Balmoral South

Air Quality Assessment

Prepared for

Maunsell

By

Air Assessments

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1 Introduction

Australasian Resources (AR), propose to construct a new iron ore mine at the southern Balmoral deposit located at Cape Preston. The project area is immediately south and adjacent to the Mineralogy Cape Preston project. The AR project will consist of a mine, concentrator, pellet plant, HBI plant, associated power station and desalination plant. As part of studies for the Project Definition Document (PDD) to be submitted in the Integrated Project Approvals System (IPAS), Maunsell have contracted Air Assessments to undertake a preliminary air quality assessment of SOx, NOx, and dust from the pellet plant, HBI and power station. As detailed designs for the plant are not yet available, the emissions apart from the power station have been based on the data used in the Mineralogy facility (EPA, 2002).

Given the time frame and preliminary nature of the data available, only an indicative study of the local impacts can be undertaken. That is, the study addresses local impacts within 10 km. This study does not address a regional assessment of smog impacts and its effect further afield such as in the Dampier region, though recourse is made to initial assessments conducted for Mineralogy (then Austeel) by SKM (2000) and reported in HGM (2000).

2 Atmospheric Emissions

2.1 Emissions from Balmoral South – Normal Operation

As the project is in initial design stage, detailed emission characteristics were not available. These therefore have been sourced from the adjacent, similar Mineralogy proposal. As described in that assessment (SKM, 2000), sources of air emissions include:

- Mining activities; the haulage operations, material handling, wind erosion from open areas and stockpiles and combustion products from vehicles. Combustion products are considered to have a minor impact because of the widespread and diffuse nature of the emissions and are generally not modelled. Fugitive particulate emissions can, however, lead to high dust concentrations in the immediate area. In this report and in the Mineralogy assessment, predictions of concentrations have not been undertaken as they are difficult to quantify and therefore model and importantly as there are no nearby sensitive areas such as residential areas. It is considered that instead of a modelling assessment, emissions from these sources are best addressed through management practices and commitments by the proponent;
- The pellet plant. Air emissions arise from the main stack (with the pollutants of concern being oxides of nitrogen and particulate) and from the two de-dusting stacks which emit particulate. These emissions and other emission parameters for these sources are listed in **Table 2-1**. For the Balmoral south project, the pellet plant is the largest source of NO_X emitting 86% of the proposals emissions. This is due to the assumed high NO_X concentrations of 400mg/m^3 as obtained from the Austeel proposal and the large volume of air released through this large diameter stack;
- The DRI plant with atmospheric emissions from the main stack emitting combustion products (oxides of nitrogen, sulphur dioxide and particulate) and the de-dusting stacks which emit particulate only; and
- Power station consisting of units to generate up to 243 MW. At the time of the study, the configuration had not been decided with a likely turbine, the open cycle Trent 60 DLE gas turbine used for modelling. As a conservative measure, seven turbines have been modelled at full load for the full year. Seven turbines will only be required for very high temperatures, above 45 degrees C, with only five turbines required for temperatures at around 20 degrees C. A greater number of turbines are required for the high temperatures as the turbines are not as efficient at these temperatures. Pollutants of concern from the gas fired power station are primarily NO_X, with small amounts of SO_2, CO and particulate emitted. In recent times, concern has been expressed as to emissions of formaldehyde and other hazardous air pollutants. These are not assessed here as the emissions of these substances from large gas fired turbines at or near base load are small. These pollutants were assessed for the Kemerton Power Station power station (similar large gas turbines) and found to

contribute a minor fraction of their respective criteria. It is noted that for the Mineralogy proposal, the EPA recommended a combined cycle power station primarily to reduce greenhouse emissions, though also because of its higher energy efficiency this would reduce gas consumption and therefore lessen NO_X emissions.

Table 2-1 Balmoral South Emissions

Stack	Easting	Northing	Stack	Stack	Volume	Emission	Volume at	Exit	SO_2	NO_x	Dust	Volume	SO_2	NO_x	Dust
			Height	Diameter	(wet)	Temp	exit temp.	velocity				dry			
	(m)	(m)	(m)	(m)	(Nm^3/hr)	(C)	(m^3/s)	(m/s)	(mg/Nm^3)	(mg/Nm^3)	(mg/Nm^3)	(Nm^3/s)	(g/s)	(g/s)	(g/s)
One Pellet Plant (7 Mtpa)															
Main Stack A	411,670	7,665,325	60	8.25	2,288,000	140	961	18	40	400	50	578.4	23.13	231.3	28.92
Feed Dedusting A	411,660	7,665,250	20	1.00	46,800	58	16	20	0	0	50	11.8	0	0	0.59
Discharge Dedusting A	411,870	7,665,200	20	1.38	93,600	40	30	20	0	0	50	23.7	0	0	1.18
Discharge Dedusting B	411,870	7,665,200	20	1.38	93,600	40	30	20	0	0	50	23.7	0	0	1.18
Screen Dedusting A	411,880	7,665,210	20	1.38	93,600	40	30	20	0	0	50	23.7	0	0	1.18
One HBI Plant (1.45 Mtpa HBI)															
Main Stack	412,000	7,665,265	60	5.84	688,000	340	429	16	7	165	20	173.9	1.22	28.7	3.48
Hot DRI Dedusting	412,130	7,665,265	65	1.58	120,000	50	39	20	0	0	40	30.3	0	0	1.21
Oxide Handling Dedusting	412,150	7,665,200	65	0.59	16,667	50	5.3	20	0	0	40	4.2	0	0	0.17
Briquetting Dedusting	412,163	7,665,220	65	0.59	16,667	50	5.3	20	0	0	40	4.2	0	0	0.17
Passivation Bin Dedusting	412,130	7,665,180	25	0.59	16,667	50	5.3	20	0	0	40	4.2	0	0	0.17
Power Station (7 open Cycle, Total)															
Unit 1 - Trent 60 DLE	411,894	7,665,840	15	3.00	414,852	456	308	44.1	0	47.6	0	106.1	0	4.94	0
Unit 2 - Trent 60 DLE	411,920	7,665,830	15	3.00	414,852	456	308	44.1	0	47.6	0	106.1	0	4.94	0
Unit 3 - Trent 60 DLE	411,946	7,665,820	15	3.00	414,852	456	308	44.1	0	47.6	0	106.1	0	4.94	0
Unit 4 - Trent 60 DLE	411,972	7,665,810	15	3.00	414,852	456	308	44.1	0	47.6	0	106.1	0	4.94	0
Unit 5 - Trent 60 DLE	411,998	7,665,800	15	3.00	414,852	456	308	44.1	0	47.6	0	106.1	0	4.94	0
Unit 6 - Trent 60 DLE	412,024	7,665,790	15	3.00	414,852	456	308	44.1	0	47.6	0	106.1	0	4.94	0
Unit 7 - Trent 60 DLE	412,050	7,665,780	15	3.00	414,852	456	308	44.1	0	47.6	0	106.1	0	4.94	0
Total Balmoral South													**24.35**	**294.7**	**38.25**

Notes:

1) Pellet plant and DRI emissions scaled from the Mineralogy SER data. The 7 Mtpa plant using a 6.9 Mtpa plant data in Mineralogy, with the 1.45 Mtpa assumed to have the emissions of a 1.57 Mtpa plant in mineralogy. The common dedusting system has been assumed 1/3 of the Mineralogy common de-dusting system

2) Power station emissions are for from as provided by Promet (2006) with eight TRENT 60 DLE turbines installed, with seven operating. The turbines are proposed with evaporative cooling with the emissions based on this which has 12% higher emissions, and 11% higher mass flow than and should result in similar ground level concentrations. Emissions are for ambient conditions of 34 deg C and 24% relative humidity.

Table 2-2 Emission Parameters for Mineralogy from HGM (2002)

Stack	Easting	Northing	Stack	Stack	Volume	Emission	Volume at	Exit	SO_2	NO_x	Dust	Volume	SO_2	NO_x	Dust
			Height	Diameter	(wet)	Temp	exit temp.	velocity				dry			
	(m)	(m)	(m)	(m)	(Nm^3/hr)	(C)	(m^3/s)	(m/s)	(mg/Nm^3)	(mg/Nm^3)	(mg/Nm^3)	(Nm^3/s)	(g/s)	(g/s)	(g/s)
Two Pellet Plants (Total 13.8 Mtpa of pellets)															
Main Stack A	413,061	7,671,800	60	8.25	2,288,000	140	961	18.0	40	400	50	578.4	23.13	231.3	28.92
Feed Dedusting A	413,125	7,671,782	20	1.00	46,800	58	16	20.0	0	0	50	11.8	0	0	0.59
Discharge Dedusting A1	413,137	7,671,955	20	1.38	93,600	40	30	20.0	0	0	50	23.7	0	0	1.18
Discharge Dedusting A2	413,137	7,671,955	20	1.38	93,600	40	30	20.0	0	0	50	23.7	0	0	1.18
Screen Dedusting A	413,167	7,671,971	20	1.38	93,600	40	30	20.0	0	0	50	23.7	0	0	1.18
Main Stack B	413,061	7,671,800	60	8.25	2,288,000	140	961	18.0	40	400	50	578.4	23.13	231.3	28.92
Feed Dedusting B	413,125	7,671,782	20	1.00	46,800	58	16	20.0	0	0	50	11.8	0	0	0.59
Discharge Dedusting B1	413,137	7,671,955	20	1.38	93,600	40	30	20.0	0	0	50	23.7	0	0	1.18
Discharge Dedusting B2	413,137	7,671,955	20	1.38	93,600	40	30	20.0	0	0	50	23.7	0	0	1.18
Screen Dedusting B	413,167	7,671,971	20	1.38	93,600	40	30	20.0	0	0	50	23.7	0	0	1.18
Three DRI Plants (Total 4.7 Mtpa of HBI)															
Main Stack A	413,068	7,672,120	60	5.84	688,000	340	429	16.0	7	165	20	173.9	1.22	28.7	3.48
Main Stack B	413,145	7,672,103	60	5.84	688,000	340	429	16.0	7	165	20	173.9	1.22	28.7	3.48
Main Stack C	413,252	7,672,079	60	5.84	688,000	340	429	16.0	7	165	20	173.9	1.22	28.7	3.48
Hot DRI Dedusting A	413,071	7,672,264	65	1.58	120,000	50	39	20.0	0	0	40	30.3	0	0	1.21
Hot DRI Dedusting B	413,149	7,672,246	65	1.58	120,000	50	39	20.0	0	0	40	30.3	0	0	1.21
Hot DRI Dedusting C	413,255	7,672,223	65	1.58	120,000	50	39	20.0	0	0	40	30.3	0	0	1.21
Oxide Handling Dedusting	413,179	7,672,223	65	1.02	50,000	50	16	20.0	0	0	40	12.6	0	0	0.51
Briquetting Dedusting	413,292	7,672,200	65	1.02	50,000	50	16	20.0	0	0	40	12.6	0	0	0.51
Passivation Bin Dedusting	413,266	7,671,992	25	1.02	50,000	50	16	20.0	0	0	40	12.6	0	0	0.51
Power Station (4 open Cycle, Total 640MW)															
Unit 1 - 160MW	412,720	7,672,700	40	5.80	1,473,082	540	1219	46.1	0	51.3	0	379.4	0	19.47	0
Unit 2 - 160MW	412,720	7,672,700	40	5.80	1,473,082	540	1219	46.1	0	51.3	0	379.4	0	19.47	0
Unit 3 - 160MW	412,720	7,672,700	40	5.80	1,473,082	540	1219	46.1	0	51.3	0	379.4	0	19.47	0
Unit 4 - 160MW	412,748	7,672,700	40	5.80	1,473,082	540	1219	46.1	0	51.3	0	379.4	0	19.47	0
Total Mineralogy													**49.92**	**626.7**	**81.7**

For completeness, the Mineralogy emissions as per their SER are also presented in **Table 2-2**. Based on this data, total emissions from both proposals of SO_2, NO_X and PM (from controlled sources) are 74.3 g/s, 921 g/s and 120 g/s respectively, of which the Balmoral South proposal contributes 33%, 32 % and 32%.

