NEW HOPE
GROUP

G.6 Air Quality

NEW HOPE GROUP

G.6.1 Meteorological Modelling Methodology

Appendix G.6.1 Meteorological Modelling Methodology

Meteorology varies across the region, particularly wind patterns. The meteorology has been incorporated into the assessment by considering data from relevant monitoring stations and extrapolating this data to other areas using a wind-field model. The result is a three-dimensional, time-varying wind-field.

On a relatively small scale, local winds are affected by the topography. At larger scales, winds are affected by synoptic scale winds, which are modified by convective processes in the daytime and also by a complex pattern of regional drainage flows, which is governed by sloping terrain. In the modelling undertaken for this EIS, it is not necessary to document the complex mechanisms that affect air movements in the area, it is simply necessary to ensure that these air movements are incorporated into the dispersion modelling studies that are conducted.

This assessment has made use of the CALPUFF dispersion model. The CALPUFF model, through the CALMET meteorological processor, simulates complex meteorological patterns that exist in a particular region. The effects of local topography and changes in land surface characteristics are accounted for by this model.

Surface meteorological data, including 10 minute records of wind speed, wind direction, relative humidity and temperature, were sourced from the BoM automatic weather station at Oakey.

TAPM was used to generate a three dimensional prognostic data grid used as an "initial guess field" in CALMET, to capture the influence of regional topographical features, such as the hills and coastline, which are outside the detailed modelling domain. CALMET has been configured in line with the Approved Methods for the Modelling and Assessments of Air Pollutants in NSW (TRC 2011). The TAPM model configuration is presented in **Table G.6.1-1**.

- **Table G.6.1-1 TAPM model configuration**

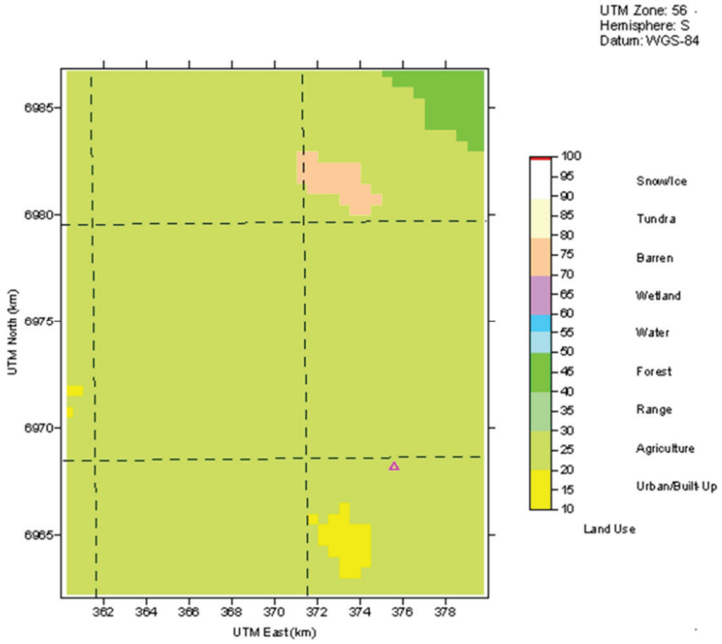
Model	Parameter	Value
TAPM (v4.0.5)	Number of grids (spacing)	4 (30 km, 10 km, 3 km, 1 km)
	Number of grids point	41 x 41 x 25
	Year of analysis	2011
	Centre of analysis	27°21.0' S, 151°41.0' E
	Meteorological data assimilation	None

A modelling domain of 20 km x 25 km with 0.25 km grid resolution and a southwest corner of 360 km E and 6,962 km N in Universal Transverse Mercator (UTM) zone 56 was used as input into CALMET v6.334.

Terrain data was captured from NASA's Shuttle Radar Topography Mission (SRTM), which has produced terrain information for the entire globe. For Australia, terrain data are available at approximately 90 m resolution (3-arc seconds).

Figure G.6.1-1 shows the model extents and landuse information used as input to the CALMET model. The location of the surface meteorological station is also shown. Landuse data were extracted from aerial imagery.

- **Figure G.6.1-1 CALMET landuse information**



The CALMET meteorological parameters used in the modelling are summarised in **Table G.6.1-2**

- **Table G.6.1-2 CALMET model configuration**

Model	Parameter	Value
CALMET (v.6.334)	Meteorological grid domain	20 km x 25 km (20 x 25 x 10 grid dimensions)
	Meteorological grid resolution	0.5 km
	Surface meteorological stations	BoM Oakey (station 041359)
	Upper air meteorological station	None
	3D windfield	3D windfields from TAPM input as an initial guess to CALMET
	Simulation length	1/1/2011 to 31/12/2011

NEW HOPE
GROUP

G.6.2 Derivation of Dust Emission Factors

Appendix G.6.2 Derivation of Dust Emission Factors

This page left intentionally blank

Table G.6.2-1 Derivation of Uncontrolled Particulate Emissions Rates from mining activities

Mining activity	Source	Adopted Method	Published Equation / Emission factors	Adopted parameters (reference)	TSP Emission factor	PM_{10} Emission factor	Units
Pre-stripping	Dozer on topsoil	NPI equation (NPI, 2012) - recommendation in Appendix A for Australian mines	$TSP = 2.6 \times \frac{s^{1.2}}{M^{1.3}}$ $PM10 = 0.34 \times \frac{s^{1.5}}{M^{1.4}}$	s = 10% (NPI) M = 2% (NPI)	16.7	4.1	kg/h
Overburden handling	Dozer on overburden	NPI equation (NPI, 2012) - recommendation in Appendix A for Australian mines	$TSP = 2.6 \times \frac{s^{1.2}}{M^{1.3}}$ $PM10 = 0.34 \times \frac{s^{1.5}}{M^{1.4}}$	s = 10% (NPI) M = 2% (NPI)	16.7	4.1	kg/h
	Drilling	NPI emission factor (NPI, 2012) - recommendation in Appendix A for Australian mines	TSP – 0.59 kg/ha/h PM_{10} – 0.31 kg/ha/h	N/A	0.59	0.31	kg/hole
	Blasting overburden	NPI equation (NPI, 2012) - recommendation in Appendix A for Australian mines	$0.00022 \times A^{1.5}$	A = 25,000 m^2 (New Hope)	870	452	kg/blast
	Blasting interburden	NPI equation (NPI, 2012) - recommendation in Appendix A for Australian mines	$0.00022 \times A^{1.5}$	A = 10,000 m^2 (New Hope)	220	114	kg/blast

Mining activity	Source	Adopted Method	Published Equation / Emission factors	Adopted parameters (reference)	TSP Emission factor	PM_{10} Emission factor	Units
	Excavators on overburden	NPI equation (NPI, 2012)	$k \times 0.0016 \times \frac{\left(\frac{U}{2.2}\right)^{1.3}}{\left(\frac{M}{2}\right)^{1.4}}$	k_{TSP} = 0.74 k_{PM10} = 0.35 U = 3.5 m/s (CALMET) M = 2.0%	0.00215	0.00102	kg/t
	Trucks dumping overburden	Default emission factor NPI 2012	TSP: 0.012 kg/t PM_{10}: 0.0043 kg/t	N/A	0.012	0.0043	kg/t
	Wind erosion from dumps	Default emission factor NPI 2012	TSP: 0.4 kg/ha/hour PM_{10}: 0.2 kg/ha/hour	N/A	0.4	0.2	kg/ha/h
Coal handling	Dozer on coal	NPI equation (NPI, 2012) - recommendation in Appendix A for Australian mines	$35.6 \times \frac{s^{1.2}}{M^{1.4}}$	s = 7% (New Hope) M = 7.5% (New Hope)	21.9	7.0	kg/h
	Excavators on coal	NPI equation (NPI, 2012)	$k_{TSP} \times 0.0596 \times M^{-0.9}$	M = 7.5% (New Hope)	0.052	0.007	kg/h
	Wind erosion in pits	Default emission factor NPI 2012	0.4 kg/ha/h	N/A	0.4	0.2	kg/ha/h
Haul Roads	Hauling overburden	Default emission factor NPI 2012	TSP: 4.42 kg/VKT PM_{10}: 1.31 kg/VKT	N/A	4.42	1.31	kg/VKT
	Hauling coal	Default emission factor NPI 2012	TSP: 4.42 kg/VKT PM_{10}: 1.31 kg/VKT	N/A	4.42	1.31	kg/VKT
	Grader	NPI equation (NPI, 2012) -	$0.0034 \times S^{2.5}$	S = 10km/h (new Hope)	1.08	0.34	kg/VKT

