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Memorandum

20 August 2024

To: Amanda Weston

From: Francine Manansala

Subject: OMPS amendment report - revised air quality impact assessment

Dear Amanda,

EMM Consulting Pty Limited (EMM) prepared an air quality and greenhouse assessment (AQGHGA) to support the Environmental Impact Statement (EIS) for the Oven Mountain Pumped Hydro Energy Storage Project (the Project) in March 2023.

Since submission of the EIS, components of the Project have been revised and as a result, an Amendment Report has been prepared to address these changes. This letter includes a revised air quality impact assessment (AQIA) that incorporates the Project changes relevant to potential air quality impacts.

A revised greenhouse gas (GHG) assessment is provided in a separate Response to Submissions (RtS) report also being submitted for the Project. That revised assessment is provided in the main body of the RtS in response to submissions received from the Environmental Protection Authority (EPA).

It is noted that there were no agency submissions received on the AQIA report from March 2023 and so this revised AQIA only relates to the proposed Project amendments.

Please do not hesitate to contact me using the details below if you have any questions.

Yours sincerely

Francine Manansala
Associate and Team Leader - Air quality and Climate
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1 Introduction

OMPS Pty Ltd (OMPS) is proposing to develop the Oven Mountain Pumped Hydro Energy Storage Project (the Project), an off-river pumped hydro energy storage system (referred to as the 'pumped hydro system') located approximately half-way between Kempsey and Armidale, adjacent to the Macleay River in northern NSW. The Project is located within the New England Renewable Energy Zone (REZ) and the Armidale Regional Local Government Area (LGA), proximate to its border with Kempsey Shire LGA. At a basic level, the Project will consist of upper and lower water reservoirs and an underground tunnel connecting them via a hydro-electric power station.

An Amendment Report is being submitted to address changes in the Project design following exhibition of the EIS. This revised air quality impact assessment (AQIA) has been prepared as an input to the Amendment Report and addresses the Project changes as relevant to air quality. The new Project incorporating the design changes is hereafter referred to as the 'Amended Project'.

2 The Amended Project

An overview of the key Project amendments is given in Table 2.1. The amendments with the most potential to affect air quality are bolded.

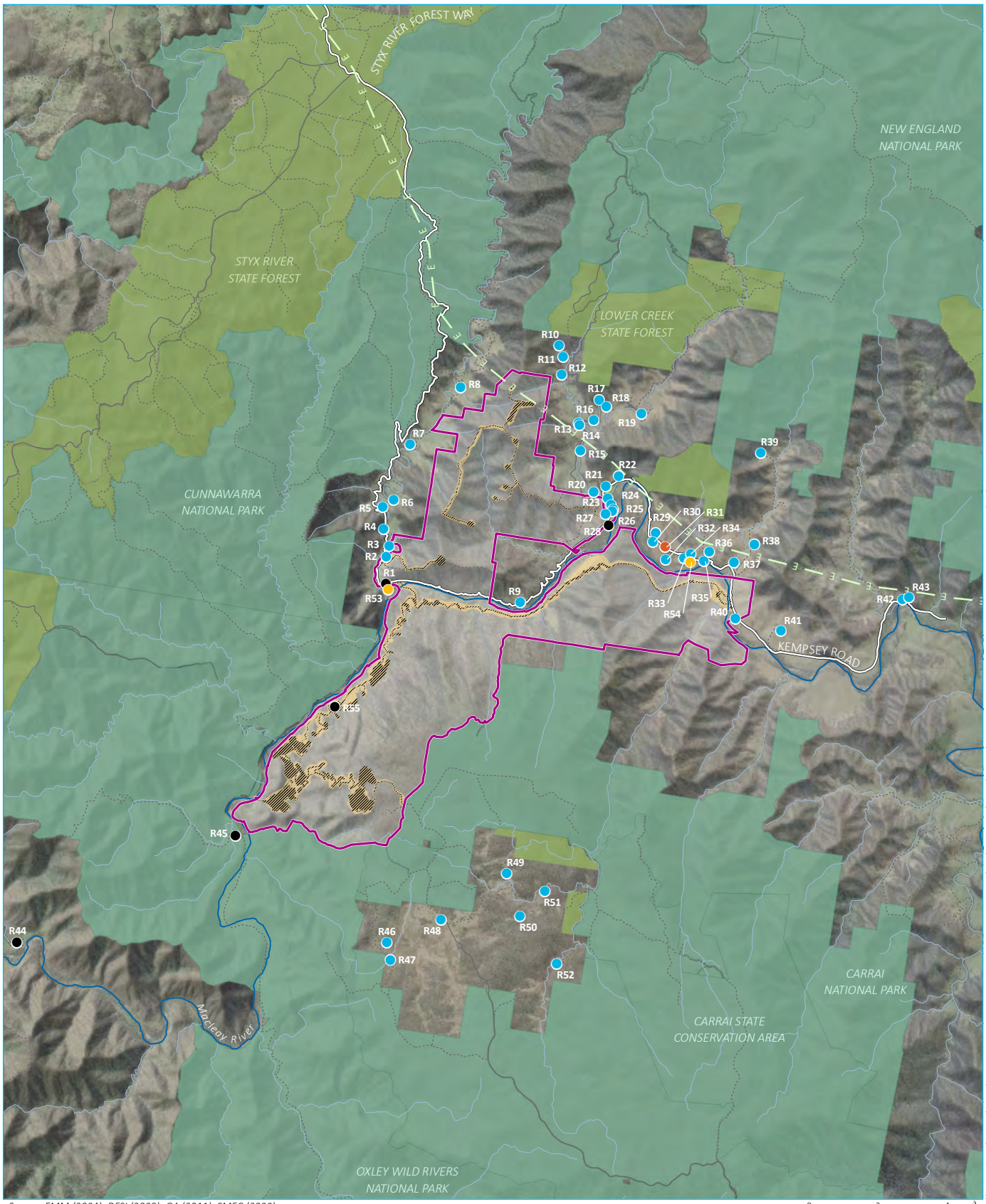
The changes shown in bold in Table 2.1 have been incorporated into revised air quality emissions estimation and dispersion modelling.

It is noted that the Amended Project includes temporary or fly camps at three locations – near Smith's Bluff, the intersection of the Main Access Road and the Eastern Access Road (EAR), and the upper reservoir. The fly camps will exist during early construction works such as road and reservoir establishment and will be decommissioned prior to spoil movement activities. As the movement of spoil is the main activities contributing to air quality emissions during the construction of the Project, the fly camps have not been considered further in this assessment. The assessment locations including the accommodation camps that were included in the AQIA for the EIS have been maintained in this study and are shown in Figure 2.1.