2.2 Speciation and Reactivity of Particulate

Data of the metal composition of the DRI plant is listed in **Table 2-3** as provided in the EPA bulletin for the Mineralogy project.

Table 2-3 Speciation of Dust from DRI Plant

Source	Fe_2O_3	SiO_2	Al_2O_3	CaO	NgO	P	S	Na_2O	K	Mn	TiO_2	V	Cu	C
Dust Collection	97.1	*1.45*	0.06	0.53	0.47	0.005	0.01	0.001	0.005	0.02	<0.001	0.01	<0.001	negl
Main Stack	48.5	*0.73*	0.03	0.27	0.24	0.003	0.005	0.001	0.003	0.01	<0.001	0.005	<0.001	~50

Note: Dust collection includes charge hopper and briquette dust collection stacks source (EPA, 2002)

Table 2-3 indicates that the composition of dust from the dust collection stacks is that of iron ore as the DRI process does not add any additional metals. The metal composition of the main stack has a similar composition, though with metal concentrations approximately half that due to an approximate equal quantity of carbon in the particulate. As such, in terms of the metals in the stack dust emissions, there should be no difference to that of iron ore dust.

For DRI dust however, there is concern due to its potentially reactive nature, particularly in the presence of moisture. The EPA bulletin stated DRI *"has caused safety problems in confined spaces with high moisture levels, such as during ocean transport. This reactivity can be reduced by stabilisation via hot briquetting (which reduces the surface area) or via passivation, where part of the DRI is oxidised (to create an insulation effect). However, there is still potential for process areas and materials handling to produce reactive DRI dust. DRI dust is known to cause health problems (eye damage) and damage to property (paint coatings). Because of this, the EPA believes that DRI dust needs to be treated more cautiously than iron ore dust and emissions must be required to meet best practice*: (EPA, 2002).

2.3 Greenhouse Emissions

It is noted that a major atmospheric emission from combustion of fuels is the release of carbon dioxide, which is significant because of its role in the enhanced greenhouse affect. This impact is not covered within this study, which addresses the local air quality impacts only.

2.4 Emissions from Balmoral South – Non Routine Operation

Non routine operations for industrial projects typically occur during start-ups, shutdowns, stoppages, maintenance periods and power failures. In the Mineralogy PER, it was indicated that during upset conditions the emissions from the MIDREX plant actually decrease, with the only increase being during transient conditions when emissions increase for a few minutes at a time, resulting in a monthly average increase of less than 0.07% (EPA, 2002, page 31). This percentage variation in emissions over a month will understate the true change in emissions when the upset is occurring. With no data on this variation on the short time scale, non routine emissions have been neglected for this assessment.

2.5 Other Significant Sources of Atmospheric Emissions in the Area

Other possible sources of air emissions in the Shire of Roebourne that may affect the air quality in the area are listed in **Table 2-4**.

Table 2-4 Major Air Emission Sources in the Shire of Roebourne in 2004/2005

Source	Emissions	Total Emissions (tonne/year)				
		CO	NO_X	SO_2	VOC	PM_{10}
Industrial Sources						
Cape Lambert Power Station	Emissions from gas fired boilers including NO_X and minor amounts of SOx, PM and VOCs	89	370	1.6	6.9	9.2
HI Dampier Power Station	Emissions from gas fired boilers which will include, NO_X and minor amounts of SOx, PM and VOCs	110	450	1.9	8.4	11
Woodside – Karratha Onshore Gas Treatment Plant	Emissions from gas fired turbines, compressors, flaring, and ship loading. NO_X, PM, VOCs including BTEX	2,500	**12,000**	3.9	**33,000**	180
Radio Hill Mine		-	14	0.59	1.1	67
Dampier Salt		31	76	7.2	6.7	15
Alinta Compressor (Mardie)		61.8	124	2.0	0.18	2.0
Other man made Sources						
Commercial shipping total		520	2,100	**1,100**	530	220
Motor vehicles		870	190	22	120	8.1
Unpaved Road Dust		0	0	0	0	**10,000**
Railways in the region		110	860	38	37	20
Recreational Boating		320	14	1	92	1
Fugitive Sources						
Wind erosion from bare areas		0	0	0	0	**48,000**
Wildfires		**120,000**	**9,400**	-	7,200	**15,000**
Biogenic (soil and vegetation)		-	**3,000**	-	**59,000**	-
Total 2004/2005		**130,000**	**29,000**	**1,200**	**100,000**	**85,000**
Burrup Fertilisers To start in 2005/2006		Not given	527	0.6	negl	negl

Notes:

1. From NPI Website http://www.npi.gov.au/ except from shipping for the individual Cape Lambert areas which is from SKM (2003).
2. Values greater than 10% of the total bolded.
3. Burrup Fertilisers from EPA (2004).

Table 2-4 indicates that the nearest other source is the Mardie compressor station, located south of Mardie station. This emits 124 tonnes per annum or on average 3.9 g/s of NO_X . As this is approximately 40km distant and a small source, it should have negligible impact in the Cape Preston area. Other larger sources that should have a greater, though low impact are the industry on the Burrup Peninsula, particularly the Woodside onshore treatment plant.

3 Ambient and Emission Criteria

The WA EPA have at present no state wide standards for ambient pollutant concentrations and have no standards or guidelines on emission limits as per other Australian States. The EPA "thinking" on acceptable emissions and ambient concentrations are contained in the guidance statement *"Implementing Best Practice in proposals submitted to the Environmental Impact Assessment process"* (EPA, 2003). This statement provides guidance on what the EPA means by "best practice in the EIA process" with the thrust of the statement, that new proposals are "required" to demonstrate that:

- *"All relevant environmental quality standards must be met;*
- *Common pollutants should be controlled by proponents adopting Best Practicable Measures (BPM);*
- *Hazardous pollutants (like dioxins) should be controlled to the Maximum Extent Achievable (MEA), which involves the most stringent measures available. For a small number of very hazardous and toxic pollutants, costs are not taken into account.*
- *There is a responsibility for proponents not only to minimise adverse impacts, but also to consider improving the environment through rehabilitation and offsets where practicable"* (EPA, 2003).

The document defines:

"Best Practicable Measures incorporates technology and environmental management procedures which are practicable, having regard to, among other things, local conditions and circumstances, including costs, and to the current state of technical knowledge, including the availability of reliable, proven technology."

"Maximum Extent Achievable requirements incorporate technology which are the most stringent measures available and achievable, at a scale relevant to the proposal, to control the level of risk imposed by the hazardous pollutants being considered." "Maximum Extent Achievable measures are only intended to cover hazardous pollutants as described above and set out in the schedule of Class 4 substances attached to the Victorian EPA's Environment Protection Policy for Air Quality Management (Victoria Govt Gazette, 2001). They are not intended to apply at pollutant levels which do not pose credible risk."

3.1 Ambient Criteria - Health

For ambient ground level concentrations, the WA EPA does not have State-wide standards, but are in the process of implementing a Statewide Environmental Protection Policy. This policy would likely apply National Environmental Protection Measure (NEPM) Standards throughout the state, where current Environmental Protection Policies do not exist. It is understood that the NEPM will apply at residential areas or places where people may congregate, such as beaches or picnic areas. The NEPM standards are listed in **Table 3-1**.

Table 3-1 National Environmental Protection Measure - Air Quality Standards and Goals

Pollutant	Averaging Period	Maximum Concentration (ppm)	Maximum Concentration ($\mu g/m^3$)	Goal
				Maximum allowable exceedances within 10 years
Carbon Monoxide	8-hour	9.0	11,240	1 day a year
Nitrogen Dioxide	1-hour 1-year	0.12 0.03	246 62	1 day a year none
Photochemical Oxidants (as ozone)	1-hour 4-hours	0.10 0.08	214 171	1 day a year 1 day a year
Sulfur Dioxide	1-hour 1-day 1-year	0.20 0.08 0.02	572 228 57	1 day a year 1 day a year none
Lead	1-year	-	0.5	none
Particles as PM_{10}	1-day	-	50	5 days a year
Advisory Reporting Standards and Goal				
Particles as $PM_{2.5}$	1-day 1-year	- -	25 $\mu g/m^3$ 8 $\mu g/m^3$	Goal is to gather sufficient data nationally to facilitate a review of the advisory Reporting standard as part of the review of this Measure scheduled to commence in 2005

Notes:

1) Concentrations of gaseous pollutants in italics have been converted from the NEPM standard quoted at 0 deg C and 101.3kPa.

In WA these criteria are usually applied at nearby residences or places where the public may congregate. As such, they can be considered to apply to public camping grounds and nearest homesteads, such as Mardie. At the work camps they could be considered to apply, but it is noted that there should not be any sensitive sub population groups such as infants, elderly or those with severe asthma for which these criteria were primarily developed.

3.2 Ambient Criteria - Vegetation

For assessing the potential impacts on vegetation, as there are no guidelines/standard for the pollutants of concern SO_2 and NO_X, the WHO air quality guidelines for Europe (WHO, 2000) have been used. These are considered applicable outside the lease area and are listed in **Table 3.2**

Table 3.2 World Health Organisation Air Quality Guidelines for Europe (WHO, 2000)

Pollutant	Vegetation Category	Guideline ($\mu g/m^3$)	Time Period
Sulfur Dioxide	Agricultural Crops	30	Annual and winter mean
	Forests and Native Vegetation	20	Annual and winter mean
	Lichens	10	Annual mean
Oxides of Nitrogen	All Vegetation	75	24-hour
	All vegetation	30	Annual mean

Note: Concentrations are expressed at 0^o C and 101.3 kPa.

3.3 Comparison to Emission Criteria

Within WA, the EPA "require that all reasonable and practicable means should be used to prevent and minimise the discharge of waste" (EPA, 1999a). For the definition of what is reasonable and practicable the EPA released guidance in 1999 for large open cycle gas turbines burning natural gas, which consider that the adoption of dry low NO_X burner technology was best practice (EPA, 1999a). For other sources, the WA EPA have not provided guidance, with proposals generally adopting other states regulations or the National Health and Medical Council guidelines (AEC/NHMRC, 1986).

In the Austeel proposal, initially conducted in 2000, the 1986 AEC/NHMRC guidelines were adopted along with the WA EPA guidance for low NO_X burners. Since 2000, a number of regulators have updated their guidelines with NSW recently adopting what are generally the most stringent guidelines within Australia for new proposals (NSW, 2005). For comparison to the proposed emissions, the AEC/NHMRC and new NSW guidelines applicable to this project are presented in **Table 3.3**.