Mining activity	Source	Adopted Method	Published Equation / Emission factors	Adopted parameters (reference)	TSP Emission factor	PM_{10} Emission factor	Units
ROM and CHPP	Loading ROM bins	NPI Default emission factor (NPI 2012) for trucks dumping coal	TSP: 0.010 kg/t PM_{10}: 00042 kg/t	N/A	0.010	0.0042	kg/t
	Dozer on ROM pad	NPI equation (NPI, 2012) for bulldozers on coal	$35.6 \times \frac{s^{1.2}}{M^{1.4}}$	s = 7% (New Hope) M = 8% (New Hope)	20	6.38	kg/h
.	Conveyor Transfer points	NPI equation (NPI 2012) for miscellaneous transfer points (including conveying)	$0.74 \times 0.0016 \times \frac{(U/2.2)^{1.3}}{(M/2)^{1.4}}$	U = 3.5 m/s M = 8% (New Hope)	0.0003	0.00015	kg/t
MHF	Stacker/reclaimer	NPI equation (NPI 2012) for miscellaneous transfer points (including conveying)	$0.74 \times 0.0016 \times \frac{(U/2.2)^{1.3}}{(M/2)^{1.4}}$	U = 3.5 m/s M = 8% (new Hope)	0.0003	0.00015	kg/t
	Dozer on product coal	NPI equation (NPI 2012) for bulldozer on coal	$TSP = 35.6 \times \frac{s^{1.2}}{M^{1.4}}$ $PM10 = 6.33 \times \frac{s^{1.5}}{M^{1.4}}$	s = 7% (New Hope) M = 10% (New Hope)	14.6	4.7	kg/h
	Truck loading	Default emission factor NPI 2012 for loading to trains	TSP: 0.0004 kg/t PM_{10}: 0.00017 kg/t	N/A	0.0004	0.00017	kg/t
	Wind erosion from stockpiles	Default emission factor NPI 2012	TSP: 0.4 kg/ha/h PM_{10}: 0.2 kg/ha/h	N/A	0.4	0.2	kg/ha/h

Mining activity	Source	Adopted Method	Published Equation / Emission factors	Adopted parameters (reference)	TSP Emission factor	PM_{10} Emission factor	Units
TLF	Side Tipper	Default emission factor NPI 2012 loading to trains	TSP: 0.0004 kg/t PM_{10}: 0.00017 kg/t	N/A	0.0004	0.00017	kg/t
	Loading to trains	Default emission factor NPI 2012 loading to trains	TSP: 0.0004 kg/t PM_{10}: 0.00017 kg/t	N/A	0.0004	0.00017	kg/t

THIS PAGE IS INTENTIONALLY LEFT BLANK

NEW HOPE GROUP

G.6.3 Predicted Air Quality Impacts at Sensitive Receptors

Appendix G.6.3 Predicted air quality impacts at sensitive receptors

Table G.6.3-1 Predicted dust concentrations and dust deposition rates for 2019

Sensitive Receptor	Maximum 24-hr PM_{10} ($\mu g/m^3$)	5th Highest 24-hr PM_{10} ($\mu g/m^3$)	Maximum 24-hr $PM_{2.5}$ ($\mu g/m^3$)	Annual $PM_{2.5}$ ($\mu g/m^3$)	Annual TSP ($\mu g/m^3$)	Average Dust Deposition ($mg/m^2/day$)	Maximum Dust Deposition ($mg/m^2/day$)
1	52	50	15	3	59	137	190
2	48	43	14	3	53	122	162
3[a]							
4	40	32	12	3	31	66	71
5	32	26	10	3	29	64	66
6	42	33	12	3	31	67	71
7	49	40	14	3	33	71	84
8	50	42	15	3	34	73	93
9	43	35	13	3	33	71	87
10	40	32	12	3	32	70	83
11	32	25	11	3	31	68	73
12	25	24	8	34	30	67	74
13	34	27	11	3	31	68	75
14	41	32	12	3	32	71	84
15	59	46	17	3	36	77	98
16	57	40	15	3	32	70	79
17	30	23	9	3	30	66	69
18	21	19	7	3	29	65	68
19	22	19	7	3	29	65	68
20	21	19	7	3	29	65	67
21	18	17	6	3	29	64	66
22	19	18	6	3	29	65	68

Sensitive Receptor	Maximum 24-hr PM_{10} (µg/m^3)	5th Highest 24-hr PM_{10} (µg/m^3)	Maximum 24-hr $PM_{2.5}$ (µg/m^3)	Annual $PM_{2.5}$ (µg/m^3)	Annual TSP (µg/m^3)	Average Dust Deposition (mg/m^2/day)	Maximum Dust Deposition (mg/m^2/day)
23	21	19	7	3	29	65	70
24	21	20	7	3	30	65	71
25	21	19	7	3	30	66	72
26	22	21	7	3	30	66	76
27	24	22	8	3	31	67	77
28	25	22	8	3	32	68	81
29	23	21	7	3	31	68	79
30	20	20	7	3	30	67	74
31	20	19	6	3	30	66	72
32	21	20	7	5	31	67	76
33	24	23	8	5	33	70	80
34	26	23	8	5	33	71	81
35	65	54	17	5	44	87	101
36	77	61	19	5	49	96	116
37	65	53	17	5	46	91	110
38	61	56	16	4	48	101	135
39	66	57	17	4	49	101	134
40	55	48	15	3	44	90	114
41	51	46	13	4	41	85	106
42	38	35	11	3	35	75	85
43	41	31	11	3	33	70	75
44	49	42	13	3	36	74	82
45[b]	46	38	11	4	37	84	76

[a] Sensitive receptor 3 (in Muldu) has been removed because NAC have reached agreement to relocate the current tenant and purchase this property.

[b] Concentrations at sensitive receptor 45 have been extracted at the closet gridded receptor

Table G.6.3-2 Predicted dust concentrations and dust deposition rates for 2023

Sensitive Receptor	Maximum 24-hr PM_{10} (µg/m^3)	5th Highest 24-hr PM_{10} (µg/m^3)	Maximum 24-hr $PM_{2.5}$ (µg/m^3)	Annual $PM_{2.5}$ (µg/m^3)	Annual TSP (µg/m^3)	Average Dust Deposition (mg/m^2/day)	Maximum Dust Deposition (mg/m^2/day)
1	61	51	18	3	69	161	227
2	53	50	16	3	59	134	187
3[a]							
4	38	29	11	3	30	66	70
5	30	23	9	3	29	64	65
6	42	30	11	3	30	66	70
7	43	34	13	3	32	68	79
8	45	36	13	3	33	70	87
9	39	31	12	3	32	69	83
10	36	28	11	3	31	68	80
11	33	28	12	3	31	68	77
12	26	22	8	3	30	67	75
13	33	27	10	3	31	68	76
14	35	30	11	3	32	69	82
15	47	40	13	3	34	72	88
16	48	35	13	3	32	69	76
17	37	27	10	3	30	66	71
18	25	20	8	3	29	65	69
19	24	20	8	3	29	65	69
20	25	20	8	3	29	65	68
21	20	17	6	3	29	64	66
22	19	18	6	3	29	65	68
23	22	20	7	3	30	65	70
24	23	21	7	3	30	66	72
25	23	21	7	3	30	66	74

Sensitive Receptor	Maximum 24-hr PM_{10} (µg/m^3)	5th Highest 24-hr PM_{10} (µg/m^3)	Maximum 24-hr $PM_{2.5}$ (µg/m^3)	Annual $PM_{2.5}$ (µg/m^3)	Annual TSP (µg/m^3)	Average Dust Deposition (mg/m^2/day)	Maximum Dust Deposition (mg/m^2/day)
26	25	23	8	3	31	67	79
27	26	25	8	3	31	68	80
28	28	26	9	3	33	70	87
29	26	24	8	3	32	69	84
30	23	22	7	4	31	68	78
31	23	21	7	4	31	67	75
32	24	22	7	6	32	69	82
33	29	27	8	6	35	73	91
34	32	30	9	5	36	75	93
35	88	82	20	4	61	119	153
36	96	94	21	4	68	148	212
37	74	67	17	4	51	111	154
38	57	43	13	4	38	80	102
39	58	44	14	3	40	83	111
40	50	44	13	3	39	85	115
41	44	40	11	4	37	78	99
42	42	31	11	3	33	71	82
43	43	29	11	3	32	69	76
44	53	37	13	3	34	72	80
45[b]	62	51	17	5	43	99	85

[a] Sensitive receptor 3 (in Muldu) has been removed because NAC have reached agreement to relocate the current tenant and purchase this property.