Table 2.1 Overview of the Project amendments in comparison to the project as exhibited in the EIS

Project element	Description of change	Summary of the Project as exhibited in the EIS	Summary of the Amended Project
Internal roads			
Eastern Access Road (EAR) refinement	**Realignment of the EAR to reduce need for earthworks, improve road safety and address drainage issues.**	**Approximately 11.4 kilometres (km)**	**Approximately 12.1 km**
Temporary bridges	A temporary bridge will be utilised prior to the construction of the two permanent bridges near Smiths Bluff (referred to as Eastern Access Temporary Bridge). A secondary, temporary access is proposed via the construction of a new, temporary bridge crossing of the Macleay River about 600 metres (m) upstream and north-west of Georges Junction (referred to as Western Access Temporary Bridge). This amendment is proposed to reduce the period of internal road construction and therefore overall construction period and improve effectiveness of emergency response measures (access and egress).	One temporary bridge: Eastern Access Temporary Bridge. Two permanent bridges near Smiths Bluff.	Two temporary bridges: Eastern Access Temporary Bridge (EATB) and Western Access Temporary Bridge (WATB). Two permanent bridges near Smiths Bluff.
Upper Dam Access Road (UDAR) refinement	Realignment of the UDAR (including removal of a large north-south connecting section of road) in response to regulator feedback to avoid known habitat and potentially significant impacts to the threatened Brush-tailed Rock Wallaby.	Approximately 7.1 km	Approximately 6.4 km
Construction			
Temporary or fly camps	While fly camps were previously anticipated for the Project, up to three fly camps are confirmed to be required and located near Smith's Bluff (Eastern fly camp), the intersection of the Main Access Road and the EAR (Western fly camp), and the upper reservoir (within spoil emplacement area) (Southern fly camp). The camps will accommodate about 20 workers and up to 90 workers depending on the ultimate configuration, and would be established within the first year of construction. All services will be trucked in and out of the sites, with no permanent facilities or services proposed.	Temporary or fly camps may be required. The location and size will be documented during the detailed design phase.	Three temporary or fly camps will provide small scale temporary work accommodation for workers completing initial road works until the main accommodation camp is completed. Proposed locations in proximity of EATB, WATB, and Upper reservoir.
Blasting and rock crushing/processing	**Allowing blasting as a construction method for road works and other above-ground works. Rock processing/crushing facilities will be required in the lower reservoir (LR) and upper reservoir (UR) areas to process rock for use in dams.**	**Blasting required for tunnels and portals.**	**Blasting required for tunnels and portals, reservoirs and road works.**
Construction water requirements	Increasing the estimated water requirements for use in construction (e.g. dust suppression, concrete batching, etc).	Approximately 1 megalitre per day (ML/day)	Approximately up to 3 ML/day
Construction envelope	Updates to the construction envelope to accommodate stakeholder feedback, design changes and refined construction requirements.	Approximately 780 hectares (ha)	Approximately 768 ha

Project element	Description of change	Summary of the Project as exhibited in the EIS	Summary of the Amended Project
Disturbance footprint	Updates to the disturbance footprint to accommodate stakeholder feedback, design changes and refined construction requirements.	Approximately 330 ha	Approximately 367 ha
Spoil and materials			
Laydown/stockpile areas	There will be four areas used for stockpiling and material laydown. One area is located along the main access road (between transmission towers 14–16), one area is located in proximity to the batching plant, one area is located near Georges Junction, and one is located near the Eastern Access Temporary Bridge on the eastern side of the Macleay River. The largest of the four areas has also been flagged as available for other ancillary uses, to provide further flexibility as the detailed design progresses.	There will be two areas used for stockpiling and material laydown, covering a total area of 114,000 square metres (m^2)	There will be four areas used for stockpiling and material laydown, covering a total area of 119,600 m^2
Spoil emplacement	**Revised spoil estimates were derived following changes to the underground arrangement and sizing. This, in addition to incorporating agency feedback, required changes to the conceptual landform design. The conceptual landform design presents reduced height and slopes however requires a greater disturbance area as a result.**	**Three permanent spoil emplacement locations to store around 2.9 million cubic metres (Mm^3) plus dead storage within the reservoirs with approximate capacity 300,000-400,000 cubic metres (m^3).**	**Two permanent spoil emplacement locations to store around 3.55 Mm^3.** **Use of dead storage in reservoir only if surplus material.**
Operational footprint	Updates to the operational footprint to accommodate design changes (including permanent spoil emplacement and transmission alignment along the UDAR).	Approximately 270 ha	Approximately 280 ha
Underground arrangement and sizing			
Underground arrangement and sizing for improved generation capacity	The Project will provide more than 900 megawatts (MW) of electricity generating capacity and at least eight hours of energy storage at full generating capacity.	Up to 900 MW and between 8 and 12 hours of energy storage. Underground arrangement and tunnel sizes reflect lower energy storage capacity.	Up to 900 MW and at least 8 hours of energy storage. Underground arrangement and tunnel sizes reflect greater energy storage capacity. Re-location of Main Access Tunnel (MAT) portal to align with amended arrangement.



Source: EMM (2024); DFSI (2020); GA (2011); SMEC (2022)

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KEY

- Project area
- Disturbance footprint
- Construction envelope

Receptor type

- Accommodation
- Industrial
- Passive Recreation
- Residential

Existing environment

- Macleay River
- Watercourse/drainage line
- Major road
- Minor road
- Vehicular track
- Existing transmission line
- NPWS reserve
- State forest

Assessment locations

Oven Mountain Pumped Hydro Energy Storage Project
Air quality impact assessment
OMPS Pty Ltd
Figure 2.1

EMM creating opportunities

3 Assessment methodology

The assessment follows the same approach as used in the AQIA for the EIS.

The assessment considered a single construction scenario, which was determined to be the 'worst-case' in terms of the scale of the construction activity (defined as movement of spoil).

While the same approach and scenario has been adopted, it must be noted that the assessment for the EIS was based on highly conservative spoil volumes provided for the preliminary design and associated haulage of spoil material between work sites. This included all spoil excavated, stockpiled, and either re-used in construction (i.e. for building pads and portals) or permanently placed at three spoil emplacement locations, with potential for in-reservoir placement. This revised assessment has been based on updated spoil volumes for an amended design and based on a revised spoil management approach, including two permanent spoil emplacements and no in-reservoir placement.

While the overall spoil volumes to be permanently emplaced has increased for the Amended Project compared to the EIS, the haulage of material between multiple work sites is slightly reduced. More specifically to this report, the updated spoil assumptions modelled for this AQIA Addendum are based on more practical (i.e. lesser) volumes (including appropriate bulking factors) rather than the highly conservative approach adopted by the EIS AQIA.

Emissions from fugitive dust sources associated with the worst-case construction emission scenario were quantified through the application of USEPA AP-42 emission factor equations. Particulate matter emissions were quantified for the three size fractions – total suspended particulates (TSP), particulate matter less than 10 micrometres (µm) in aerodynamic diameter (PM_{10}) and particulate matter less than 2.5 µm in aerodynamic diameter ($PM_{2.5}$).

As there are no air quality monitoring stations (AQMSs) in the vicinity of the Project area, concurrent daily PM_{10} and $PM_{2.5}$ concentrations recorded at the DPE Armidale, Tamworth, Gunnedah and Narrabri AQMSs for 2021 were combined into a regional average profile. The values for each day were defined as the mean for the whole dataset. These synthetic background profiles were used in the cumulative assessment provided in Section 5.2. Annual average background TSP and dust deposition values were determined using typical ratios or values due to a lack of available data.