Table 3.3 AEC/NHMRC(1986) and new NSW (2005) Emission Guidelines

Pollutant	AEC/NHMRC		NSW EPA		Proposed Emissions from AR (mg/m^3)
	(mg/m^3)	Application	(mg/m^3)	Application	
Solid Particles	100		50	Iron and steel primary production. Fuel burning equipment, sinter plants kiln, power generating and furnace	20 – 50
	250		20	Crushing grinding separating or materials handling activity	40 - 50
Sulphur Dioxide	250	Fuel burning equipment			0 – 40
Oxides of Nitrogen	70	Gas turbines > 10MW	70	(>30 MW gas fired)	47.6
	350	Gas fired boilers (used in the 2000 assessment of the Pellet plant)	500	Fuel burning equipment, sinter plants kiln, power generating and furnace	165 – 400

Note: Concentrations are expressed at 0^o C and 101.3 kPa.

Comparison with the emissions in **Table 3.3** indicates that the NO_X emissions from the pellet plant and DRI plant meet the newer NSW guidelines for Iron and Steel (Primary production) of 500 mg/m^3. It is noted that the Pellet Plant exceeds slightly the guideline of 350 mg/m^3 adopted in the 2000 assessment, though it is noted that this guideline is not really applicable to this industry. Though meeting the NSW guidelines, it is noted that the EPA recommended a condition for Austeel requiring the proponent investigate and report on best practice NO_X control and measures to reduce NO_X emissions from the pellet plant. This is especially the case given that the 1998 Mid West Iron and Steel project proposed emissions of NO_X of only 200 mg/m^3. As such, as per the recommendations for Austeel, it is considered that an analysis of best practice with regards to NO_X emissions from pellet plants should be undertaken.

For the power station with dry low NO_X burners, the NO_X emissions of 47.6 mg/m^3 will meet the EPA guidelines (25ppm or approximately 51 mg/m^3) for new gas fired power stations.

For particulate, the proposed emissions meet the older AEC/NHMRC guidelines of 250 mg/m^3 for material handling as used in Austeel, but do not meet the much more stringent NSW guidelines (20 mg/m^3). It is noted that the NSW guidelines are considered by some to be over stringent and not readily achievable (Doig, 2006). As such it is considered that a limit of 50 mg/m^3 which is line with fuel burning equipment for iron and steel plant in NSW is applicable. The exception to this may be any material handling with DRI where, given the reactivity issue of DRI dust, the NSW limits of 20 mg/m^3 may be applicable.

4 Existing Air Pollutant Concentrations in the Region

Because of the remoteness of the site from sources, existing levels of SO_2 and NO_2 at Cape Lambert should be low. Evidence for this is provided in the very low monthly averages recorded at Mardie station as part of the Burrup rock art monitoring by CSIRO (2006). Of the other pollutants flagged, ozone levels will, at times, be moderate as indicated in the DEP monitoring at Dampier (DoE, 2004). Over the two years of monitoring, two events with 1-hour concentrations slightly exceeding 0.06ppm or 60% of the NEPM standard were recorded. These were due to bushfire smoke and as such, similar levels could be expected at Cape Preston.

Particulate levels either as TSP, PM_{10} or $PM_{2.5}$ can be high in the region due to natural sources such as bushfires and wind storms. Based on data collected by BHP Billiton at their background monitor at Boodarie and Port Hedland airport (BHP Billiton, 2002 and BHP Billiton, 2006) the number of exceedances of:

- TSP (24-hour average 260 $\mu g/m^3$ level) can vary between typically zero occurrences per year to on occasions two per year due to dust storms; and
- PM_{10} (24-hour average 50 $\mu g/m^3$ level, the NEPM standard with a goal of no more than 5 exceedances) can vary between zero per year to 46 per year on an annualised basis. The highest number of exceedances occurred for 2000 which had significant amount of smoke from fires in the Pilbara, as discussed in DoE (2004). Zero exceedances occurred for 1996 from sampling for only 8 months of the year, hence probably understating the true value a little.

5 Modelling Methodology

5.1 AERMOD Model Set Up

Atmospheric emissions may have both local and regional impacts. For local impacts, with stacks in the range of 15 to 65m and generally very buoyant plumes, the following dispersion processes are considered important:

- Potential plume downwash of the plume by the turbulent eddies that develop when air flows over and around nearby tall buildings. If the plume is emitted or is caught in such an eddy, it can be brought to ground much sooner than would otherwise occur, resulting in higher ground level concentrations;
- Convective dispersion. During the day time, the earths heated surface will generate convective cells of rising and descending air which can also bring elevated plumes to the ground more quickly than otherwise would occur;
- Proximity to the coast. The coast is 12 km to the northwest for Balmoral south and 6km for the Mineralogy project. This will result in the presence of a temperature inversion (thermal internal boundary layer) at a height in the range of 100 to 500m above the ground for onshore flows. At this distance downwind and for the stacks proposed, the inversion will tend to act as a lid on the plume, which may lead to higher concentrations than would occur for a more inland site;
- The presence of relatively low hills, approximately 100 m above plant base around 5 km to the east. This may lead to higher concentrations on the hills than would occur for flat terrain; and
- With the large quantity of NO_X emitted the potential for photochemical smog formation as already occurs to some degree in the Dampier Karratha area.

In the 2000 and 2002 assessment, to address these issues both local modelling and regional photochemical modelling was undertaken. For local modelling, the USEPA regulatory model at the time, ISC3Prime was used. Since then the USEPA have replaced this model with a newer improved model AERMOD, which can more realistically model convective dispersion and plume impacts on hills. ISC3Prime and the similar model, AUSPLUME have both been shown to over-predict concentrations on hills from stacks.

Other models considered for predicting concentrations were:

- TAPM, which was discounted due to the long run times required for the large number of sources here;
- AUSPLUME (v6). This was discounted as it cannot model convective dispersion for stacks less than 100m; and
- CALPUFF (v6). This was considered as an alternative to AERMOD, with AERMOD used in this project as in the US, AERMOD would be the preferred model for this situation.

5.2 AERMOD Model Set Up

The following set up options for AERMOD were used:

- Building downwash was included using the PRIME algorithms with site buildings as used in the Austeel modelling;
- A 500m grid over a 22 by 27 km area centred on the site. That is 45 by 55 grid points;
- Inclusion of terrain;
- Meteorological files produced by the model TAPM for the year 1999; and
- No chemical transformation or deposition, except for the prediction of NO_2 as discussed below.

A typical AERMOD input file is presented in **Appendix A**.

5.3 Meteorological Data

Meteorological data for AERMOD was obtained from the model TAPM for the year 1999. TAPM was used as it can readily derive a file suitable for AERMOD with the required heat fluxes and friction velocities. The meteorological data used in the 2000 and 2002 Mineralogy assessments from Karratha, did not include these parameters, being only in format required for ISC3Prime or AUSPLUME. It is noted that on-site meteorological data is now being collected with this monitoring commencing in late August 2006. At the time of modelling for the initial report (late December 2006), only 6 weeks of wind data was available due to issues with data loss. As such, this data could not be considered for use in modelling. For the revised modelling in early April 2007 with the increased number of gas turbines, there was insufficient time to create and validate an AERMOD file from local data, with the 6 months of useable data at this stage also not sufficient to create a 12 month data file.

For the development of the meteorological file for AERMOD, TAPM was run using 25, 10, and 3 km grids with 31 by 31 grid points in the north/south and east/west directions. The landuse within TAPM was defined as class 17 (grassland very sparse hummock), soil as duplex sandy clay loam with the soil moisture varied from 0.07 (August to January) to 0.12 (from March to May).

The observed wind rose from Karratha for this period and that predicted by TAPM are presented in **Figure 5.1** and **Figure 5.2**. These show some differences, particularly a tendency for TAPM to predict lower wind speeds. This is thought to be due to TAPM specifying a higher surface roughness for this area than actually exists. The wind rose predicted by TAPM at the site at Cape Preston and as used in the modelling is presented in **Figure 5.3**. This shows more easterly winds and southerlies than occur at Karratha, possibly due to the influence of the range of hills to the east of the site.