[b] Concentrations at sensitive receptor 45 have been extracted at the closet gridded receptor

NEW HOPE GROUP

Table G.6.3-3 Predicted dust concentrations and dust deposition rates for 2029

Sensitive Receptor	Maximum 24-hr PM_{10} (µg/m^3)	5th Highest 24-hr PM_{10} (µg/m^3)	Maximum 24-hr $PM_{2.5}$ (µg/m^3)	Annual $PM_{2.5}$ (µg/m^3)	Annual TSP (µg/m^3)	Average Dust Deposition (mg/m^2/day)	Maximum Dust Deposition (mg/m^2/day)
1	60	53	16	3	50	114	164
2	55	48	14	3	45	100	131
3[a]							
4	31	26	9	3	30	65	69
5	26	21	8	3	29	64	65
6	36	27	9	3	30	65	69
7	36	30	10	3	31	68	78
8	37	32	10	3	32	70	85
9	32	28	9	3	31	69	81
10	30	25	9	3	31	68	78
11	27	25	9	3	30	67	74
12	23	20	7	3	29	66	74
13	28	24	9	3	30	67	74
14	29	26	10	3	31	68	78
15	35	31	10	3	32	70	81
16	33	30	10	3	31	70	81
17	34	30	10	3	31	68	75
18	29	24	9	3	30	66	71
19	29	24	9	3	30	66	71
20	26	23	8	3	29	65	69
21	20	17	6	3	29	64	66
22	19	18	6	3	29	65	69
23	22	20	7	3	30	66	72
24	23	20	7	3	30	66	74
25	22	20	7	3	30	67	77

Sensitive Receptor	Maximum 24-hr PM_{10} (µg/m^3)	5th Highest 24-hr PM_{10} (µg/m^3)	Maximum 24-hr $PM_{2.5}$ (µg/m^3)	Annual $PM_{2.5}$ (µg/m^3)	Annual TSP (µg/m^3)	Average Dust Deposition (mg/m^2/day)	Maximum Dust Deposition (mg/m^2/day)
26	24	23	7	3	31	68	83
27	26	24	8	3	31	69	85
28	27	25	8	3	33	72	91
29	25	24	8	3	32	70	87
30	23	21	7	3	31	69	79
31	23	21	7	3	31	67	76
32	24	22	7	3	32	70	84
33	30	27	9	3	35	76	97
34	33	30	9	3	36	78	99
35	109	88	24	3	61	138	193
36	83	74	20	3	55	130	218
37	57	53	15	3	42	97	143
38	51	39	12	3	34	74	86
39	54	40	13	3	35	75	90
40	48	36	12	3	35	76	93
41	42	33	11	3	33	73	86
42	36	28	10	3	31	69	77
43	34	27	9	3	31	68	73
44	39	28	11	3	32	70	76
45[b]	57	47	14	4	44	109	90

[a] Sensitive receptor 3 (in Muldu) has been removed because NAC have reached agreement to relocate the current tenant and purchase this property.
[b] Concentrations at sensitive receptor 45 have been extracted at the closet gridded receptor

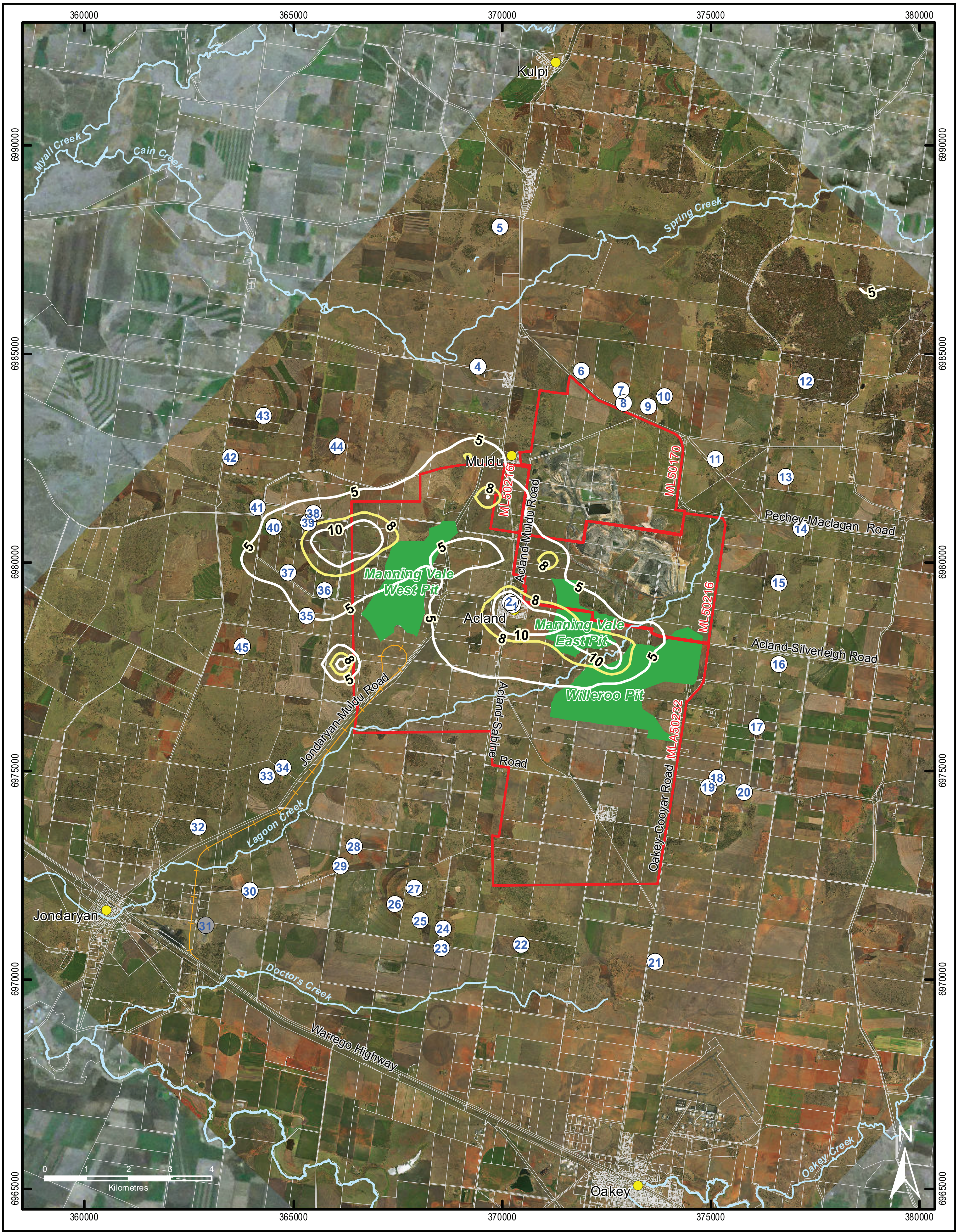
THIS PAGE IS INTENTIONALLY LEFT BLANK

NEW HOPE GROUP

G.6.4 Contour Plots of Annual Average TSP and PM2.5 Concentrations

Appendix G.6.4 Contour plots of annual average TSP and $PM_{2.5}$ concentrations

This page left intentionally blank



LEGEND

- Towns and Localities
- Sensitive Receptor - Residential
- Sensitive Receptor - Commercial
- Rail Spur
- Creeks
- Concentration Contour at air quality objective
- Concentration Contour
- Mining Tenements
- Stage 3 Pit Areas
- Cadastre

