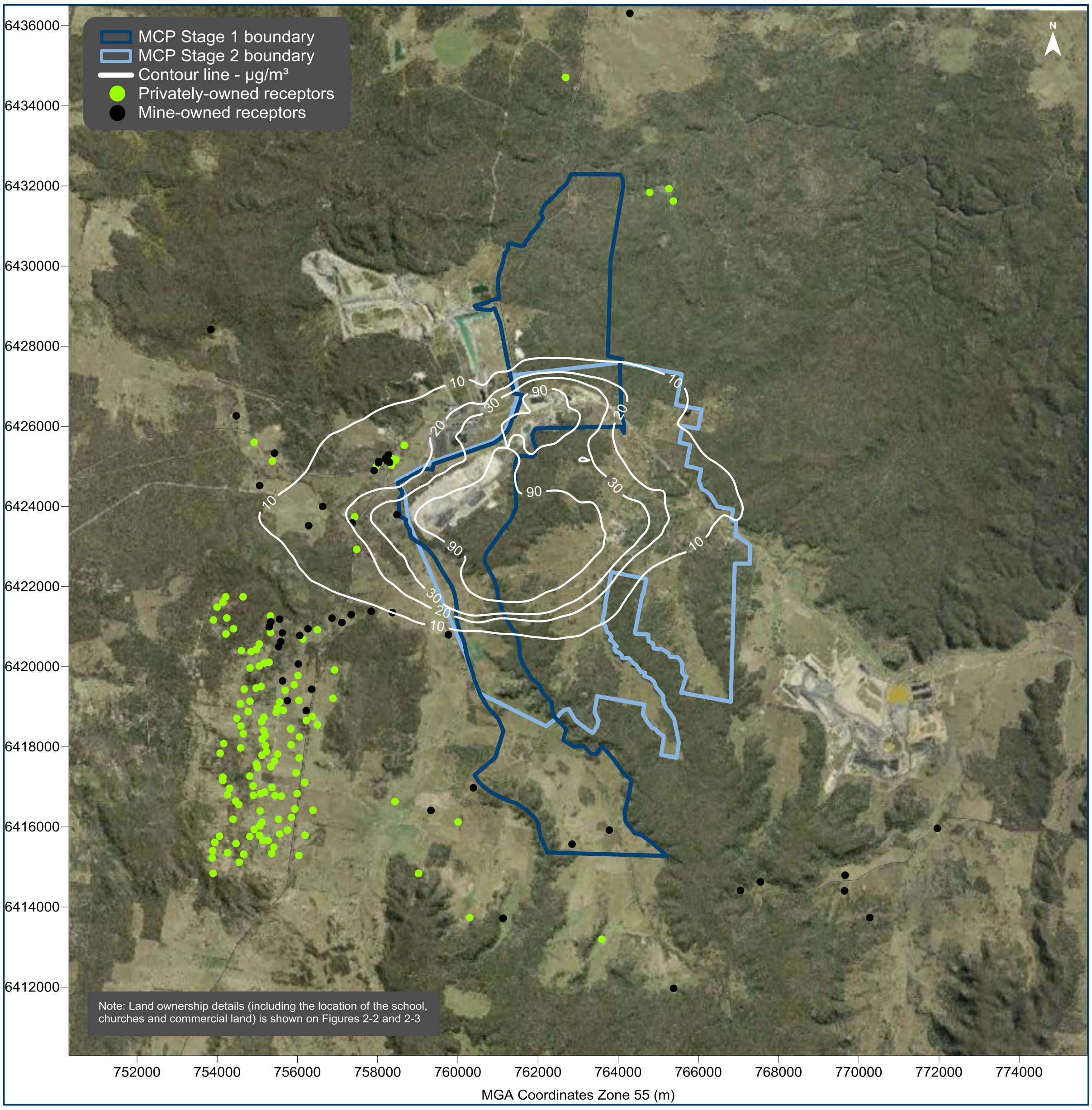


Figure C-3: Predicted annual average TSP concentrations due to emissions from the Modification