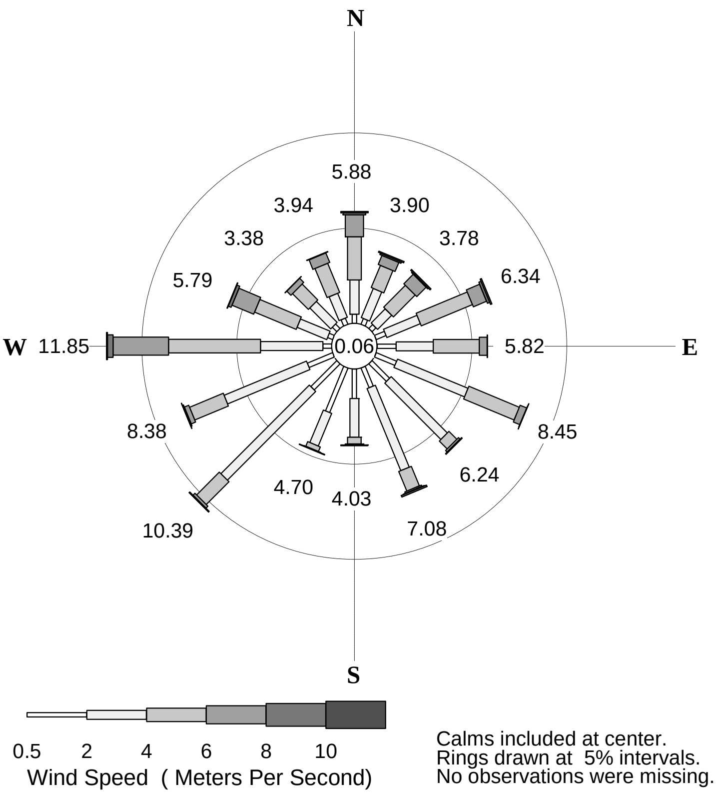

Figure 5.1 Observed wind rose at the DEC Karratha Site for 1999

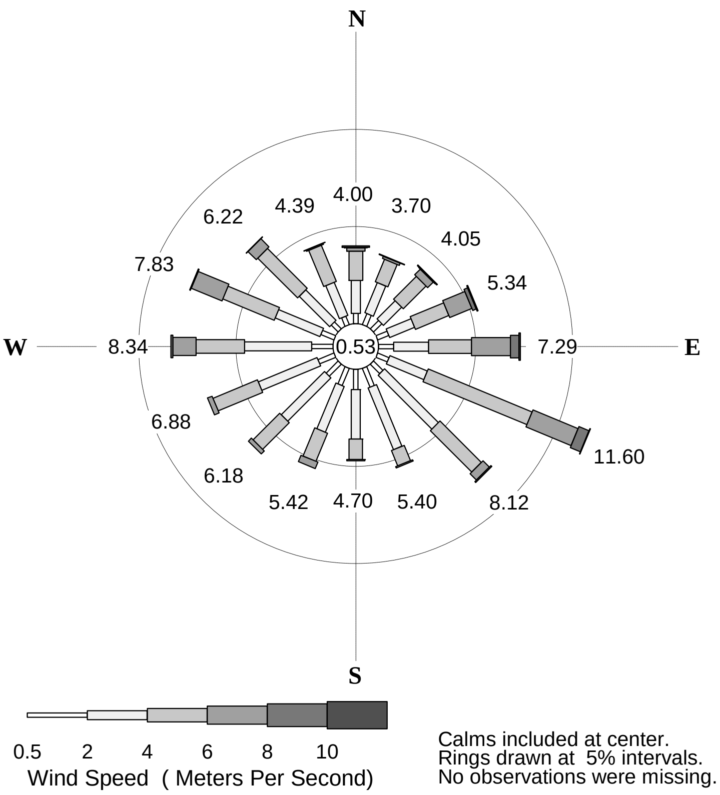

Figure 5.2 TAPM Predicted wind rose at the DEC Karratha Site for 1999

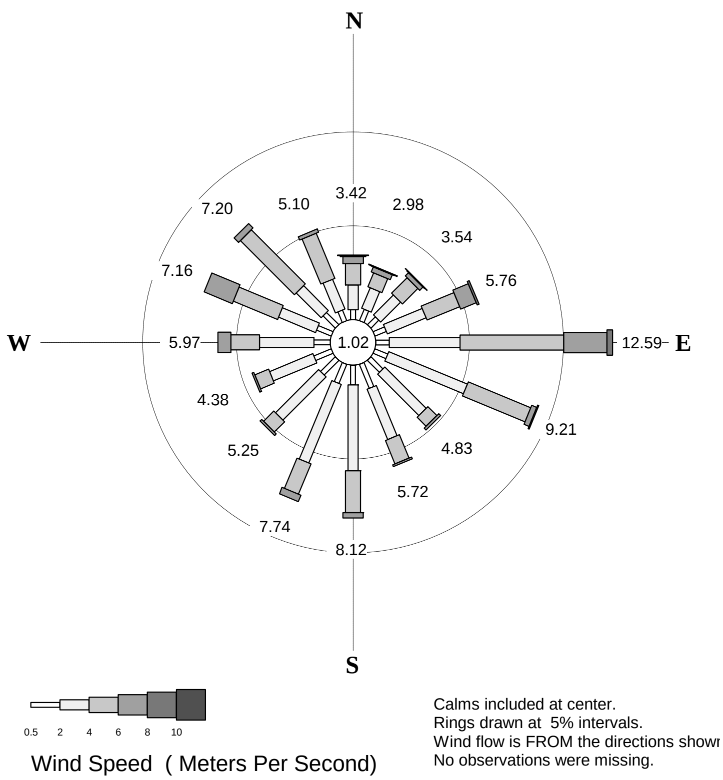

Figure 5.3 TAPM Predicted wind rose at the Cape Preston Site for 1999

5.4 Proportion of NO_X in the form of NO_2

To estimate the proportion of NO_X in the form of NO_2 (the species of concern to human health), a NO to NO_2 relationship is required. One method that is commonly adopted is to use the ozone limiting method (OLM) as developed by Cole and Sumerhays (1979) and as specified by the USEPA and the NSW modelling regulations (NSW, 2005). The OLM estimates the NO_2 concentrations as:

$$[NO_2]_{total} = K \times [NO_2]_{pred} + \min\{(0.9 \times [NO_X]_{pred} \text{ or } (46/48) \times [O_3]_{bkgd}\} + [NO_2]_{bkgd} \qquad \textbf{Eq 5.1}$$

Where:

- $[NO_X]$ is the predicted NO_X concentration in µg/m^3,
- $[O_3]$ is the measured ozone concentration in µg/m^3,
- NO_2 is the NO_2 concentrations in µg/m^3, and
- "*pred*" refers to predictions and "*bkgd*" refers to measured background concentrations

- K is a coefficient, with typical value of 0.1 used because NO_X emissions from combustion sources are typically less than 10%. For dry low NO_X turbines however, values of 33% have been reported for loads greater than 80%.

For background values for use with the OLM, hourly data can be used, or as an approximation a typical conservative concentration.

With the uncertainty in the NO to NO_2 conversion and considering that this may vary for different sources, as an alternative to the OLM, the empirical relationship derived from data at Dampier in SKM (2001) and used in the Austeel 2002 assessment (SKM, 2002) and Gorgon Assessment (SKM, 2005) has been used. The study by SKM (2001) determined a conservative estimate of the conversion of NO to NO_2 to be:

$$[NO_2] = 14.39 + 0.30 \, x \, [NO_X] \qquad NOx > 20.56 \ \mu g/m^3 \qquad \textbf{Eq 5.2}$$

$$[NO_2] = [NO_X] \qquad NOx < 20.56 \ \mu g/m^3 \qquad \textbf{Eq 5.3}$$

For NO_2 to NO_X ratios below 0.2, which is the expected upper limit for the composite emissions from the project, **Equations 5.2** and **5.3** will predict higher NO_2 concentrations than that from **Equation 5.**1 and as such will be conservative.

5.5 Background Concentrations used in Modelling

For determining cumulative concentrations from proposed sources and the existing background concentrations, the Victorian EPA (Victoria Government Gazette, 2001) recommend the use of the 70th percentile measured concentration as the background value. The NSW EPA modelling guidelines (NSW EPA, 2005) have a two tiered approach and recommend the use of the maximum background concentration for level 1 (screening assessments), whilst for level 2 assessments, recommending the addition of hourly observations to hourly predicted concentrations. For this assessment, the 70th percentile concentration has been adopted for determining the background concentration.

Based on Dampier data, the 70th percentile 1-hour and annual average NO_2 concentrations are 4.2µg/m^3 and 2 µg/m^3 respectively. As Dampier has a number of nearby and/or large sources (Woodside, HI power station and shipping) these concentrations are likely to be above true background 70th percentile concentrations.

Based on the available DEC PM_{10} monitoring over 2 ½ years at Dampier from 1998 to 2000, the 70th percentile 24-hour PM_{10} concentration is 22 µg/m^3. This will overstate the true background PM_{10} level as this site is near the Hamersley Iron training centre on the coast and is influenced by the Hamersley Iron operations. For SO_2, it is considered that background concentrations at Cape Preston will be negligible.

6 Predicted Concentrations

6.1 Concentrations from the Balmoral South plant Alone

Predicted concentrations of the pollutants (NO_2, PM_{10}, SO_2) as well as NO_X are presented in **Table 6-1** . Contour plots of the pollutants closest to the adopted criteria NO_X, NO_2 and PM_{10} are also presented in **Figure 6.1** to **Figure 6.4**.

Table 6-1 Predicted Maximum Concentration from Balmoral South Alone

Pollutant	Averaging Period	Standard ($\mu g/m^3$)	Predicted Concentrations ($\mu g/m^3$)		Percentage of Standard or Guideline (%)
			Anywhere	Nearby Camps	Nearby Camps
Nitrogen Oxides	24-hour (max)	75	30.5	7	9
	Annual	30	4.1	0.45	1.5
Nitrogen Dioxide	1-hour (max)	*246*	108	40	16
	1-year	*62*	4.1	0.45	0.7
Sulphur Dioxide	1 hour (max)	*572*	29	9	1.6
	24-hour	*228*	2.9	0.6	0.3
	Annual	*57*	0.34	0.028	0.05
Particles as PM_{10}	1-day (max)	-	84	6	-
	1-day (6th)	50	53	4	8

Notes:

1) Concentrations of gaseous pollutants in italics have been converted from the NEPM standard quoted at 0 deg C and 101.3kPa.
2) All criteria are for human health excepting nitrogen oxides which are for vegetation.
3) Both the health and vegetation standards are not applicable on the lease areas.
4) These concentrations exclude background concentrations.

The predicted concentrations show:

- Highest 24-hour and annual average NO_X and SO_2 concentrations occur within the first 500 to 1000m of the stacks and decrease rapidly with distance from the plant. Maximum 1-hour occur further away at 3 to 6 km from the plant. For PM_{10} maximum 24-hour concentrations occur at the plant itself and decrease very rapidly with distance;
- The maximum 1-hour NO_X and NO_2 concentrations are predicted to occur for two conditions:
    - Early morning, low wind speeds (<2 m/s), with low mixing heights below 150m where the plume is trapped in a low inversion. This results in the high concentrations 3 to 6 km from the site; and
    - Moderate winds (5 to 6 m/s) during the day with mixing heights in the range of 500 to 1000m. This results in concentrations close in, within 500m of the stack. These concentrations appear to be due to moderate to weak convective conditions bringing the plume down to the ground. Model runs with and without the inclusion of building effects, had minor affect on these concentrations, indicating that the nearby buildings have negligible effect on the dispersion.

- At the nearby camps and camping grounds where the NEPM standards are considered to apply, the concentrations are at most 16% of the 1-hour NEPM NO_2 standard with the sixth highest PM_{10} concentration being 8% of its respective standard; and
- Accounting for background concentrations, with 1-hour and annual concentrations for NO_2 of 4.2µg/m^3 and 2 µg/m^3, the total cumulative concentration at the nearby camps is estimated at 44 µg/m^3 and 2.45 µg/m^3. These concentrations are only 18% and 4% of the NEPM NO_2 standards. For PM_{10}, taking a typical background concentration from Dampier of 22 µg/m^3, the 6th highest concentrations at the nearest camp or camping ground would be 26 µg/m^3 or 52% of the NEPM standard.

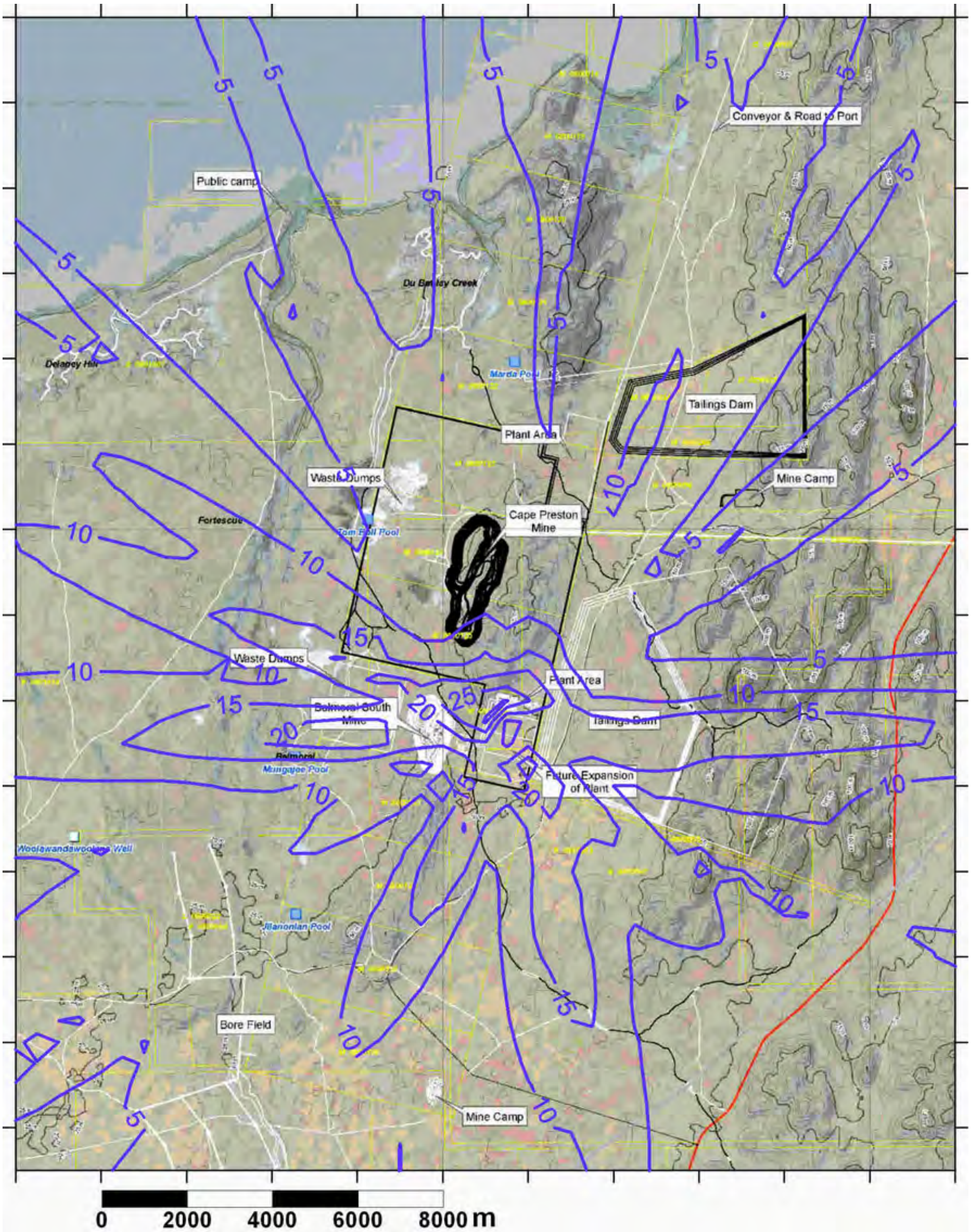

Figure 6.1 Predicted Maximum 24-hour NO_X Concentration (µg/m^3) from Balmoral South