NEW HOPE GROUP

SKM

NEW ACLAND COAL MINE STAGE 3 PROJECT

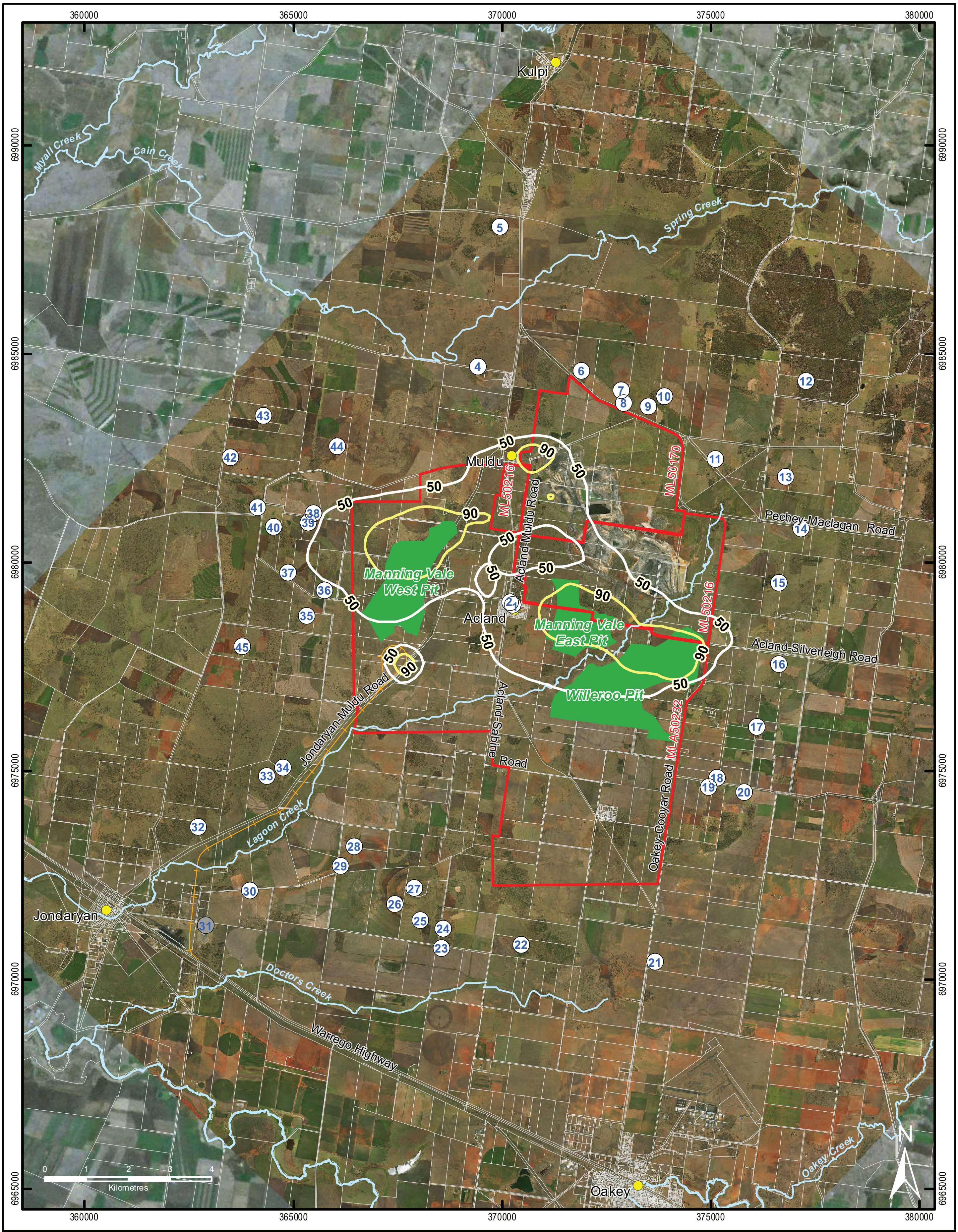
Figure G.6.4-1 - Contour plot of predicted annual average $PM_{2.5}$ concentrations ($\mu g/m^3$) for 2019

Scale 1:120,000 on A4

Projection: Australian Geodetic Datum – Zone 56 (AGD84)

Path: \\skmconsulting.com\BNEProjects\QENV2\Projects\QE06644\Spatial\ArcGIS\01_SEIS\09_AirQuality\131128_NewHope_AirQuality_FigureG6_4_1_Contours_PredictedAnnualAvg_PM2_5Concentrations2019.mxd

Produced: 29/11/2013



LEGEND

- Towns and Localities
- Sensitive Receptor - Residential
- Sensitive Receptor - Commercial
- Rail Spur
- Creeks
- Concentration Contour at air quality objective
- Concentration Contour
- Mining Tenements
- Stage 3 Pit Areas
- Cadastre

NEW HOPE GROUP

SKM

NEW ACLAND COAL MINE STAGE 3 PROJECT

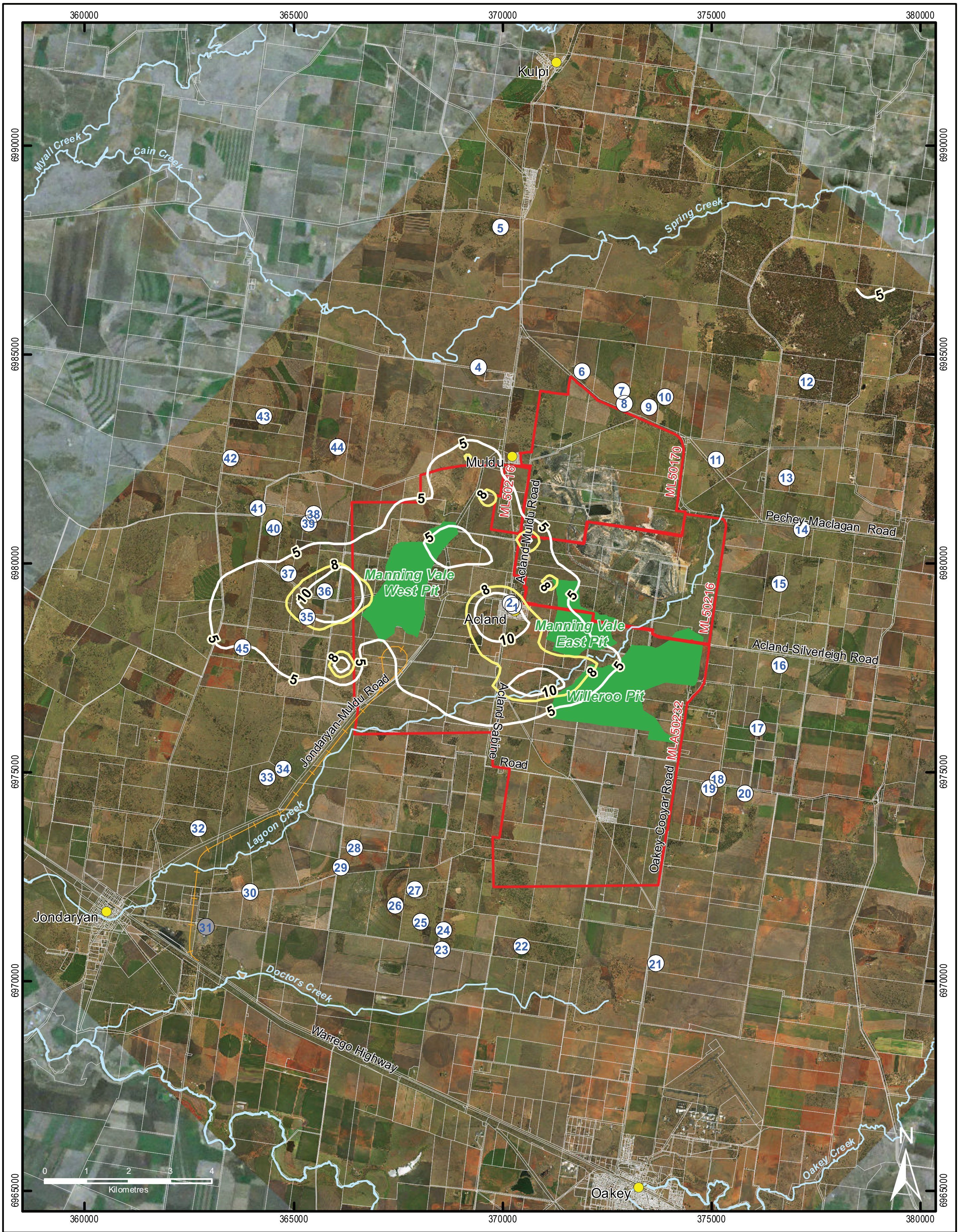
Figure G.6.4-2 - Contour plot of predicted annual average TSP concentrations (µg/m^3) for 2019

Scale 1:120,000 on A4

Projection: Australian Geodetic Datum – Zone 56 (AGD84)

Path: \\skmconsulting.com\BNEProjects\QENV2\Projects\QE06644\Spatial\ArcGIS\01_Figures\01_SEIS\09_AirQuality\131128_NewHope_AirQuality_FigureG6_4_2_Contours_PredictedAnnualAvg_TSP_Concentrations2019.mxd

Produced: 29/11/2013



LEGEND

- Towns and Localities
- Sensitive Receptor - Residential
- Sensitive Receptor - Commercial
- Rail Spur
- Creeks
- Concentration Contour at air quality objective
- Concentration Contour
- Mining Tenements
- Stage 3 Pit Areas
- Cadastre