The dispersion modelling for this assessment involved the use of The Air Pollution Model (TAPM) and CALMET/CALPUFF. Upper air profiles were generated by the Commonwealth Scientific and Industrial Research Organisation's (CSIRO) TAPM meteorological model. CALMET was used as the meteorological pre-processor for the dispersion model CALPUFF.

Each emission source was represented in CALPUFF as a volume source, located according to the layout of the Project's construction areas.

In addition to the 55 individual assessment locations, pollutant concentrations were predicted over a 29 km (x-axis) by 21 km (y-axis) domain with 300 m resolution.

Simulations were undertaken for the 12-month period of 2021.

4 Emissions inventory

4.1 Amended Project emissions

The emissions inventory developed for the AQIA to support the EIS was revised to include the applicable Project changes described in Table 2.1. It is noted that blasting was originally included at the tunnel portals only. In the amended Project, blasting is also planned along the EAR as part of road establishment activities. The number and frequency of the blasts is not yet known. However, the air quality emissions inventory currently assumes a worst-case scenario of trucks hauling construction materials along the EAR during a year of peak construction activities (i.e. maximum spoil movement and concrete batching). Blasting along the EAR would occur during road establishment only and would therefore not coincide with emissions generated from trucks hauling construction materials along the EAR. Furthermore, calculated daily emissions from truck haulage (the most significant source of emissions overall) will be significantly higher than calculated daily emissions from blasting activities. Therefore, the worst-case scenario has been captured.

The calculated annual TSP, PM_{10} and $PM_{2.5}$ emissions for each activity occurring for the Amended Project are shown in Table 4.1 with further detail provided in Table A.1 of Annexure A. A graphical summary of the contribution to annual dust emissions by source type is provided in Figure 4.1.

From the data presented in the following figures and tables, the most significant source of particulate matter emissions from the Project's operations is associated with unpaved haulage, material handling, wind erosion and fuel combustion from trucks.

4.2 Comparison to EIS emissions

A comparison of the estimated emissions (categorised by type) from the EIS and the Amended Project is given in Table 4.2. The following points are made:

- Overall estimated TSP, PM_{10} and $PM_{2.5}$ emissions have decreased by 23%, 20%, and 16% respectively as a result of the Amended Project.
- Drilling and blasting, and crushing and screening, are new sources associated with the Amended Project. These sources make up between 0.1% and 0.7% of TSP, PM_{10} and $PM_{2.5}$ emissions as a result of the Amended Project.
- Unpaved haulage, material handling, concrete batching plant processes, and fuel combustion emissions, have decreased by 25% for TSP, PM_{10} and $PM_{2.5}$ emissions as a result of the Amended Project. This is largely due to the reduction in the maximum amount of spoil handled as part of the Amended Project - 3,076,632 tonnes/year for the Amended Project compared to 4,854,260 tonnes/year for the Project as exhibited in the EIS.
- Wind erosion emissions have increased by 16% for TSP, PM_{10} and $PM_{2.5}$ emissions as a result of the Amended Project. This is due to the larger spoil emplacement areas proposed for the Amended Project.

Table 4.1 Calculated annual TSP, PM_{10} and $PM_{2.5}$ emissions for the Amended Project

Emission source	Calculated annual emissions (kg/year) by source		
	TSP	PM_{10}	$PM_{2.5}$
Tailrace tunnel			
Conveyer transferring spoil from Tailrace portal to surface	78	37	6
Loading spoil from conveyor to trucks	78	37	6
Hauling spoil from tailrace tunnel to northern spoil area	6,219	1,777	178
Unloading spoil from trucks to western spoil area	78	37	6
Main access tunnel			
Conveyer transferring spoil from MAT portal to surface	78	37	6
Loading spoil from conveyor to trucks	78	37	6
Hauling spoil from main access tunnel to northern spoil area	3,521	1,006	101
Unloading spoil from trucks to western spoil area	78	37	6
Emergency cable and ventilation tunnel (ECVT)			
Conveyer transferring spoil from ECVT to surface	78	37	6
Loading spoil from conveyor to trucks	78	37	6
Hauling spoil from ECVT to northern spoil area	3,099	886	89
Unloading spoil from trucks to western spoil area	78	37	6
Lower dam and reservoir			
FELs/excavators removing spoil	2,407	1,139	172
Loading spoil to trucks	2,407	1,139	172
Hauling spoil from lower dam and reservoir to western spoil area	180,098	51,458	5,146
Unloading spoil from trucks to western spoil area	2,407	1,139	172
Upper dam and reservoir			
FELs/excavators removing spoil	2,748	1,300	197
Loading spoil to trucks	2,748	1,300	197
Hauling spoil from upper dam and reservoir to eastern spoil area	94,761	27,075	2,708
Unloading spoil from trucks to eastern spoil area	2,748	1,300	197

Emission source	Calculated annual emissions (kg/year) by source		
	TSP	PM_{10}	$PM_{2.5}$
Concrete batching plant (CBP)/construction materials			
CBP processing activities	1,072	429	136
Hauling construction materials on the Eastern Access Road to the CBP	351,432	100,412	10,041
All wind erosion			
Wind erosion from concrete aggregate stockpiles	343	171	26
Wind erosion from western spoil area	6,909	3,454	518
Wind erosion from eastern spoil area	7,415	3,708	556
Wind erosion from lower dam and reservoir	21,490	10,745	1,612
Wind erosion from upper dam and reservoir	19,729	9,864	1,480
Dozers working on spoil			
Dozers working on western spoil area	51,311	12,399	5,388
Dozers working on eastern spoil area	51,311	12,399	5,388
Drilling and blasting			
Drilling - tailrace tunnel	472	245	14
Blasting - tailrace tunnel	28	14	1
Drilling - MAT	472	245	14
Blasting - MAT	28	14	1
Drilling - ECVT	472	245	14
Blasting - ECVT	28	14	1
Crushing and screening			
Crushing rock - lower dam and reservoir	824	371	69
Screening rock - lower dam and reservoir	1,511	508	34
Crushing rock - upper dam and reservoir	941	424	78
Screening rock - upper dam and reservoir	1,725	580	39
All diesel combustion			
Diesel combustion (whole site)	36,000	36,000	33,000
Total	**857,382**	**282,095**	**67,788**