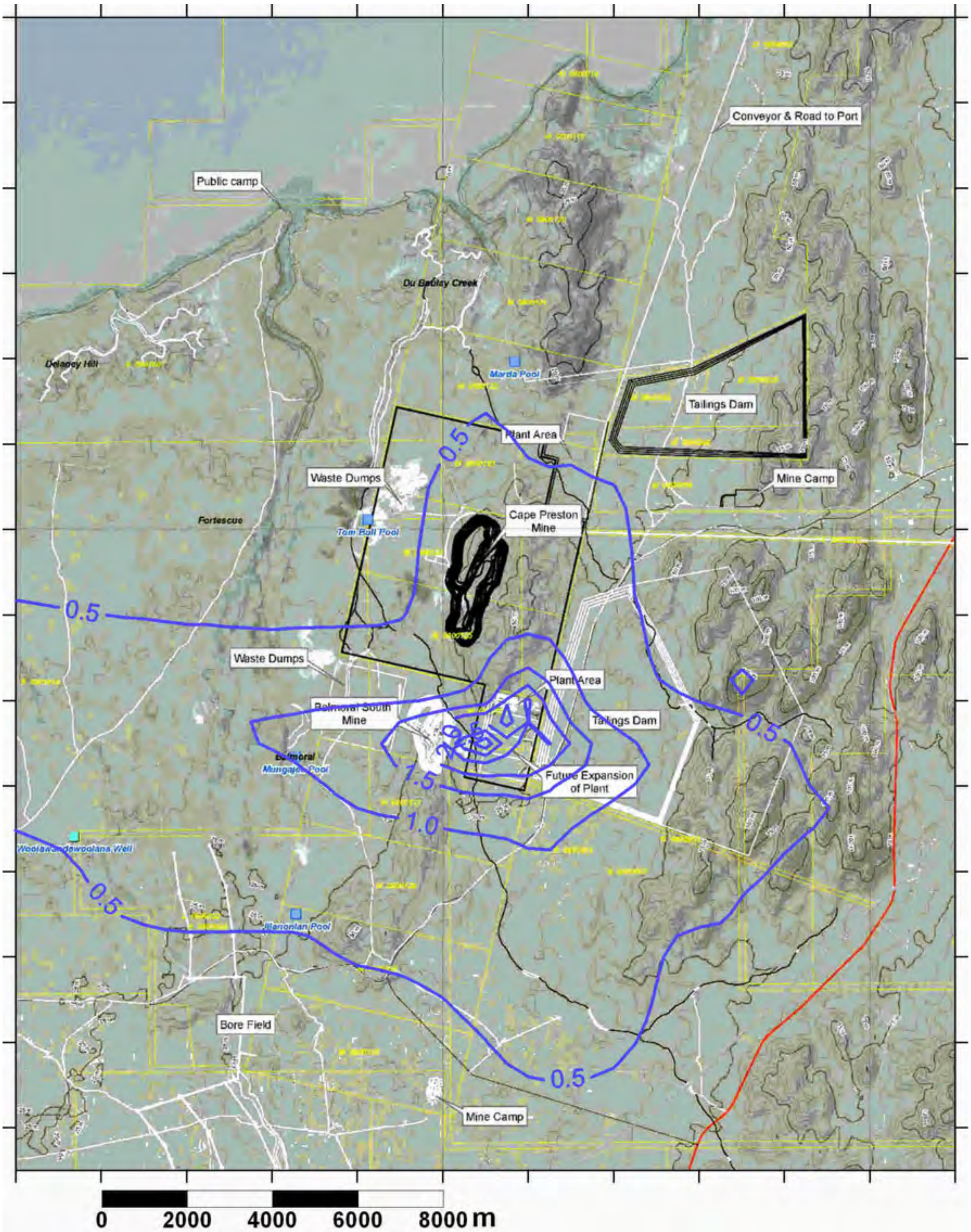

Figure 6.2 Predicted Annual Average NO_X Concentration ($\mu g/m^3$) from Balmoral South

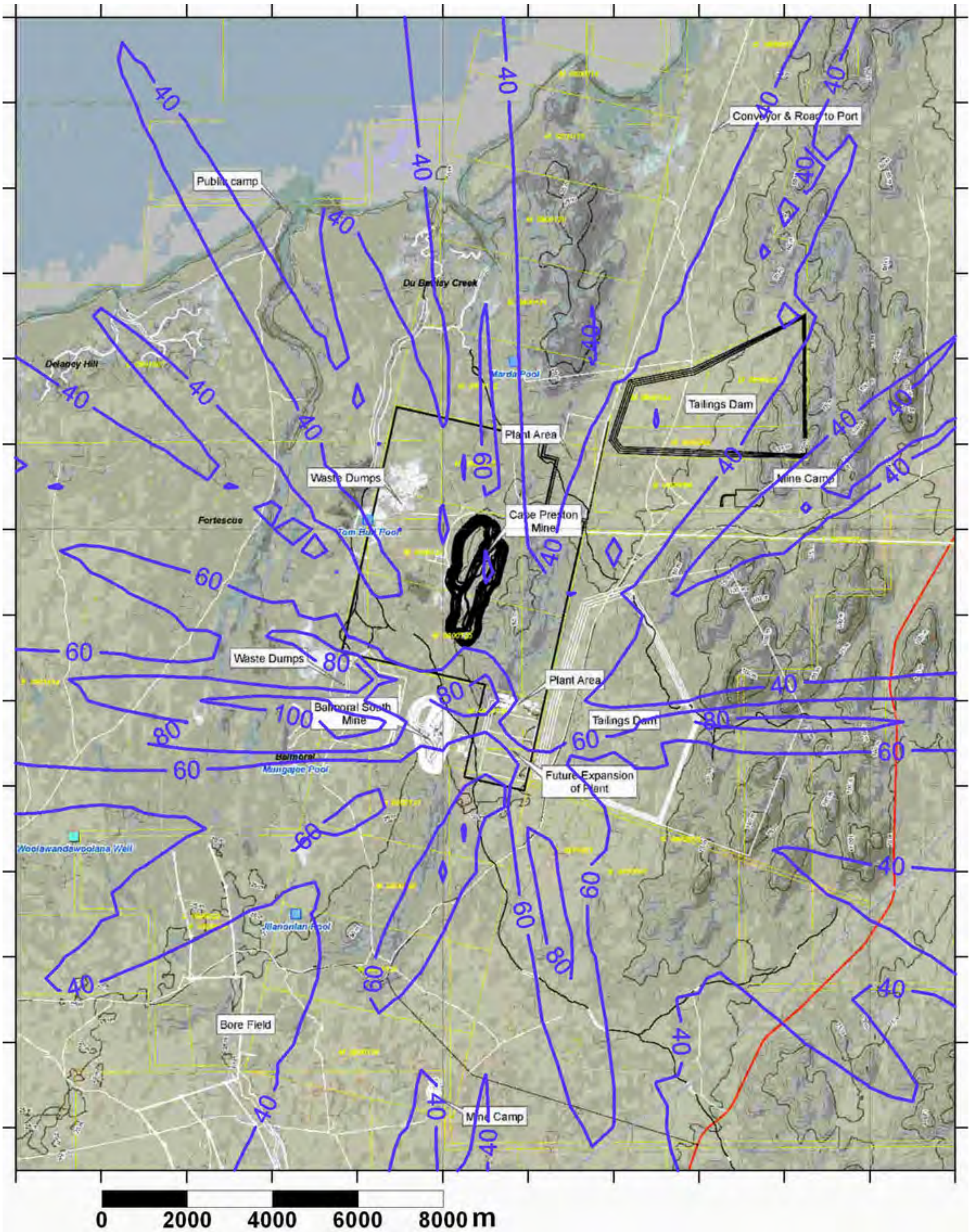

Figure 6.3 Predicted Maximum 1-hour NO_2 Concentration ($\mu g/m^3$) from Balmoral South

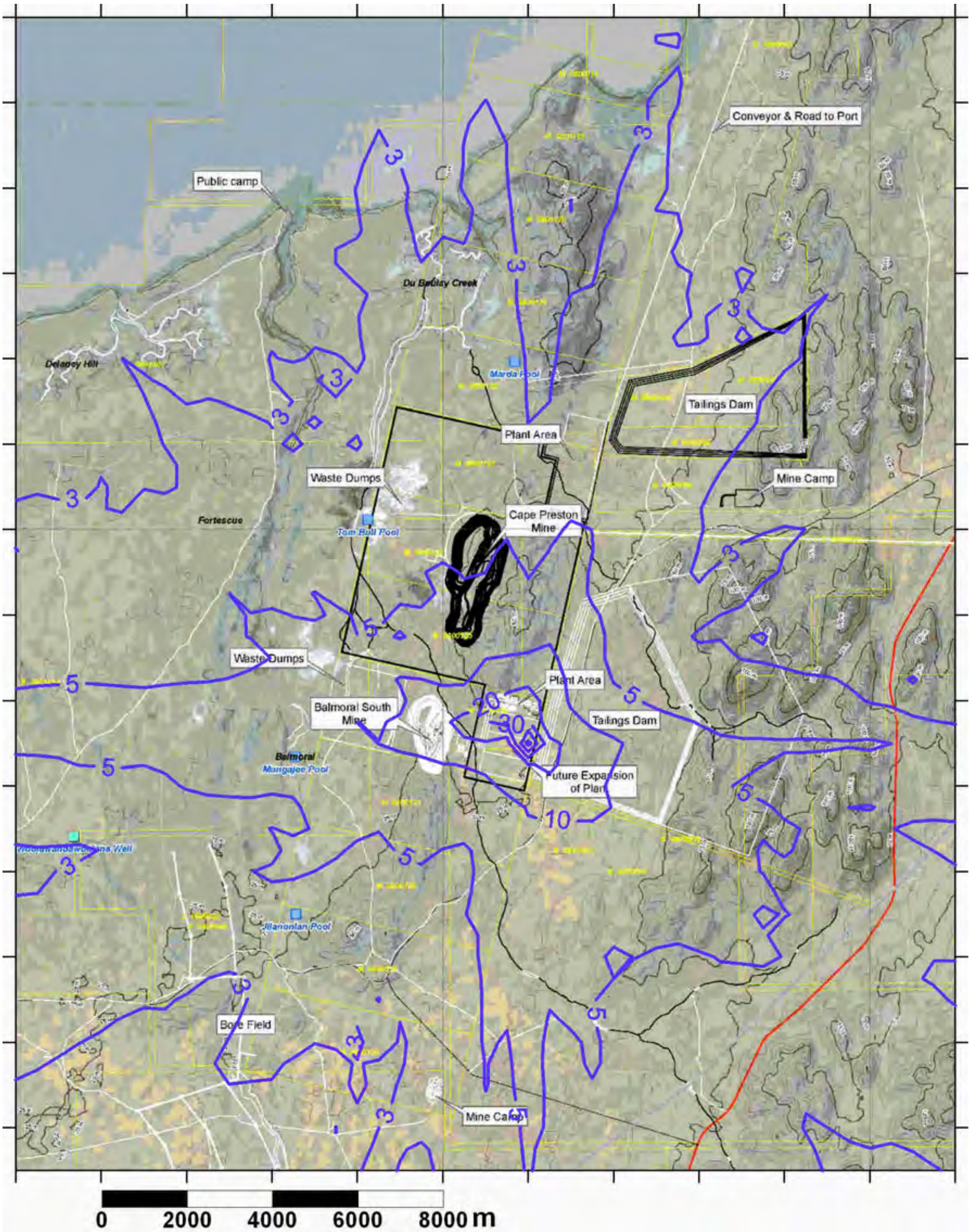

Figure 6.4 Predicted sixth 24-hour PM_{10} Concentration (μg/m^3) from Balmoral South