NEW HOPE GROUP

SKM

NEW ACLAND COAL MINE STAGE 3 PROJECT

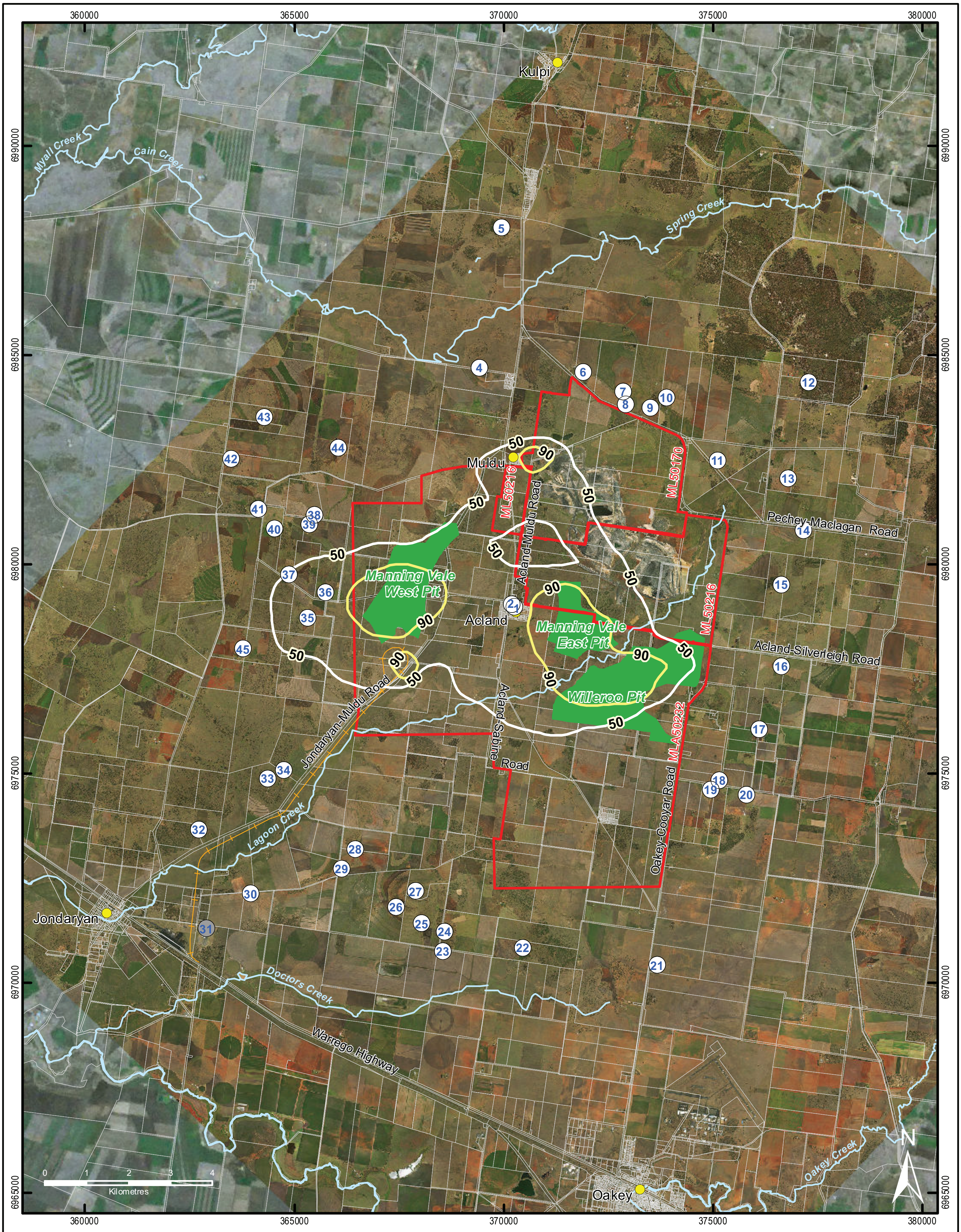
Figure G.6.4-3 - Contour plot of predicted annual average $PM_{2.5}$ concentrations (µg/m^3) for 2023

Scale 1:120,000 on A4

Projection: Australian Geodetic Datum – Zone 56 (AGD84)

Path: \\skmconsulting.com\BNEProjects\QE06644\Projects\QENV2\Projects\QE06644\Spatial\ArcGIS\01_SEIS\09_AirQuality\131128_NewHope_AirQuality_FigureG6_4_3_Contours_PredictedAnnualAvg_PM2_5Concentrations2023.mxd

Produced: 29/11/2013



LEGEND

- Towns and Localities
- Sensitive Receptor - Residential
- Sensitive Receptor - Commercial
- Rail Spur
- Creeks
- Concentration Contour
- Concentration Contour at air quality objective
- Mining Tenements
- Stage 3 Pit Areas
- Cadastre

NEW HOPE GROUP

SKM

NEW ACLAND COAL MINE STAGE 3 PROJECT

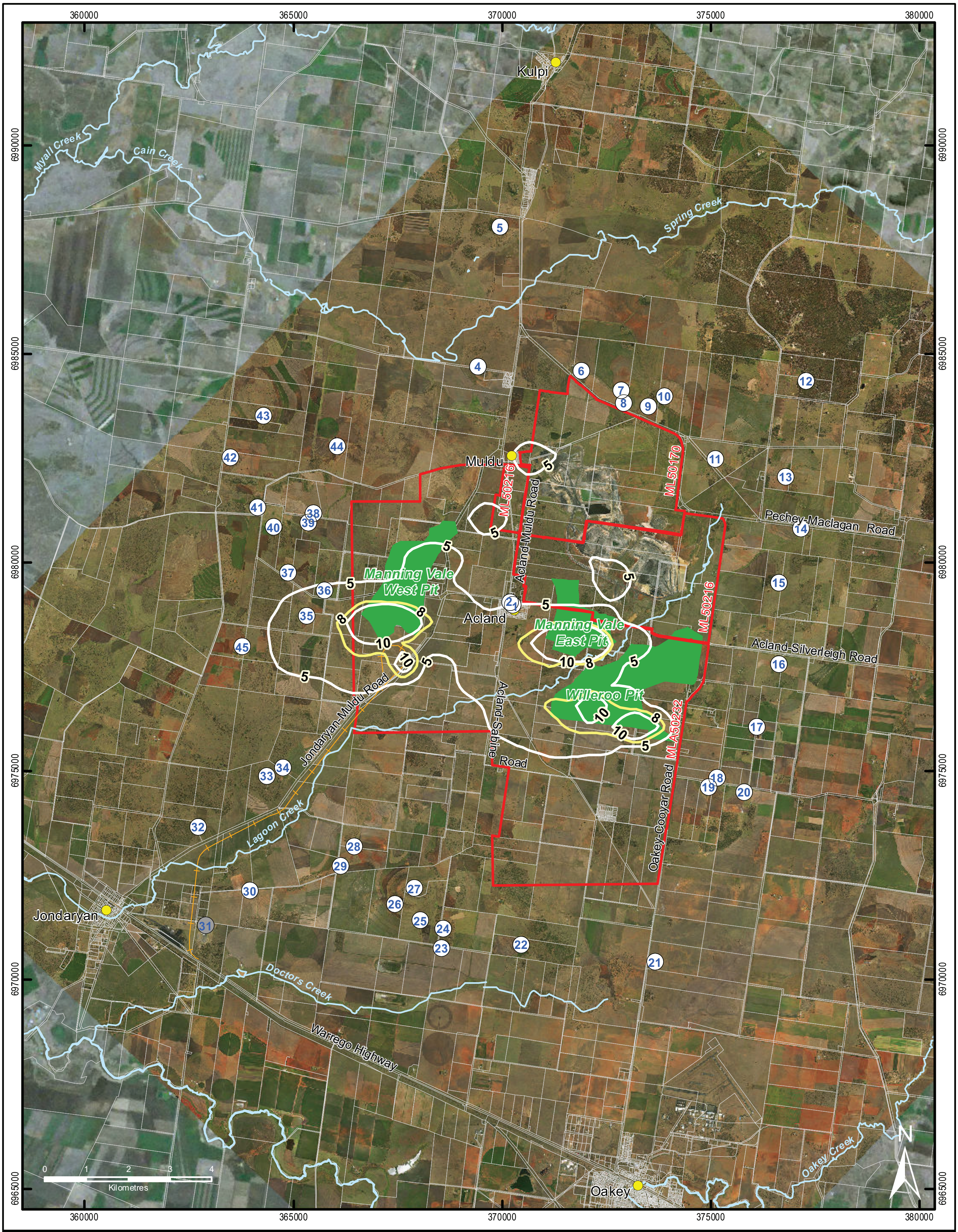
Figure G.6.4-4 - Contour plot of predicted annual average TSP concentrations (µg/m^3) for 2023

Scale 1:120,000 on A4

Projection: Australian Geodetic Datum – Zone 56 (AGD84)

Path: \\skmconsulting.com\BNEProjects\QENV2\Projects\QE06644\Spatial\ArcGIS\01_Figures\01_SEIS\09_AirQuality\131128_NewHope_AirQuality_FigureG6_4_4_Contours_PredictedAnnualAvg_TSP_Concentrations2023.mxd