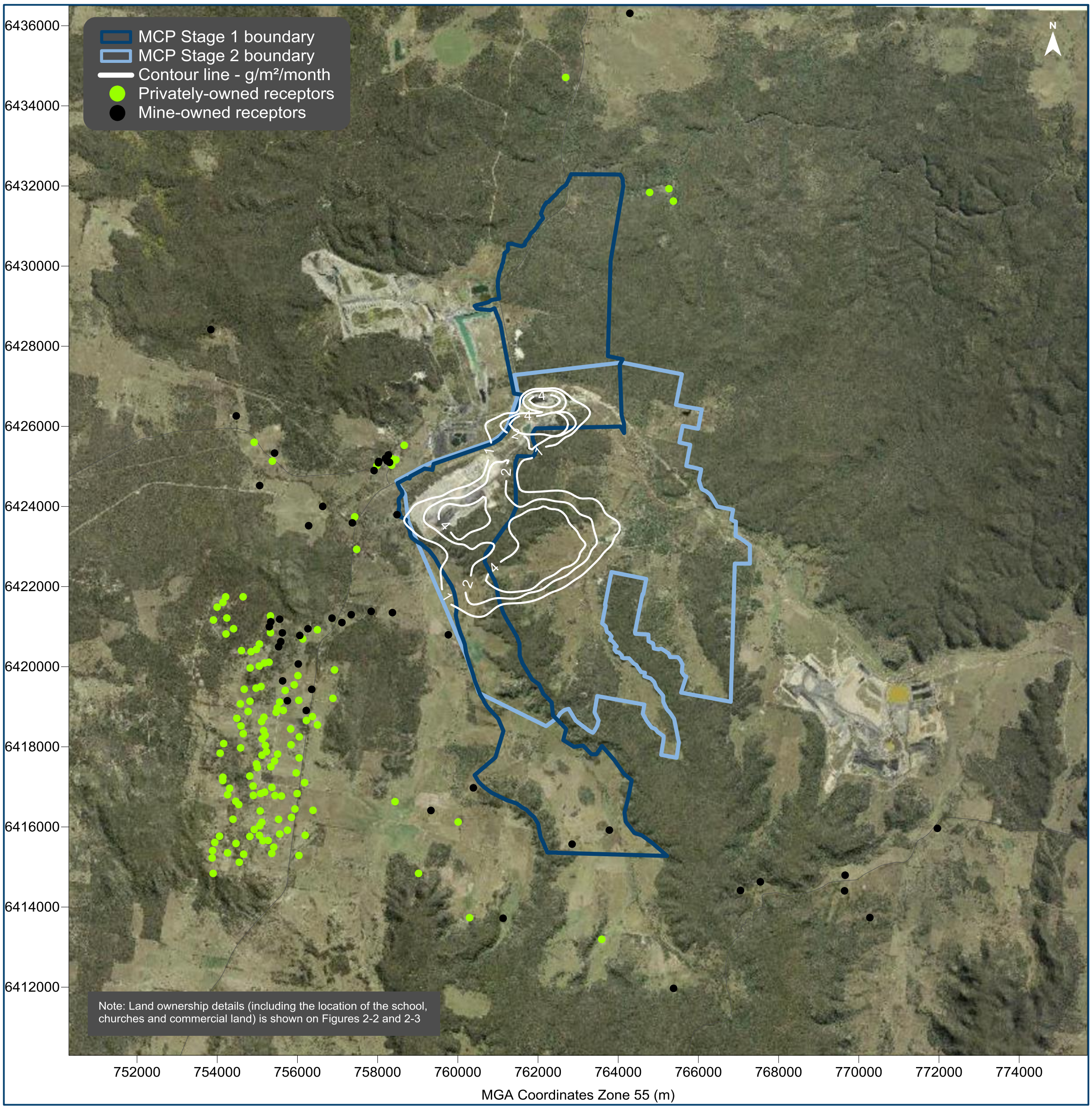


Figure C-4: Predicted annual average dust deposition levels due to emissions from the Modification