6.2 Cumulative Impacts from Balmoral South and Mineralogy

Predicted concentrations considering both the Balmoral south and Mineralogy projects are presented in **Table 6-2** and in **Figure 6.5** to **Figure 6.8**.

Table 6-2 Predicted Maximum Concentration from the Balmoral South and Mineralogy Projects

Pollutant	Averaging Period	Standard ($\mu g/m^3$)	Predicted Concentrations ($\mu g/m^3$)		Percentage of Standard or Guideline (%)
			Anywhere	Nearest Camps	Nearest Camps
Nitrogen Oxides	24-hour (max)	75	58	30	40
	Annual	30	8	2	7
Nitrogen Dioxide	1-hour (max)	*246*	190	130	53
	1-year	*62*	8	2	3.2
Sulphur Dioxide	1 hour (max)	*572*	55	42	7.3
	24-hour	*228*	5	3.2	1.4
	Annual	*57*	0.7	0.18	0.3
Particles as PM_{10}	1-day (max)	-	85	10	-
	1-day (6th)	50	54	5	10

Notes:

1) Concentrations of gaseous pollutants in italics have been converted from the NEPM standard quoted at 0 deg C and 101.3kPa.
2) All criteria are for human health excepting nitrogen oxides which is for vegetation.
3) Both the health and vegetation standards are not applicable on the lease areas.
4) The concentrations exclude background concentrations.

Table 6-2 and **Figure 6.5** to **Figure 6.8** indicate that:

- The larger Mineralogy project is the larger source of these pollutants and for the 1-hour and 24-hour averages is the primary contributor to the highest concentrations on the model grid (see **Figure 6.5** and **Figure 6.7**);
- At the nearby camps and camping grounds where the NEPM criteria are considered to apply, the concentrations are at most 10% of the 24-hour PM_{10} and 53% of the 1-hour NEPM NO_2 standards; and
- Considering background concentrations, the cumulative 1-hour and annual average NO_2 concentration at nearby camps are estimated at 134 $\mu g/m^3$ and 4 $\mu g/m^3$ respectively. These are 59% and 7% of the NEPM NO_2 standards. For PM_{10}, taking a typical background concentration from Dampier of 22 $\mu g/m^3$, the 6^{th} highest concentrations at the nearest camp or camping ground would be 32 $\mu g/m^3$ or 64% of the NEPM standard.

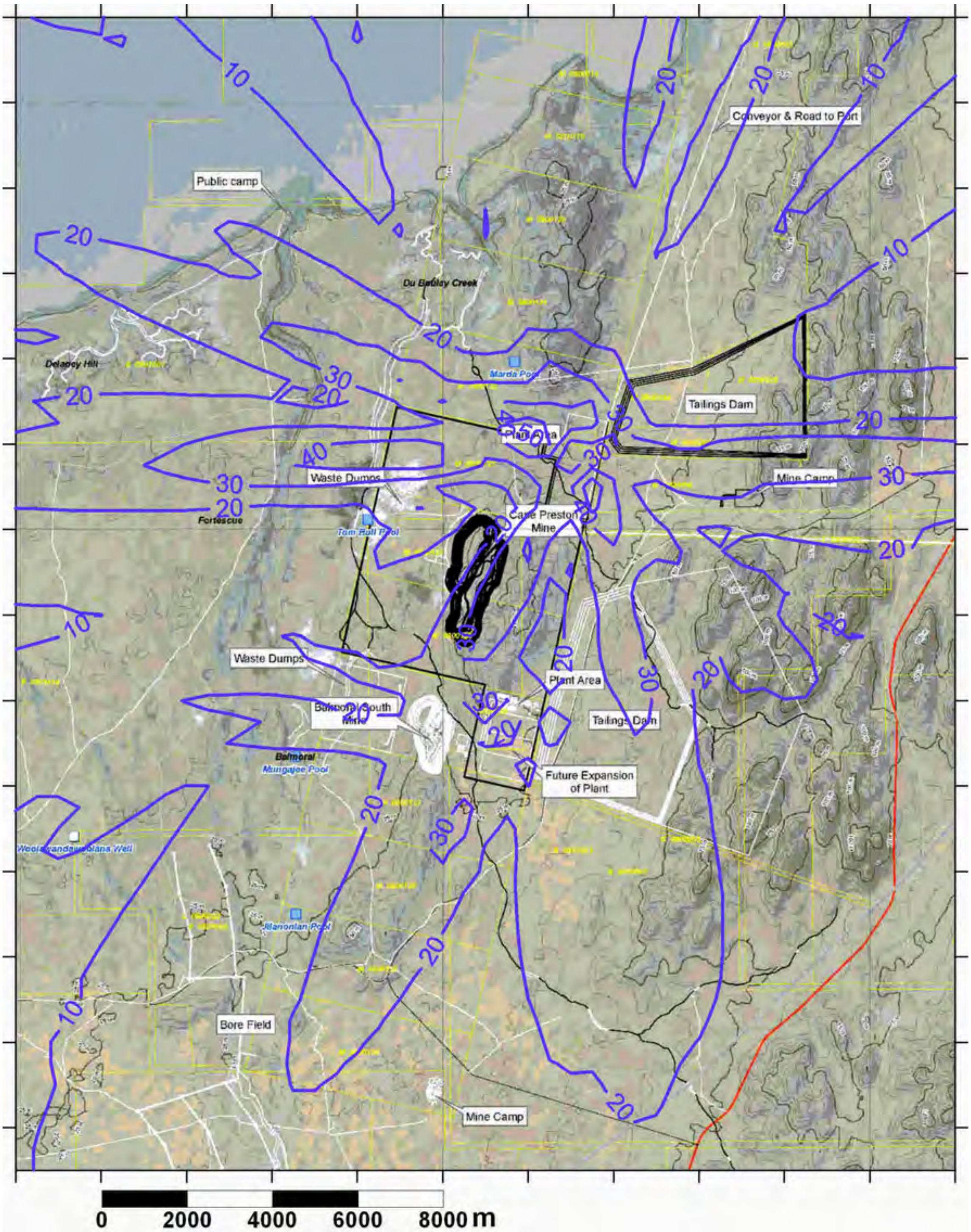

Figure 6.5 Predicted Maximum 24-hour NO_X Concentration ($\mu g/m^3$) from Mineralogy and Balmoral South

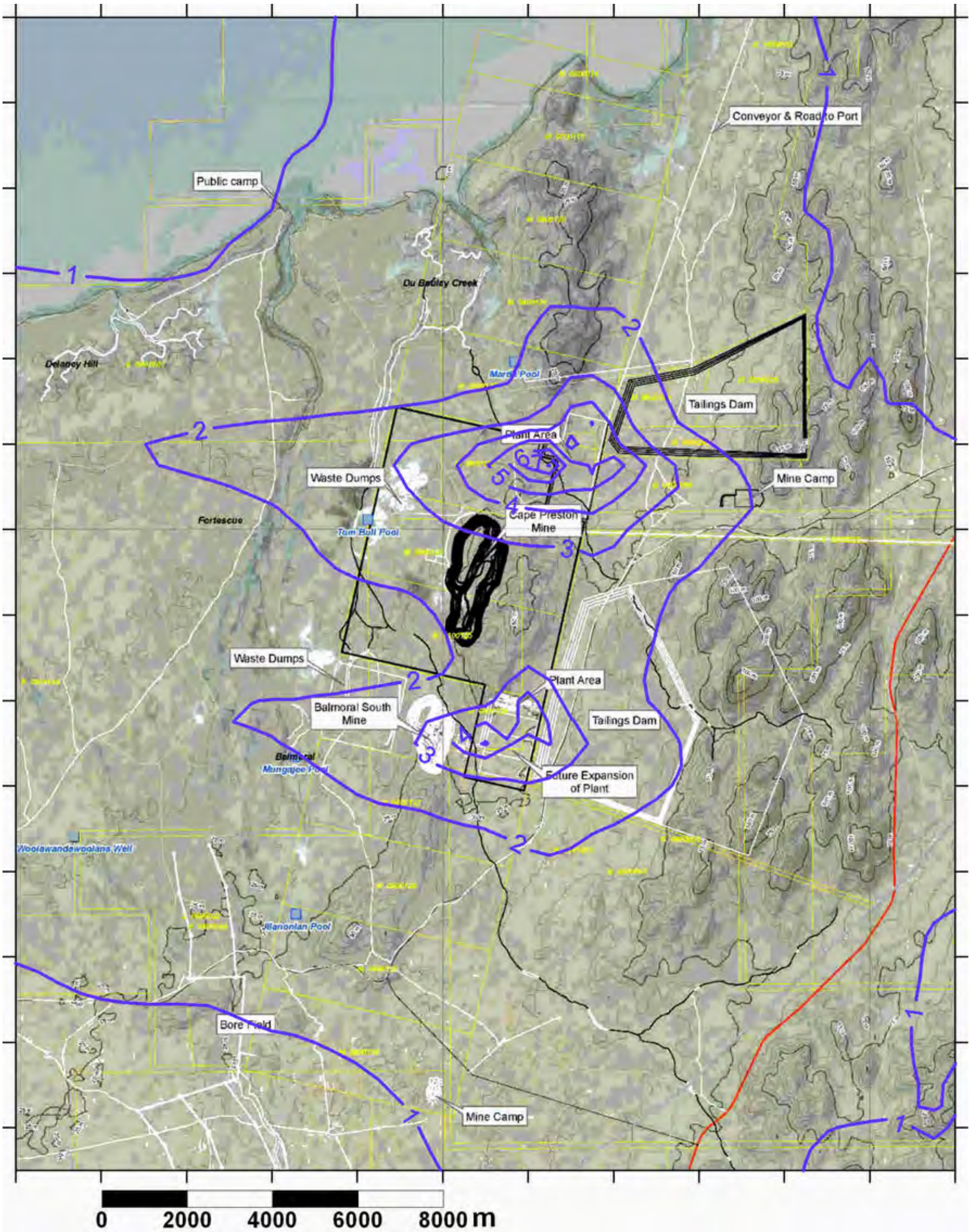

Figure 6.6 Predicted Annual Average NO_X Concentration (µg/m^3) from Mineralogy and Balmoral South