Produced: 29/11/2013



LEGEND

- Towns and Localities
- Sensitive Receptor - Residential
- Sensitive Receptor - Commercial
- Rail Spur
- Creeks
- Concentration Contour at air quality objective
- Concentration Contour
- Mining Tenements
- Stage 3 Pit Areas
- Cadastre

NEW HOPE GROUP

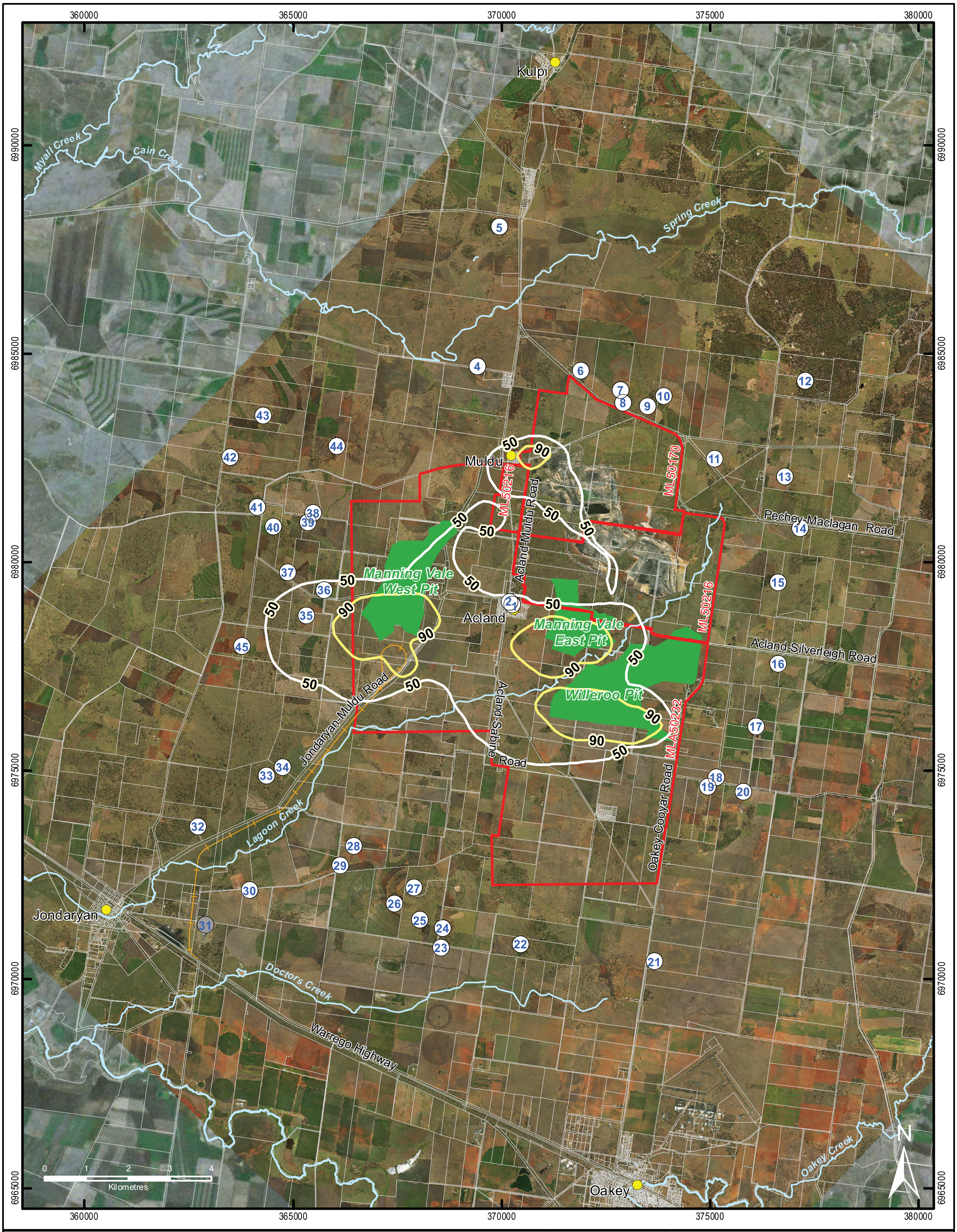
SKM

NEW ACLAND COAL MINE
STAGE 3 PROJECT

Figure G.6.4-5 - Contour plot of predicted annual average $PM_{2.5}$ concentrations ($\mu g/m^3$) for 2029

Scale 1:120,000 on A4
Projection: Australian Geodetic Datum – Zone 56 (AGD84)

Produced: 29/11/2013 Path: \\skmconsulting.com\BNEProjects\QE06644\Spatial\ArcGIS\01_Figures\01_SEIS\09_AirQuality\131128_NewHope_AirQuality_FigureG6_4_5_Contours_PredictedAnnualAvg_PM2_5Concentrations2029.mxd



LEGEND

- Towns and Localities
- Sensitive Receptor - Residential
- Sensitive Receptor - Commercial
- Rail Spur
- Creeks
- Concentration Contour
- Concentration Contour at air quality objective
- Mining Tenements
- Stage 3 Pit Areas
- Cadastre

NEW HOPE GROUP

SKM

NEW ACLAND COAL MINE STAGE 3 PROJECT

Figure G.6.4-6 - Contour plot of predicted annual average TSP concentrations (µg/m^3) for 2029

Scale 1:120,000 on A4

Projection: Australian Geodetic Datum – Zone 56 (AGD84)

Path: \\skmconsulting.com\BNEProjects\QENV2\Projects\QE06644\Spatial\ArcGIS\01_Figures\01_SEIS\09_AirQuality\131128_NewHope_AirQuality_FigureG6_4_6_Contours_PredictedAnnualAvg_TSP_Concentrations2029.mxd

Produced: 29/11/2013

THIS PAGE IS INTENTIONALLY LEFT BLANK

NEW HOPE
GROUP

G.6.5 Water Quality Sampling from Rainwater Tanks Near the Mine

Appendix G.6.5 Water quality sampling from rainwater tanks near the Mine

This page left intentionally blank

Potable water testing of rainwater tanks near the Mine

Parameter	Units	ADWG Guidelines 6 2011 Health guideline values	ADWG Guidelines 6 2011 Aesthetic guideline values	Tank 1 (east of the Mine - 2009)	Tank 2 (east of the Mine - 2009)	Tank 3 (east of the Mine - 2009)	Tank 5 (south of the Mine - 2009)	Tank 3 (east of the Mine - 2007)	Tank 4 (southeast of the Mine - 2007)
Aluminium as Al - Total	µg/L		200				43	45	47
Antimony as Sb - Total	µg/L	3		<1	<1	<1	<1	<6	<1
Arsenic as As - Total	µg/L	10		<1	<1	<1	<1	<1	<1
Beryllium as Be - Total	µg/L	60		<1	<1	<1	<1	<1	<1
Bicarbonate Alk'y as CaCO3	mg/L			2	2	2	2	2.5	8.5
Bicarbonate as HCO3	mg/L			2.4	2.4	2.4	2.4	3	10
Cadmium as Cd - Total	µg/L	2					<1	<1	<1
Calcium as Ca - Total	mg/L			1	1.5	2.4	1.8	<1	3.1
Calcium Hardness as CaCO3	mg/L			2.5	3.7	6	4.5	1.3	7.7
Carbonate Alkalinity as CaCO3	mg/L			0.0000062	0.0000062	0.0000048	0.00016	0.0000098	0.0054
Carbonate as CO3	mg/L			0.0000074	0.0000074	0.0000058	0.00019	0.000012	0.0065
Chloride as Cl	mg/L		250	2	2.3	2.1	2.9	<1	11
Chromium as Cr - Total	µg/L			<0.003	0.004	<0.003	10	2.1	1.6
Colour - TRUE 0.45µm	Hazen units		15	<1	<1	<1	19	1.1	1.2
Conductivity @ 25°C	µS/cm			19	29	25	33		81
Copper as Cu - Total	µg/L	2000	1000	47	2.3	23	27	13	2.6
E. coli - MF	CFU/100mL	Not detected		13	60	8	>60	67	27
Faecal Coliforms - DW	CFU/100mL			13	>60	23	>60	67	39
Fluoride as F	mg/L	1500		<0.1	<0.1	<0.1			
Free Carbon Dioxide	mg/L			140	140	180	5.6	140	2.9
Free Carbon Dioxide at pHs	mg/L			0.01	0.0067	0.004	0.0067	0.025	0.0011
Heterotrophic Plate Count	cfu/mL			>300	>300	140	>300	>300	2900
Hydroxide Alkalinity as CaCO3	mg/L			0.000016	0.000016	0.000012	0.00042	0.00002	0.0031
Hydroxide as OH (mg/L)	mg/L			0.0000051	0.0000051	0.0000038	0.00013		0.00099
Iron as Fe - Dissolved	µg/L			<5	12	<5	<5	7.3	35
Iron as Fe - Total	µg/L		300	70	88	34	41	34	40
Lead as Pb - Total	µg/L	10		1.6	<1	<1	2.6	<1	<1
Magnesium as Mg - Total	mg/L			<1	<1	<1	<1	<1	2.2
Manganese as Mn - Total	µg/L	500	100	20	22	20	14	12	1
Mercury as Hg - Total	µg/L	1					<0.5	<0.5	<0.5
Nickel as Ni - Total	µg/L	20					<1	<3	<3
Nitrate as N	mg/L	50		0.69	0.85	0.85	1.3	0.53	1.3
Nitrite + Nitrate as N	mg/L			0.7	0.85	0.85	1.3	0.53	1.3
Orthophosphate as P	mg/L			0.009	0.028	0.048	0.24	0.2	0.034
pH Value @ 25°C	unitless		6.5-8.5	4.5	4.5	4.4	5.9	4.6	6.8
Potassium as K - Total	mg/L			<1	<1	<1	2.3	<1	<1
Residual Alkali	meq/L			0.3	0.24	0.19	0.23	1.3	0.48
Selenium as Se - Total	µg/L	10		<5	<5	<5	<5	<5	<5
Silver as Ag - Total	µg/L	100		<1	<1	<1	<1	<1	<1
Sodium Adsorption Ratio - Water	unitless			0.19	0.25	0.13	3.4	0.6	0.37
Sodium as Na - Total	mg/L		180	1.1	1.6	<1	24	2.7	4.8
Sulphate as SO4	mg/L	500	250	1.6	1.9	1.6	1.8	<1	1.3
Total Coliforms MF APHA	CFU/100mL			>80	>80	23	>80	>80	55
Total Dissolved Salts (calc'd)	mg/L			10	12	12	36	7.8	32
Total Hardness as CaCO3	mg/L		200	6.6	7.8	10	8.6	2	17
Turbidity - Filtered 0.2µm	NTU			<0.1	0.2	0.4	0.6	0.3	0.6
Turbidity - Raw	NTU		5	0.8	1.8	1.5	2.8	2.7	0.6
Zinc as Zn - Total	µg/L		3000	620	210	91	590	54	86