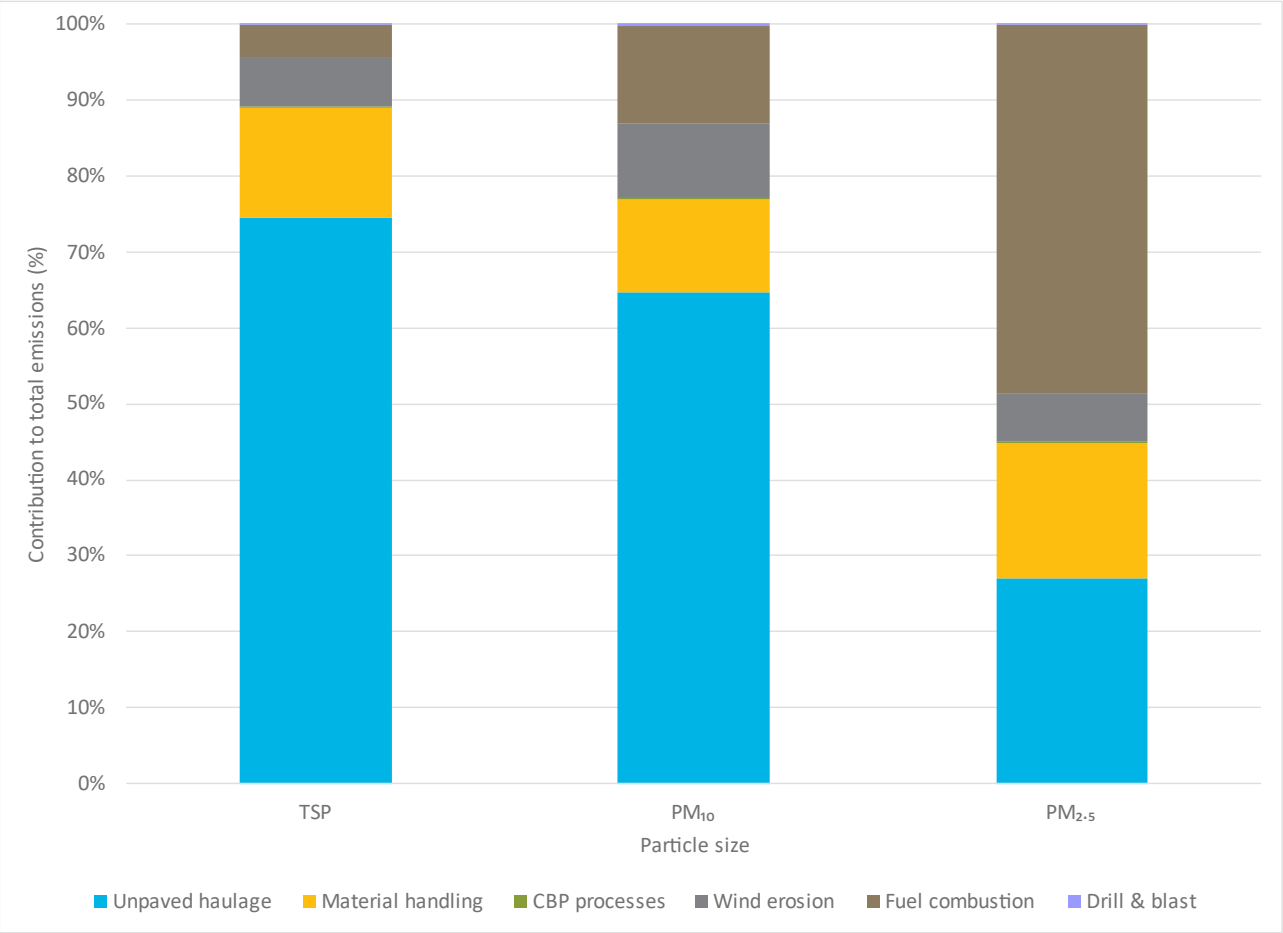

Figure 4.1 **Contribution to annual particulate matter emissions by emissions source type and particle size**

Table 4.2 **Calculated annual TSP, PM10 and PM2.5 emissions**

Emission source type	Project emissions as exhibited in the EIS (kg/year)			Amended Project emissions (kg/year)		
	TSP	PM_{10}	$PM_{2.5}$	TSP	PM_{10}	$PM_{2.5}$
Unpaved haulage	838,714	239,639	23,964	639,130	182,613	18,261
Material handling	179,445	49,266	17,990	118,791	32,447	11,933
Wind erosion	48,068	24,034	3,605	55,886	27,943	4,191
CBP processes	1,180	472	150	1,072	429	136
Fuel combustion	44,641	44,641	40,921	36,000	36,000	33,000
Drilling and blasting	-	-	-	1,499	780	45
Crushing and screening	-	-	-	5,003	1,883	221
Total	**1,112,048**	**358,051**	**86,630**	**857,382**	**282,095**	**67,788**

Note: CBP = concrete batching plant.

5 Dispersion model results

5.1 Incremental results

Predicted incremental TSP, PM_{10}, $PM_{2.5}$, and dust deposition levels from the Amended Project's construction phase are presented in Table 5.1 for each of the assessment locations.

The predicted concentrations and deposition rates for all pollutants and averaging periods during the Project's construction phase are well below the applicable NSW EPA assessment criterion at all assessment locations.

Except for dust deposition, the assessment criteria listed are applicable to cumulative concentrations. Analysis of cumulative impact compliance is presented in Section 5.2.

Contour plots have not been included in this report as predicted results are lower than those shown in the EIS (see Section 5.3).

Table 5.1 Incremental (Amended Project-only) concentration and deposition results

Assessment location ID	Predicted incremental concentration (µg/m³) and deposition rate (g/m²/month)					
	TSP	PM_{10}		$PM_{2.5}$		Dust deposition
Criterion	**90**	**50**	**25**	**25**	**8**	**2**
R1	1.5	4.3	1.1	0.8	0.2	0.1
R2	0.3	0.9	0.2	0.4	0.1	<0.1
R3	0.2	0.6	0.1	0.4	0.1	<0.1
R4	0.1	0.5	0.1	0.3	<0.1	<0.1
R5	0.1	0.4	0.1	0.2	<0.1	<0.1
R6	0.1	0.4	0.1	0.2	<0.1	<0.1
R7	<0.1	0.2	<0.1	0.1	<0.1	<0.1
R8	<0.1	0.2	<0.1	0.1	<0.1	<0.1
R9	5.0	9.4	3.4	1.8	0.6	0.4
R10	<0.1	0.2	<0.1	0.1	<0.1	<0.1
R11	<0.1	0.2	<0.1	0.1	<0.1	<0.1
R12	<0.1	0.2	<0.1	0.1	<0.1	<0.1
R13	<0.1	0.3	<0.1	0.2	<0.1	<0.1
R14	<0.1	0.3	<0.1	0.2	<0.1	<0.1
R15	<0.1	0.3	<0.1	0.2	<0.1	<0.1
R16	<0.1	0.3	<0.1	0.1	<0.1	<0.1
R17	<0.1	0.2	<0.1	0.1	<0.1	<0.1
R18	<0.1	0.2	<0.1	0.1	<0.1	<0.1
R19	<0.1	0.2	<0.1	0.1	<0.1	<0.1
R20	0.1	0.5	0.1	0.3	<0.1	<0.1