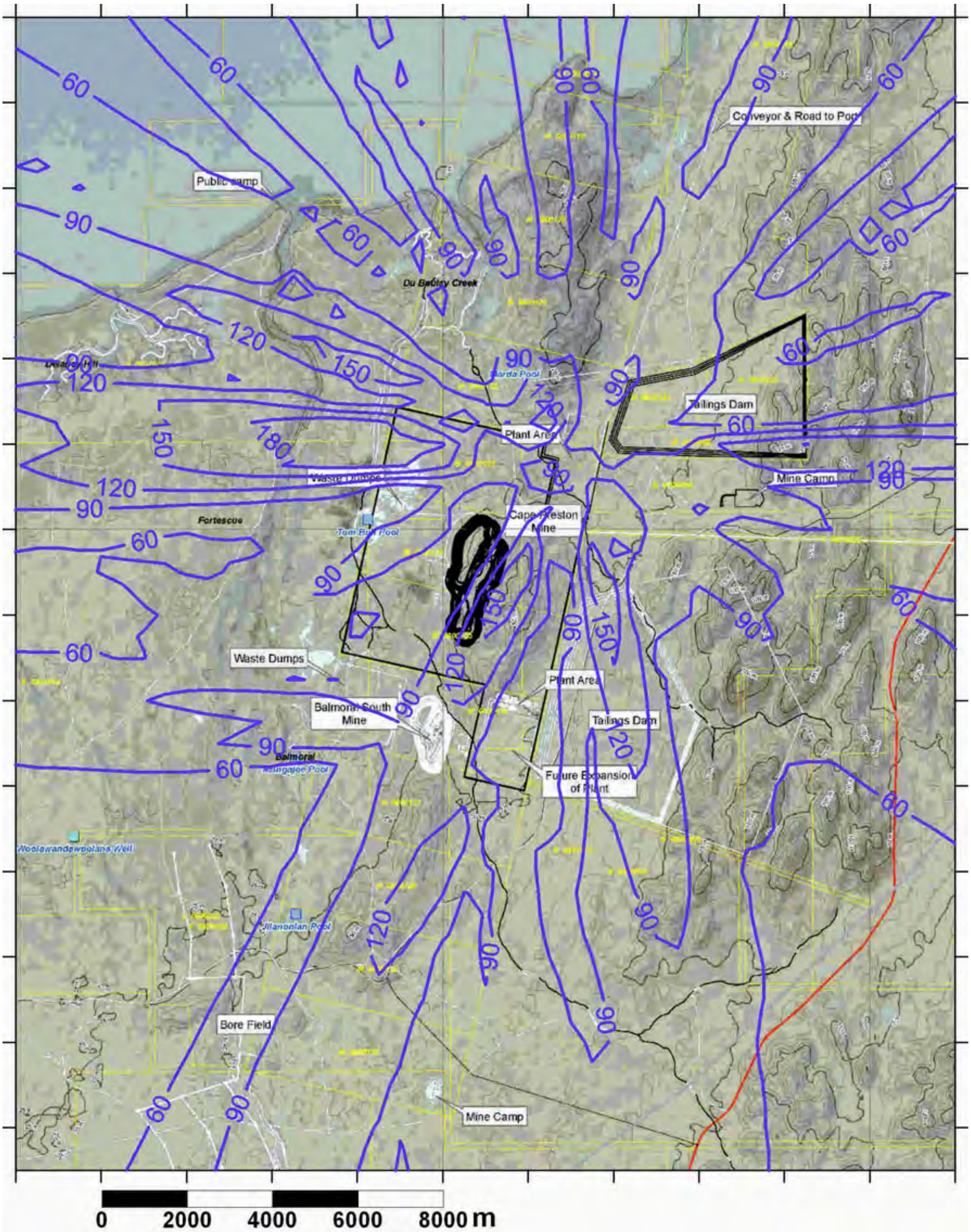

Figure 6.7 Predicted Maximum 1-hour NO_2 Concentration (µg/m^3) from Mineralogy and Balmoral South

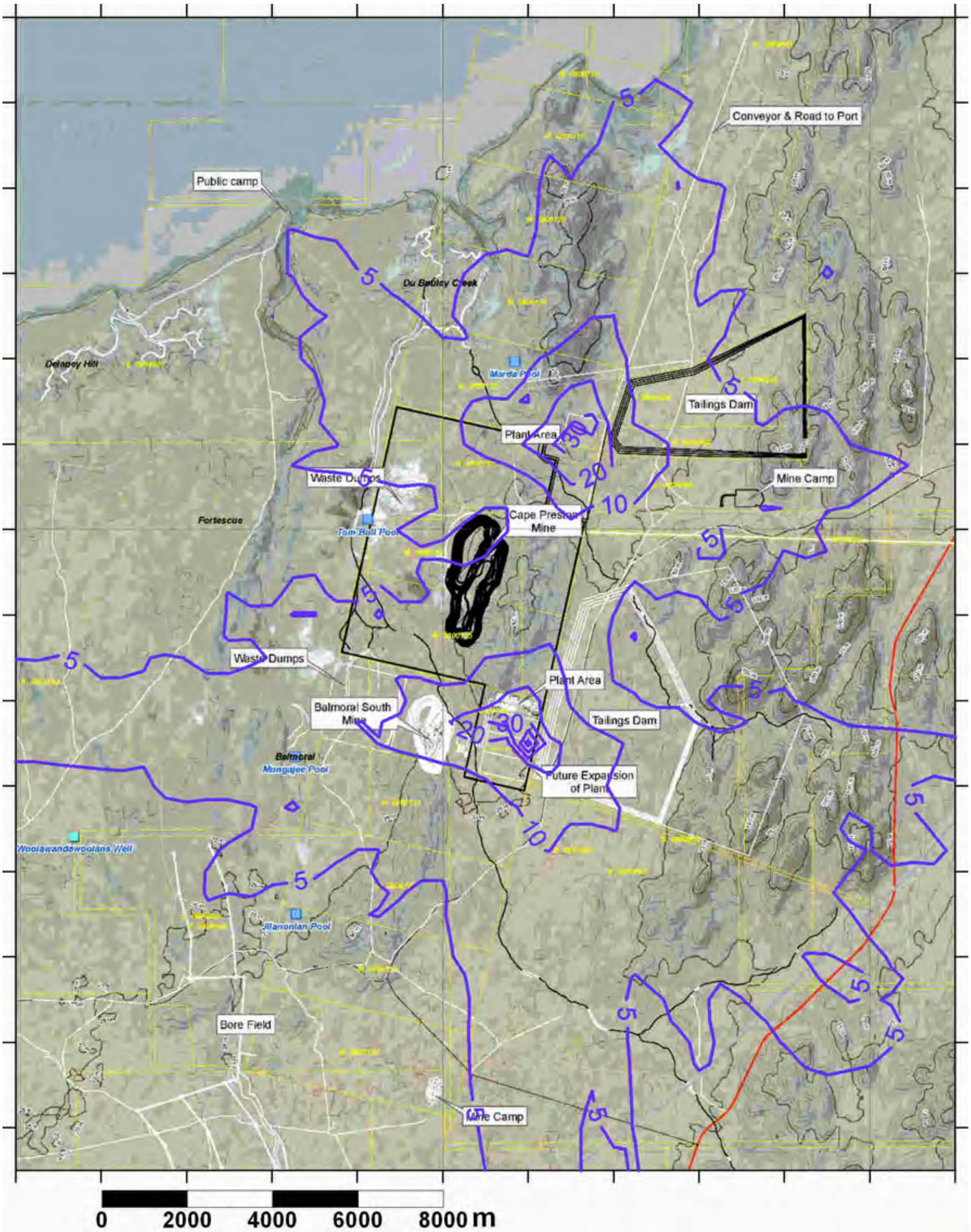

Figure 6.8 Predicted sixth highest 24-hour PM_{10} Concentration (µg/m^3) from Mineralogy and Balmoral South

6.3 Assessment of Smog Impacts

An assessment of the smog impacts in the region, particularly the impact in Damper region was undertaken in SKM (2000). This assessment was based on:

- Using the model TAPM v1 with model predictions for two months only (August 1997 and March 1998) due to the long model run times and the analysis by CSIRO (1998) indicating that these months would lead to maximum smog concentrations on land;
- Emissions included the Woodside onshore treatment plant with expansion, Hamersley Iron Power Station at Dampier and the proposed Plenty River ammonium nitrate plant, PEXCO ammonium nitrate plant and gas to synthetic hydrocarbon (Syntroleum) plant. Emissions for the 2000 Austeel assessment comprised one Pellet plant, DRI plant and 320 MW open cycle power station with total NO_X emissions of 356 g/s or 11,227 tpa and negligible VOC were emissions.

The model results indicated that the Austeel plant would make negligible difference to ozone concentrations in the Dampier/Karratha area. This would appear to be the case as the conditions under which the greatest ozone formation occur, do not correspond to the conditions in which the NO_X plumes from the Cape Preston are advected to Dampier area in relative high concentrations. The maximum concentrations of ozone at Cape Preston were predicted to be due to the plumes from the Dampier region, indicating the dominance of this source for photochemical smog in the region.

With the Balmoral south project and now expanded Mineralogy project, NO_X emissions will be 2.6 times than that modelled in 2000. As such, with the large increase in emissions, though the previous modelling indicates that the industry at Cape Preston will have a minor impact at other areas, it is considered that regional smog impact should be revisited. Other factors that may change the previous results are that:

- Volatile organic compound emissions from the Austeel proposal may have been understated for the pellet plant, as indicated by the VOC emission factors provided in the USEPA emission factors “handbooks”; and
- There have been improvements in the TAPM model and estimates of background reactive compounds, which may change the modelling outcomes somewhat.

7 Conclusions and Recommendations

This report presents a preliminary assessment of the likely ground level concentrations from the Balmoral South pellet plant, DRI plant and power station. Estimates have been derived using emissions based on the Austeel (now Mineralogy) proposal of 2000 and 2002, the use of the model AERMOD and meteorological data predicted using TAPM. Based on these the following are predicted:

Balmoral South project alone

- At the nearby camps and camping grounds where the NEPM standards are considered to apply the concentration are predicted to be at most 16% of the 1-hour NEPM NO_2 standard, 8% of the PM_{10} standard and at most 1.6% of the SO_2 standard; and
- Considering background concentrations, the cumulative NO_2 concentration at these locations are estimated to be at most 18% of the NEPM NO_2 standards. For PM_{10}, taking into account background concentrations, the 6^{th} highest concentrations at the nearest camp or camping area would be 26 $\mu g/m^3$ or 52% of the NEPM standard, this consisting primarily of background “dust”. For SO_2 with negligible background concentrations, the concentrations will be at most 1.6% of the standard.

Mineralogy and Balmoral South projects

- The Mineralogy project is the larger source of emissions and for the 1-hour and 24-hour averages is the primary contributor to the highest concentrations in the area;
- At the nearby camps and camping grounds where the NEPM criteria are considered to apply, the concentrations are predicted to be at most 53% of the 1-hour NEPM NO_2 standard ,10% of the 24-hour PM_{10} standard and 7.3% of the SO_2 standard; and
- Considering background concentrations, the cumulative NO_2 concentration at nearby camps are predicted to be 59% of the NEPM NO_2 standards, with PM_{10} at 64% of the NEPM standard, with SO_2 unchanged at 7.3% of the standard.