Key

- ADWG listed
- Outside ADWG Health Limit
- Outside ADWG Aesthetic Range
- Not analysed

NEW HOPE GROUP

G.6.6 Comparison of Predicted AQ with Monitoring Data for Current Mine

Appendix G.6.6 Comparison of predicted air quality with monitoring data for current operations

Introduction

The current mining operations at the New Acland Coal (the Mine) have been modelled using the same methodology as used in the air quality assessment. The predicted 24 hour PM_{10} concentrations have been compared to air quality monitoring data recorded at two locations near the Mine.

A summary of the validation modelling is as follows;

- The mining scenario was based on the July 2011 to June 2012 operating period;
- Coal and overburden mining rates were based on the data used in the National Pollutant Inventory (NPI) for the same period; and
- Ambient air monitoring for PM_{10} was measured by a third party NATA accredited consultant.

Existing air quality

NAC has collected air quality data at various sensitive receptors around the New Acland mine on a campaign measurement basis for approximately 11 years. The monitoring data that has been used in the validation study is a three monthly PM_{10} monitoring campaign at Balgowan approximately 2 km northwest of the mine. Three PM_{10} samples measured at Acland have also been discussed.

A summary of the monitoring results are presented in **Figure G.6.6-1**. The locations of air quality monitoring stations used in this study are presented in **Figure G.6.6-2.**

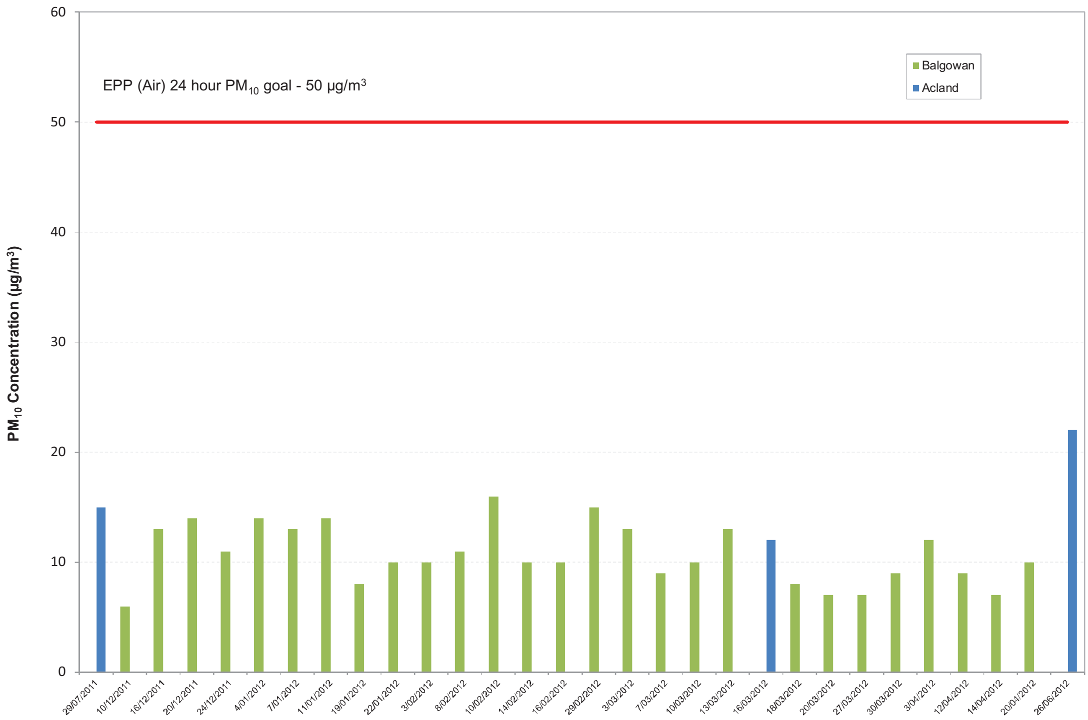


Figure G.6.6-1 PM_{10} concentrations recorded at Balgowan and Acland (µg/m^3) during the modelled year (July 2011 – June 2012)

Background air quality

For the purposes of this validation study the 70th percentile 24 hour average PM_{10} from the Balgowan data (13 µg/m^3) presented has been adopted as the background concentration.

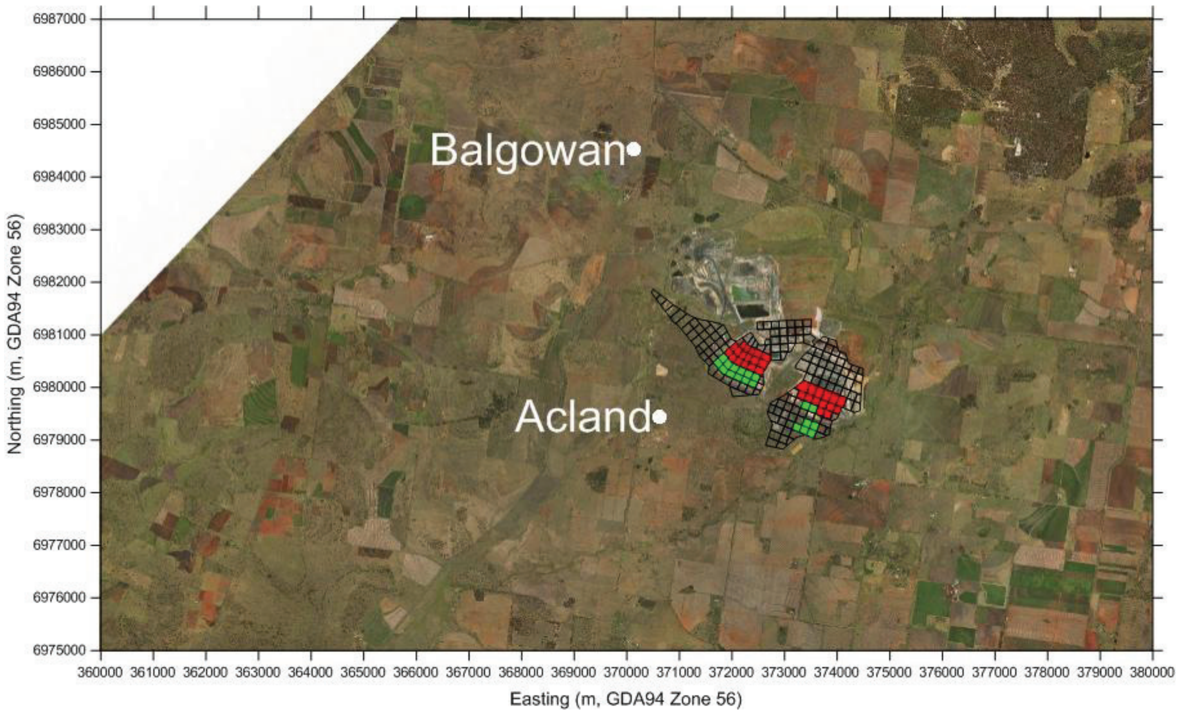


Figure G.6.6-2 PM_{10} monitoring concentrations

Emissions inventory

The mining rates for operating scenario modelled in the validation study are presented in **Table G.6.6-2**. The activity data for mining operations was provided by New Hope.