Assessment location ID	Predicted incremental concentration (µg/m³) and deposition rate (g/m²/month)					
	TSP	PM_{10}		$PM_{2.5}$		Dust deposition
Criterion	**90**	**50**	**25**	**25**	**8**	**2**
R21	0.1	0.5	0.1	0.2	<0.1	<0.1
R22	0.1	0.4	0.1	0.2	<0.1	<0.1
R23	0.2	0.5	0.1	0.3	<0.1	<0.1
R24	0.2	0.7	0.2	0.3	0.1	<0.1
R25	0.2	0.8	0.2	0.3	0.1	<0.1
R26	0.3	0.9	0.2	0.3	0.1	<0.1
R27	0.3	0.8	0.2	0.3	0.1	<0.1
R28	0.4	1.1	0.4	0.4	0.1	<0.1
R29	0.5	1.5	0.4	0.3	0.1	<0.1
R30	1.0	2.5	0.8	0.5	0.2	0.1
R31	0.8	2.0	0.7	0.4	0.2	<0.1
R32	1.9	3.7	1.5	0.7	0.3	0.1
R33	1.4	4.5	1.1	0.7	0.2	0.1
R34	0.8	4.0	0.7	0.7	0.2	<0.1
R35	1.2	5.6	1.0	1.0	0.2	0.1
R36	0.4	2.6	0.4	0.5	0.1	<0.1
R37	0.3	2.5	0.3	0.5	0.1	<0.1
R38	0.1	0.5	0.1	0.2	<0.1	<0.1
R39	0.0	0.2	<0.1	0.1	<0.1	<0.1
R40	3.9	6.6	2.6	1.1	0.4	0.3
R41	0.3	0.7	0.2	0.2	0.1	<0.1
R42	0.1	0.2	0.1	0.1	<0.1	<0.1
R43	0.1	0.2	<0.1	0.1	<0.1	<0.1
R44	0.0	0.3	<0.1	0.2	<0.1	<0.1
R45	0.2	2.2	0.2	0.9	0.1	<0.1
R46	0.0	0.1	<0.1	0.1	<0.1	<0.1
R47	0.0	0.1	<0.1	0.1	<0.1	<0.1
R48	0.0	0.1	<0.1	0.1	<0.1	<0.1
R49	0.0	0.2	<0.1	0.1	<0.1	<0.1
R50	0.0	0.1	<0.1	0.1	<0.1	<0.1
R51	<0.1	0.1	<0.1	0.1	<0.1	<0.1

Assessment location ID	Predicted incremental concentration (µg/m³) and deposition rate (g/m²/month)					
	TSP	PM_{10}		$PM_{2.5}$		Dust deposition
Criterion	**90**	**50**	**25**	**25**	**8**	**2**
R52	<0.1	0.1	<0.1	<0.1	<0.1	<0.1
R53	1.9	4.2	1.3	0.8	0.3	0.1
R54	2.0	7.1	1.6	1.1	0.3	0.1
R55	5.6	4.5	2.4	1.1	0.5	1.2

Note: Criteria for TSP, PM_{10} and $PM_{2.5}$ are applicable to cumulative (increment + background). Criteria are provided for comparison purposes only.

5.2 Cumulative results

Cumulative impacts (i.e. the Amended Project plus background) at each of the assessment locations surrounding the Amended Project have been assessed in the following way:

- For 24-hour average concentrations – each daily-varying predicted 24-hour average concentration for PM_{10} and $PM_{2.5}$ from the Amended Project has been combined with the corresponding concentrations from the adopted 2021 background concentration datasets.
- For annual average concentrations – the predicted annual average concentrations have been paired with the corresponding background annual average concentration.

Predicted cumulative TSP, PM_{10}, $PM_{2.5}$, and dust deposition levels from the Amended Project's construction phase are presented in Table 5.2 for each of the assessment locations.

The predicted cumulative concentrations and deposition rates for all pollutants and averaging periods during the Amended Project's construction phase are below the applicable NSW EPA assessment criterion at all assessment locations.

Table 5.2 Cumulative (Amended Project plus background) concentration and deposition results

Assessment location ID	Predicted cumulative concentration (µg/m³) and deposition rate (g/m²/month)					
	TSP	PM_{10}		$PM_{2.5}$		Dust deposition
Criterion	**90**	**50**	**25**	**25**	**8**	**4**
R1	27.7	34.6	11.6	14.6	5.8	1.1
R2	26.4	34.4	10.7	14.4	5.7	1.0
R3	26.4	34.3	10.6	14.4	5.6	1.0
R4	26.3	34.3	10.6	14.4	5.6	1.0
R5	26.3	34.3	10.5	14.4	5.6	1.0
R6	26.3	34.3	10.5	14.4	5.6	1.0
R7	26.2	34.3	10.5	14.3	5.6	1.0
R8	26.2	34.3	10.5	14.3	5.6	1.0
R9	31.2	35.2	13.9	15.2	6.2	1.4
R10	26.2	34.3	10.5	14.3	5.6	1.0

Assessment location ID	Predicted cumulative concentration (µg/m³) and deposition rate (g/m²/month)					
	TSP	PM_{10}		$PM_{2.5}$		Dust deposition
Criterion	90	50	25	25	8	4
R11	26.2	34.3	10.5	14.3	5.6	1.0
R12	26.2	34.3	10.5	14.3	5.6	1.0
R13	26.2	34.3	10.5	14.3	5.6	1.0
R14	26.2	34.3	10.5	14.3	5.6	1.0
R15	26.2	34.3	10.5	14.3	5.6	1.0
R16	26.2	34.3	10.5	14.3	5.6	1.0
R17	26.2	34.3	10.5	14.3	5.6	1.0
R18	26.2	34.3	10.5	14.3	5.6	1.0
R19	26.2	34.3	10.5	14.3	5.6	1.0
R20	26.3	34.3	10.6	14.3	5.6	1.0
R21	26.3	34.3	10.6	14.3	5.6	1.0
R22	26.3	34.3	10.5	14.3	5.6	1.0
R23	26.3	34.4	10.6	14.3	5.6	1.0
R24	26.4	34.4	10.7	14.4	5.6	1.0
R25	26.4	34.4	10.7	14.4	5.6	1.0
R26	26.5	34.4	10.7	14.4	5.6	1.0
R27	26.5	34.4	10.7	14.4	5.6	1.0
R28	26.6	34.5	10.8	14.4	5.7	1.0
R29	26.7	34.6	10.9	14.4	5.7	1.0
R30	27.1	34.8	11.3	14.4	5.7	1.1
R31	27.0	34.8	11.2	14.4	5.7	1.0
R32	28.0	35.2	12.0	14.6	5.9	1.1
R33	27.6	35.3	11.6	14.6	5.8	1.1
R34	27.0	35.1	11.2	14.4	5.7	1.0
R35	27.4	35.4	11.5	14.6	5.8	1.1
R36	26.6	34.8	10.8	14.4	5.7	1.0
R37	26.5	34.7	10.8	14.4	5.7	1.0
R38	26.3	34.4	10.6	14.3	5.6	1.0
R39	26.2	34.3	10.5	14.3	5.6	1.0
R40	30.1	35.9	13.1	15.4	6.0	1.3
R41	26.5	34.8	10.7	14.5	5.6	1.0

Assessment location ID	Predicted cumulative concentration (µg/m³) and deposition rate (g/m²/month)					
	TSP	PM_{10}		$PM_{2.5}$		Dust deposition
Criterion	90	50	25	25	8	4
R42	26.2	34.3	10.5	14.3	5.6	1.0
R43	26.2	34.3	10.5	14.3	5.6	1.0
R44	26.2	34.3	10.5	14.3	5.6	1.0
R45	26.4	34.8	10.7	14.5	5.7	1.0
R46	26.2	34.3	10.5	14.3	5.6	1.0
R47	26.2	34.3	10.5	14.3	5.6	1.0
R48	26.2	34.3	10.5	14.3	5.6	1.0
R49	26.2	34.4	10.5	14.3	5.6	1.0
R50	26.2	34.3	10.5	14.3	5.6	1.0
R51	26.2	34.3	10.5	14.3	5.6	1.0
R52	26.2	34.3	10.5	14.3	5.6	1.0
R53	28.1	34.7	11.8	14.7	5.8	1.1
R54	28.2	35.8	12.1	14.7	5.9	1.1
R55	31.8	36.5	12.9	15.0	6.1	2.2

5.3 Comparison to EIS results

A comparison of incremental maximum 24-hour average PM_{10} concentrations (a key metric of the assessment) between the results presented in the EIS and for the Amended Project is shown in Figure 5.1. Predicted incremental TSP, PM_{10}, $PM_{2.5}$ and dust deposition results at all assessment locations were lower for the Amended Project compared to the EIS.

A comparison of cumulative 24-hour average PM_{10} concentrations between the EIS and for the Amended Project is shown in Figure 5.2. Predicted cumulative TSP, PM_{10}, $PM_{2.5}$ and dust deposition results at all assessment locations were the same or lower for the Amended Project compared to the EIS. The cumulative results were similar due to the same background concentrations assumed across both assessments.

The results are considered to reflect the updated spoil management approach discussed in Section 3.

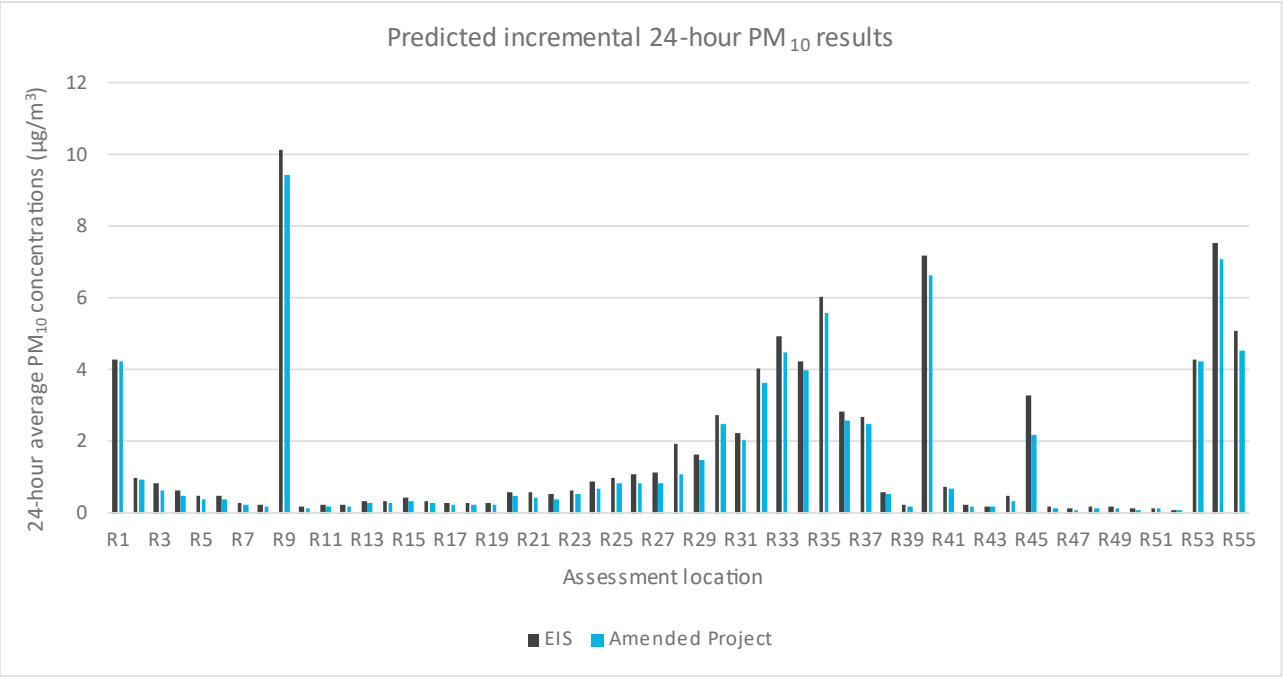

Figure 5.1 **Incremental 24-hour average PM_{10} concentrations – EIS and the Amended Project**

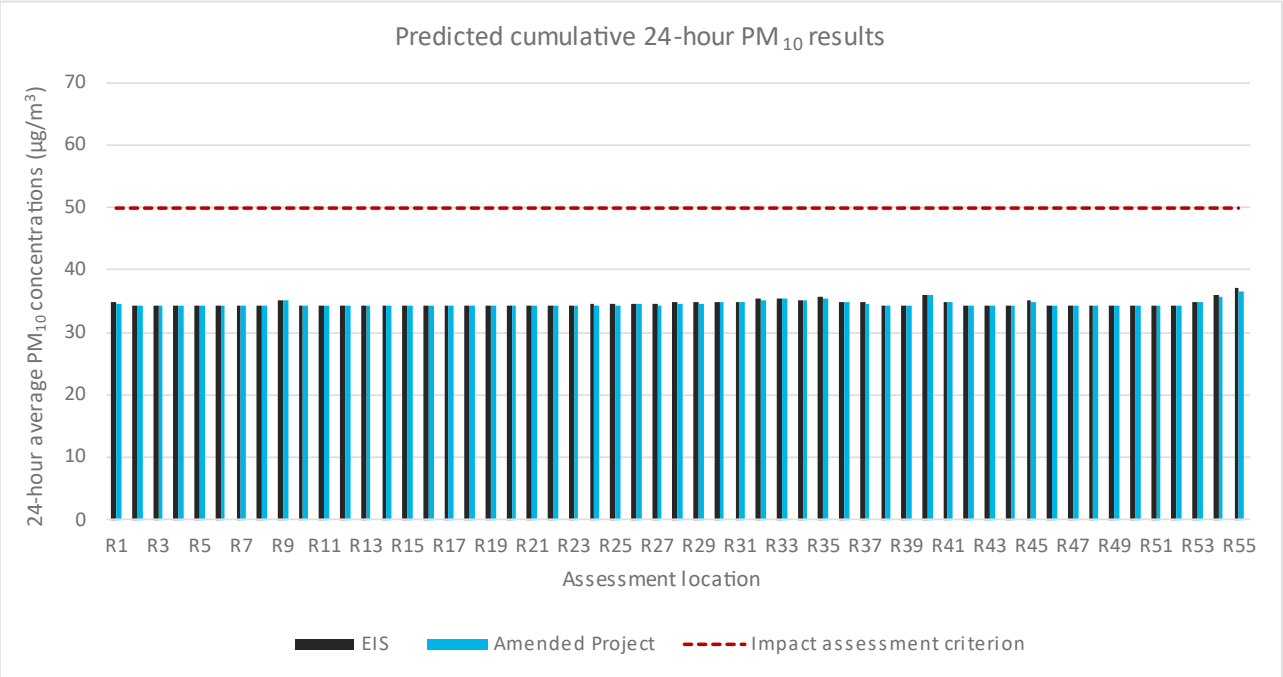

Figure 5.2 **Cumulative 24-hour average PM_{10} concentrations – EIS and the Amended Project**