Table G.6.6-2 Mine information and activity data for the three mining scenarios

Parameter		July 2011 – June 2012
Overburden removal Total (x 1000 bcm)	Total for mine	26,161
Production rates ROM coal rate (kt)	Total for mine	10,286
Coal production rate	Total for all pits (Mt)	>4.8
Blasting overburden	Average area (m^2)	15,000
	Number	modelled one per day
Return haul distance – Coal from pit to CHPP (km)	South Pit	4 km
	North Pit	4 km

Emission rates for the sources outlined in **Section 9.4.1** were derived from industry-standard emission factors that have been collated by the National Pollutant Inventory (NPI) and United States Environmental Protection Agency (USEPA) AP-42 emissions estimation methodology. These factors are based on measurements of dust emissions from other operational coal mines in Australia and the United States.

The uncontrolled emission factors and estimation equations, where applicable, used in the assessment are summarised in **Table G.6.2-1. Appendix G.6.2** provides the derivation of the uncontrolled emission rates in including any site specific parameters where applicable. The adopted controls are in line with typical air quality management practices and also with the current on site management measures. The controlled emissions rates modelled in the validation study are presented in **Table G.6.6-3**.

Table G.6.6-3 Summary of controlled emission rates modelled

Source type	2011 – 2012 (kg/yr)
	PM_{10}
Scraper	28,552
Excavator/truck loading	58,117
Dozer on overburden	163,315
Trucks dumping overburden	184,392
Drilling	3,311
Blasting	46,852
Excavating coal	49,355
Dozer on coal	83,144
Trucks dumping coal	40,179
In pit hauling	91,910
Hauling ROM coal to CHPP	22,335
Road grading	12,410
Wind erosion	57,028
ROM pad	127,384
CHPP	65,676
TOTAL PM_{10}	1,033,960

Modelling methodology

Dispersion modelling requires hourly breakdown of wind speed and direction, and other meteorological parameters.

A one year (July 2011 to June 2012) meteorological dataset for wind speed and wind direction, air temperature, relative humidity, mixing height and other micro-meteorological variable has been prepared for the study area using the CALMET meteorological model. The methodology to develop this meteorological dataset is consistent with methodology presented in **Appendix G.6.1.**

Dust concentrations due to mining activities were predicted using CALPUFF (Version 6.42). CALPUFF is a Lagrangian dispersion model that simulates the dispersion of pollutants within a turbulent atmosphere by representing emissions as a series of puffs emitted sequentially.

The dispersion modelling options include:

- Emissions were volume sources with the source parameters in **Table 9-15, Chapter 9**;
- Emissions from each volume source were developed on an hourly time step, taking into account the level of activity at that location and, in some cases, the hourly wind speed;
- Geometric mean diameter and geometric standard deviation for PM_{10} (less than 10 µm), is presented in **Table 9-16, Chapter 9**.

Modelling Results

The dispersion modelling was performed using the meteorological information provided by the CALMET model, atmospheric dispersion with CALPUFF, wind dependency emission characteristics and the estimated emissions from **Table G.6.6-2**.

Time series plots including background PM_{10} concentrations for both monitoring locations are also presented in **Figure G.6.6-3** and **Figure G.6.6-4.**

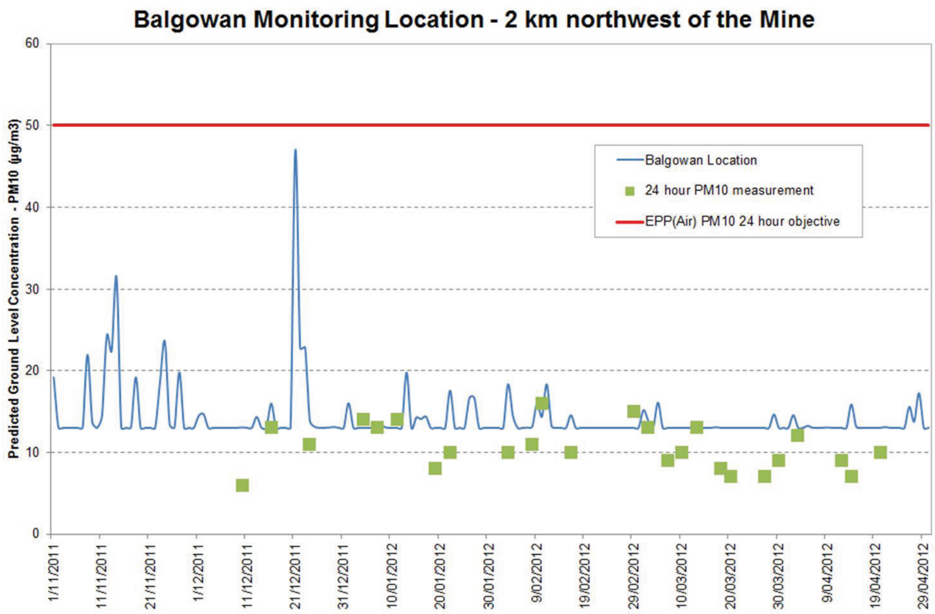


Figure G.6.6-3 Time series of predicted PM_{10} concentrations and PM_{10} monitoring data at Balgowan

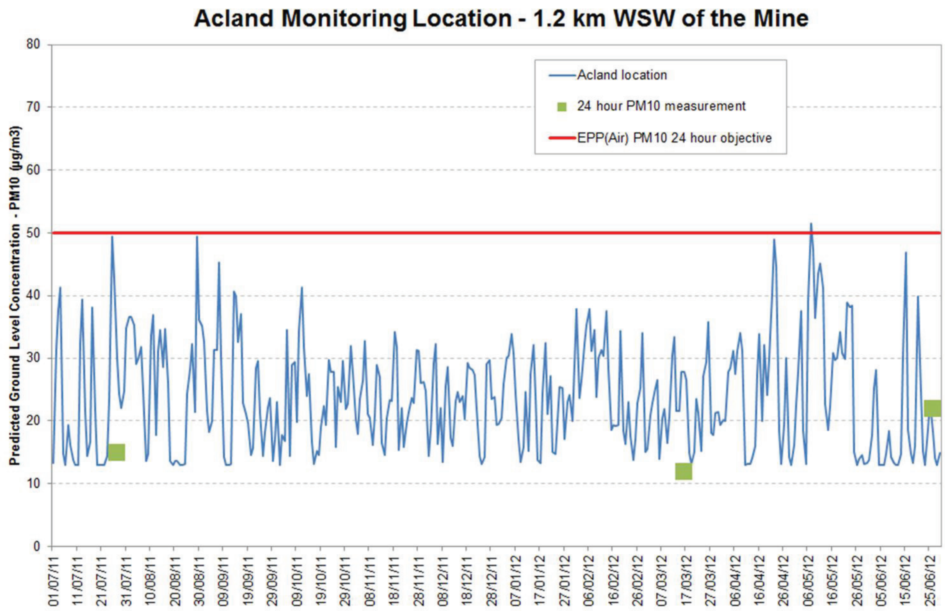


Figure G.6.6-4 Time series of predicted PM_{10} concentrations and PM_{10} monitoring data at Acland

Summary

The results of the validation modelling is summarised as follows.

- No exceedances of the EPP (Air) objective of 50 µg/m^3 for the 5th highest 24 hour average are predicted to occur at the Balgowan monitoring location

- The predicted PM_{10} concentrations at Balgowan have generally over predicted air quality impacts in comparison with the monitoring data.

- The predicted PM_{10} at Acland have generally over predicted air quality impacts in comparison with the monitoring data. The monitoring dataset at Acland is not sufficient to provide a statistical analysis of model performance.

- The modelling methodology adopted for the air quality assessment of the revised Project generally has over predicated air quality impacts for current operations at the Mine. The model results are consistent with findings from published comparisons of predicted particulate concentrations with modelling data (Holmes and Lakmaker, 2007; Bridgman *et al*. 2002).