6 Mitigation measures

OMPS is committing to the management of particulate matter emissions from the Amended Project's construction and operation.

6.1 Fugitive particulate matter emissions

A range of mitigation measures will be implemented during the Amended Project's construction phase. Proposed dust management measures as well as the control factor assumed in the modelling, include the following:

- Dozer working areas will be watered (50% control).
- Wind erosion from spoil disposal areas will be controlled through watering (50% control).
- Unpaved roads within spoil movement areas will be watered using water carts (75% control).

These particulate matter emission management methods were incorporated into the emissions calculations and dispersion modelling.

6.2 Diesel combustion emissions

The following management practices will be implemented where feasible to minimise emissions from the combustion of diesel during the Amended Project's construction and operational phases:

- Where feasible, mobile and stationary equipment compliant with a more recent emission standard than USEPA Tier 2 will be sourced.
- Unpaved roads will be routinely maintained to reduce truck tyre rolling resistance.
- All equipment will be routinely serviced to maintain manufacturers' emission specifications.
- Idling of diesel equipment will be minimised wherever feasible.
- Low-sulphur diesel fuels and lubricants will be used where feasible.

7 Conclusions

A revised AQIA has been prepared to support the Amendment Report for the Amended Project.

Dispersion modelling was completed for a worst-case construction phase scenario of the Amended Project using the TAPM and CALMET/CALPUFF model system.

Emissions of TSP, PM_{10} and $PM_{2.5}$ were estimated and modelled for the peak period of construction activities, including all applicable amendments, based on the maximum 12-month period of spoil moved. Estimated emissions were up to 23% lower for the Amended Project as compared to the EIS.

The results of the modelling show that the predicted concentrations and deposition rates for incremental TSP, PM_{10}, $PM_{2.5}$ and dust deposition during the Amended Project's construction phase are below the applicable impact assessment criteria at all assessment locations.

Cumulative impacts were assessed by combining modelled impacts with recorded ambient background levels. The cumulative results showed that during the Amended Project's construction phase compliance with applicable NSW EPA impact assessment criteria was predicted at all sensitive receptor locations for all pollutants and averaging periods.

Predicted incremental TSP, PM_{10}, $PM_{2.5}$ and dust deposition results at all assessment locations were lower for the Amended Project compared to the EIS. Predicted cumulative results were the same or lower between the two assessments. Predicted results were well below the impact assessment criteria for both assessments.

Annexure A
Emissions inventory

EMM
creating opportunities

A.1 Introduction

The methodology for estimating emissions is the same as that adopted in the AQIA submitted for the EIS.

The emissions inventory developed for the worst-case construction phase of the Amended Project is presented in Table A.1.

Table A.1 Emissions inventory - Amended Project

Activity	Emission estimate TSP (kg/y)	Emission estimate PM_{10} (kg/y)	Emission estimate $PM_{2.5}$ (kg/y)	Activity rate	Units	TSP emission factor	PM_{10} emission factor	$PM_{2.5}$ emission factor	Unit	Parameter 1	Unit	Parameter 2	Unit	Parameter 3	Unit	Parameter 3	Unit	Reduction factor	Emission control	Emission factor source
Tailrace tunnel																				
Conveyer transferring spoil from Tailrace portal to surface	78	37	6	44,641	t/y	0.0018	0.0008	0.00013	kg/t	3.0	Ave wind speed (m/s)	2	Moisture (%)							AP-42 13.2.4 - Materials handling equation
Loading spoil from conveyor to trucks	78	37	6	44,641	t/y	0.0018	0.0008	0.00013	kg/t	3.0	Ave wind speed (m/s)	2	Moisture (%)							AP-42 13.2.4 - Materials handling equation
Hauling spoil from tailrace tunnel to northern spoil area	6,219	1,777	178	6,004	VKT/y	4.14	1.18	0.12	kg/VKT	8.5	Road silt content (%)	5.5	Return haul distance (km)	1,089	Loads/y	53	Ave weight (t)	0.75	Watering	AP-42 13.2.1 - Paved roads
Unloading spoil from trucks to western spoil area	78	37	6	44,641	t/y	0.0018	0.0008	0.00013	kg/t	3.0	Ave wind speed (m/s)	2	Moisture (%)							AP-42 13.2.4 - Materials handling equation
Main access tunnel																				
Conveyer transferring spoil from main access tunnel portal to surface	78	37	6	44,641	t/y	0.0018	0.0008	0.00013	kg/t	3.0	Ave wind speed (m/s)	2	Moisture (%)							AP-42 13.2.4 - Materials handling equation
Loading spoil from conveyor to trucks	78	37	6	44,641	t/y	0.0018	0.0008	0.00013	kg/t	3.0	Ave wind speed (m/s)	2	Moisture (%)							AP-42 13.2.4 - Materials handling equation
Hauling spoil from main access tunnel to northern spoil area	3,521	1,006	101	3,399	VKT/y	4.14	1.18	0.12	kg/VKT	8.5	Road silt content (%)	3.1	Return haul distance (km)	1,089	Loads/y	53	Ave weight (t)	0.75	Watering	AP-42 13.2.1 - Paved roads
Unloading spoil from trucks to western spoil area	78	37	6	44,641	t/y	0.0018	0.0008	0.00013	kg/t	3.0	Ave wind speed (m/s)	2	Moisture (%)							AP-42 13.2.4 - Materials handling equation
Emergency cable and ventilation tunnel																				
Conveyer transferring spoil from emergency cable and ventilation tunnel to surface	78	37	6	44,641	t/y	0.0018	0.0008	0.00013	kg/t	3.0	Ave wind speed (m/s)	2	Moisture (%)							AP-42 13.2.4 - Materials handling equation
Loading spoil from conveyor to trucks	78	37	6	44,641	t/y	0.0018	0.0008	0.00013	kg/t	3.0	Ave wind speed (m/s)	2	Moisture (%)							AP-42 13.2.4 - Materials handling equation
Hauling spoil from emergency cable and ventilation tunnel to northern spoil area	3,099	886	89	2,992	VKT/y	4.14	1.18	0.12	kg/VKT	8.5	Road silt content (%)	2.7	Return haul distance (km)	1,089	Loads/y	53	Ave weight (t)	0.75	Watering	AP-42 13.2.1 - Paved roads
Unloading spoil from trucks to western spoil area	78	37	6	44,641	t/y	0.0018	0.0008	0.00013	kg/t	3.0	Ave wind speed (m/s)	2	Moisture (%)							AP-42 13.2.4 - Materials handling equation
Lower dam and reservoir																				
FELs/excavators removing spoil	2,407	1,139	172	1,374,083	t/y	0.0018	0.0008	0.00013	kg/t	3.0	Ave wind speed (m/s)	2	Moisture (%)							AP-42 13.2.4 - Materials handling equation
Loading spoil to trucks	2,407	1,139	172	1,374,083	t/y	0.0018	0.0008	0.00013	kg/t	3.0	Ave wind speed (m/s)	2	Moisture (%)							AP-42 13.2.4 - Materials handling equation
Hauling spoil from lower dam and reservoir to western spoil area	180,098	51,458	5,146	173,872	VKT/y	4.14	1.18	0.12	kg/VKT	8.5	Road silt content (%)	5.2	Return haul distance (km)	33,514	Loads/y	53	Ave weight (t)	0.75	Watering	AP-42 13.2.1 - Paved roads
Unloading spoil from trucks to western spoil area	2,407	1,139	172	1,374,083	t/y	0.0018	0.0008	0.00013	kg/t	3.0	Ave wind speed (m/s)	2	Moisture (%)							AP-42 13.2.4 - Materials handling equation
Upper dam and reservoir																				
FELs/excavators removing spoil	2,748	1,300	197	1,568,625	t/y	0.0018	0.0008	0.00013	kg/t	3.0	Ave wind speed (m/s)	2	Moisture (%)							AP-42 13.2.4 - Materials handling equation
Loading spoil to trucks	2,748	1,300	197	1,568,625	t/y	0.0018	0.0008	0.00013	kg/t	3.0	Ave wind speed (m/s)	2	Moisture (%)							AP-42 13.2.4 - Materials handling equation
Hauling spoil from upper dam and reservoir to eastern spoil area	94,761	27,075	2,708	91,485	VKT/y	4.14	1.18	0.12	kg/VKT	8.5	Road silt content (%)	2.4	Return haul distance (km)	38,259	Loads/y	53	Ave weight (t)	0.75	Watering	AP-42 13.2.1 - Paved roads
Unloading spoil from trucks to eastern spoil area	2,748	1,300	197	1,568,625	t/y	0.0018	0.0008	0.00013	kg/t	3.0	Ave wind speed (m/s)	2	Moisture (%)							AP-42 13.2.4 - Materials handling equation
Concrete batching plant (CBP)/construction materials																				
CBP processing activities	1,072	429	136																	AP-42 13.2.4 - Materials handling equation
Hauling construction materials on the Eastern Access Road to the CBP	351,432	100,412	10,041	132,004	VKT/y	2.66	0.76	0.08	kg/VKT	8.5	Road silt content (%)	37.6	Return haul distance (km)	3,515	Loads/y	20	Ave weight (t)			AP-42 13.2.1 - Paved roads
All wind erosion																				
Wind erosion from concrete aggregate stockpiles	343	171	26	0.8	Area (ha)	850	425	64	kg/ha/y									0.5	Watering	AP-42 11.9 - Wind erosion of exposed areas
Wind erosion from western spoil area	6,909	3,454	518	16.3	Area (ha)	850	425	64	kg/ha/y									0.5	Watering	AP-42 11.9 - Wind erosion of exposed areas
Wind erosion from eastern spoil area	7,415	3,708	556	17.4	Area (ha)	850	425	64	kg/ha/y									0.5	Watering	AP-42 11.9 - Wind erosion of exposed areas
Wind erosion from lower dam and reservoir	21,490	10,745	1,612	25.3	Area (ha)	850	425	64	kg/ha/y											AP-42 11.9 - Wind erosion of exposed areas
Wind erosion from upper dam and reservoir	19,729	9,864	1,480	23.2	Area (ha)	850	425	64	kg/ha/y											AP-42 11.9 - Wind erosion of exposed areas
Dozers working on spoil																				
Dozers working on western spoil area	51,311	12,399	5,388	6,132	h/y	16.7	4.0	1.8	kg/h	10	Silt content (%)	2	Moisture (%)					0.5	Watering	AP-42 11.9 - Bulldozer on material other than coal
Dozers working on eastern spoil area	51,311	12,399	5,388	6,132	h/y	16.7	4.0	1.8	kg/h	10	Silt content (%)	2	Moisture (%)					0.5	Watering	AP-42 11.9 - Bulldozer on material other than coal
Drilling and blasting																				
Drilling - tailrace tunnel	472	245	14	800	holes/y	0.59	0.31	0.02	kg/hole											AP-42 13.2.4 - Materials handling equation
Blasting - tailrace tunnel	28	14	1	4	blasts/y	6.96	3.62	0.21	kg/blasts	1,000	Area of blast (m^2)	200	Holes/blast							AP-42 13.2.4 - Materials handling equation
Drilling - main access tunnel	472	245	14	800	holes/y	0.59	0.31	0.02	kg/hole											AP-42 13.2.4 - Materials handling equation
Blasting - main access tunnel	28	14	1	4	blasts/y	6.96	3.62	0.21	kg/blasts	1,000	Area of blast (m^2)	200	Holes/blast							AP-42 13.2.4 - Materials handling equation
Drilling - emergency cable and ventilation tunnel	472	245	14	800	holes/y	0.59	0.31	0.02	kg/hole											AP-42 13.2.4 - Materials handling equation
Blasting - emergency cable and ventilation tunnel	28	14	1	4	blasts/y	6.96	3.62	0.21	kg/blasts	1,000	Area of blast (m^2)	200	Holes/blast							AP-42 13.2.4 - Materials handling equation
Crushing and screening																				
Crushing rock - lower dam and reservoir	824	371	69	1,374,083	t/y	0.0006	0.00027	0.00005	kg/t											AP-42 11.19.2-1 - Crushed stone processing
Screening rock - lower dam and reservoir	1,511	508	34	1,374,083	t/y	0.0011	0.00037	0.000025	kg/t											AP-42 11.19.2-1 - Crushed stone processing
Crushing rock - upper dam and reservoir	941	424	78	1,568,625	t/y	0.0006	0.0003	0.00005	kg/t											AP-42 11.19.2-1 - Crushed stone processing
Screening rock - upper dam and reservoir	1,725	580	39	1,568,625	t/y	0.0011	0.00037	0.000025	kg/t											AP-42 11.19.2-1 - Crushed stone processing
Other																				
Diesel combustion (whole site)	36,000	36,000	33,000																	Miscellaneous - engine specifications
Total (t/y)	**857.382**	**282.095**	**67.788**																	