It is noted that the above assessment has not included other sources such as fugitive dust. Fugitive dust is considered best addressed through developing comprehensive dust management plans (which would typically include ambient monitoring) as estimating fugitive dust emissions and therefore the resultant predictions of dust concentrations, is reasonably uncertain.

The results above are noted as preliminary, primarily because of the uncertainty in the emissions being based on the 2002 proposal by Austeel, apart for the power station. As such, it is recommended that to refine the predicted air quality impacts, the following is required:

- Incorporate the more detailed plant design and emission for both projects, in particular the NO_X emissions from the Pellet plant which are at present considered likely to be overestimated;
- Incorporate the on-site meteorological data currently being collected;
- Provide more detail on any upset and abnormal conditions, including possible failure of pollution control equipment,
- Re-undertake a regional smog assessments, to account for the larger emissions of NO_X and incorporating more accurate VOC estimates from the plant and regional emission inventory; and

- For the predictions of NO_2, confirm the NO_2 to NO_X ratios from the Pellet and DRI plant and power station.

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Appendix A Typical AERMOD File

```
CO STARTING
   TITLEONE  Apr 2007. Austeel (shifted north) and Balmoral South
   TITLETWO  Pellet Plant, DRI and Power Station
   MODELOPT  CONC
   AVERTIME  1 24 PERIOD
   POLLUTID  NOX

** CO ELEVUNIT card is obsolescent; moved to RE pathway
** ELEVUNIT  METERS
   RUNORNOT  RUN
   ERRORFIL  DEPERR.OUT
CO FINISHED

SO STARTING
   ELEVUNIT  METERS

   LOCATION  PP_Main1 POINT 413061 7671800 20.0
   SRCPARAM  PP_Main1 231.34 60.0 413 18.0 8.25

   LOCATION  PP_Main2 POINT 413228 7671768 20.0
   SRCPARAM  PP_Main2 231.34 60.0 413 18.0 8.25

   LOCATION  DR_Maina POINT 413068 7672120 20.0
   SRCPARAM  DR_Maina 28.70 60.0 613 16.0 5.84

   LOCATION  DR_Mainb POINT 413145 7672103 20.0
   SRCPARAM  DR_Mainb 28.70 60.0 613 16.0 5.84

   LOCATION  DR_Mainc POINT 413252 7672079 20.0
   SRCPARAM  DR_Mainc 28.70 60.0 613 16.0 5.84

   LOCATION  power1 POINT 412720 7672700 20.0
   SRCPARAM  power1 77.88 40.0 813 46.1 5.80

   LOCATION  BSPP_Main POINT 411670 7665325 20.0
   SRCPARAM  BSPP_Main 231.3 60.0 413 18.0 8.25

   LOCATION  BSDR_Main POINT 412000 7665265 20.0
   SRCPARAM  BSDR_Main 28.70 60.0 613 16.0 5.84

   LOCATION  BS_power POINT 411920 7665830 20.0
   SRCPARAM  BS_power 14.82 15.0 729 44.1 3.00

   LOCATION  BS_powe2 POINT 412024 7665790 20.0
   SRCPARAM  BS_powe2 19.76 15.0 729 44.1 3.00

SO BUILDHGT PP_Main1   33.70   33.70   33.70   33.70   33.70   33.70
SO BUILDHGT PP_Main1   33.70   33.70   33.70   27.80   33.70   33.70
SO BUILDHGT PP_Main1   33.70   33.70   33.70   33.70   33.70   33.70
SO BUILDHGT PP_Main1   33.70   33.70   33.70   33.70   33.70   33.70
SO BUILDHGT PP_Main1   33.70   33.70   33.70   27.80   33.70   33.70
SO BUILDHGT PP_Main1   33.70   33.70   33.70   33.70   33.70   33.70
SO BUILDWID PP_Main1   92.08   94.61   94.96   92.42   87.07   79.07
SO BUILDWID PP_Main1   68.68   56.19   42.00  162.56   33.99   46.65
SO BUILDWID PP_Main1   57.88   67.36   74.79   79.95   86.17   90.50
SO BUILDWID PP_Main1   92.08   94.61   94.96   92.42   87.07   79.07
SO BUILDWID PP_Main1   68.68   56.19   42.00  162.56   33.99   46.65
SO BUILDWID PP_Main1   57.88   67.36   74.79   79.95   86.17   90.50
SO BUILDLEN PP_Main1   26.53   33.99   46.65   57.88   67.36   74.79
SO BUILDLEN PP_Main1   79.95   86.17   90.50   24.94   94.61   94.96
SO BUILDLEN PP_Main1   92.42   87.07   79.07   68.68   56.19   42.00
SO BUILDLEN PP_Main1   26.53   33.99   46.65   57.88   67.36   74.79
SO BUILDLEN PP_Main1   79.95   86.17   90.50   24.94   94.61   94.96
SO BUILDLEN PP_Main1   92.42   87.07   79.07   68.68   56.19   42.00
```

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SO XBADJ    PP_Main1  -44.45  -39.30  -38.16  -35.86  -32.47  -28.09
SO XBADJ    PP_Main1  -22.86  -20.43  -18.10   50.70  -11.88   -8.18
SO XBADJ    PP_Main1   -4.22   -0.14    3.94    7.90   11.63   15.00
SO XBADJ    PP_Main1   17.92    5.31   -8.49  -22.02  -34.89  -46.70
SO XBADJ    PP_Main1  -57.09  -65.74  -72.40  -75.64  -82.74  -86.78
SO XBADJ    PP_Main1  -88.19  -86.92  -83.01  -76.58  -67.82  -57.00
SO YBADJ    PP_Main1  -30.82  -35.43  -39.30  -41.99  -43.39  -43.48
SO YBADJ    PP_Main1  -42.24  -39.72  -36.00   63.82  -22.30  -14.84
SO YBADJ    PP_Main1   -6.92    1.21    9.30   17.11   22.66   27.15
SO YBADJ    PP_Main1   30.82   35.43   39.30   41.99   43.39   43.48
SO YBADJ    PP_Main1   42.24   39.72   36.00  -63.82   22.30   14.84
SO YBADJ    PP_Main1    6.92   -1.21   -9.30  -17.11  -22.66  -27.15

SO BUILDHGT PP_Main2   33.70   33.70   33.70   33.70   33.70   33.70
SO BUILDHGT PP_Main2   33.70   33.70   33.70   27.80   33.70   33.70
SO BUILDHGT PP_Main2   33.70   33.70   33.70   33.70   33.70   33.70
SO BUILDHGT PP_Main2   33.70   33.70   33.70   33.70   33.70   33.70
SO BUILDHGT PP_Main2   33.70   33.70   33.70   27.80   33.70   33.70
SO BUILDHGT PP_Main2   33.70   33.70   33.70   33.70   33.70   33.70
SO BUILDWID PP_Main2   89.20   88.69   89.50   87.59   83.02   75.92
SO BUILDWID PP_Main2   66.52   55.10   42.00  162.56   37.20   49.31
SO BUILDWID PP_Main2   59.92   68.71   75.41   79.82   82.95   87.40
SO BUILDWID PP_Main2   89.20   88.69   89.50   87.59   83.02   75.92
SO BUILDWID PP_Main2   66.52   55.10   42.00  163.56   37.20   49.31
SO BUILDWID PP_Main2   59.92   68.71   75.41   79.82   82.95   87.40
SO BUILDLEN PP_Main2   27.63   37.20   49.31   59.92   68.71   75.41
SO BUILDLEN PP_Main2   79.82   82.95   90.50   24.94   88.69   89.50
SO BUILDLEN PP_Main2   87.59   83.02   75.92   66.52   55.10   42.00
SO BUILDLEN PP_Main2   27.63   37.20   49.31   59.92   68.71   75.41
SO BUILDLEN PP_Main2   79.82   82.95   87.40   23.40   88.69   89.50
SO BUILDLEN PP_Main2   87.59   83.02   75.92   66.52   55.10   42.00
SO XBADJ    PP_Main2  -43.51  -52.68  -62.80  -71.01  -77.06  -80.77
SO XBADJ    PP_Main2  -82.03  -80.79 -185.10 -119.32  -63.28  -57.58
SO XBADJ    PP_Main2  -50.13  -41.16  -30.94  -19.77   -8.01    4.00
SO XBADJ    PP_Main2   15.89   15.48   13.49   11.09    8.35    5.36
SO XBADJ    PP_Main2    2.21   -2.16  -10.30   29.77  -25.41  -31.92
SO XBADJ    PP_Main2  -37.46  -41.86  -44.99  -46.75  -47.09  -46.00
SO YBADJ    PP_Main2   26.47   18.94   12.83    6.34   -0.35   -7.03
SO YBADJ    PP_Main2  -13.49  -19.54   -4.00   66.33  -34.08  -38.14
SO YBADJ    PP_Main2  -41.05  -42.71  -43.07  -42.12  -39.32  -33.40
SO YBADJ    PP_Main2  -26.47  -18.94  -12.83   -6.34    0.35    7.03
SO YBADJ    PP_Main2   13.49   19.54   25.00  -62.31   34.08   38.14
SO YBADJ    PP_Main2   41.05   42.71   43.07   42.12   39.32   33.40


SO BUILDHGT DR_Maina   19.40   19.40   19.40   19.40    0.00    0.00
SO BUILDHGT DR_Maina    0.00    0.00    0.00    0.00    0.00    0.00
SO BUILDHGT DR_Maina    0.00    0.00    0.00    0.00   19.40   19.40
SO BUILDHGT DR_Maina   19.40   19.40   19.40   19.40   19.40   19.40
SO BUILDHGT DR_Maina   19.40   19.40    0.00    0.00    0.00    0.00
SO BUILDHGT DR_Maina    0.00    0.00    0.00    0.00   19.40   19.40
SO BUILDWID DR_Maina   15.91   20.72   29.63   37.63    0.00    0.00
SO BUILDWID DR_Maina    0.00    0.00    0.00    0.00    0.00    0.00
SO BUILDWID DR_Maina    0.00    0.00    0.00    0.00   34.32   25.50
SO BUILDWID DR_Maina   15.91   20.72   29.63   37.63   46.03   51.75
SO BUILDWID DR_Maina   55.89   58.33    0.00    0.00    0.00    0.00
SO BUILDWID DR_Maina    0.00    0.00    0.00    0.00   34.32   25.50
SO BUILDLEN DR_Maina   57.13   58.53   58.65   56.99    0.00    0.00
SO BUILDLEN DR_Maina    0.00    0.00    0.00    0.00    0.00    0.00
SO BUILDLEN DR_Maina    0.00    0.00    0.00    0.00   56.36   57.00
SO BUILDLEN DR_Maina   57.13   58.53   58.65   56.99   52.96   48.08
SO BUILDLEN DR_Maina   41.75   34.14    0.00    0.00    0.00    0.00
SO BUILDLEN DR_Maina    0.00    0.00    0.00    0.00   56.36   57.00
SO XBADJ    DR_Maina   28.63   27.39   25.31   22.47    0.00    0.00
SO XBADJ    DR_Maina    0.00    0.00    0.00    0.00    0.00    0.00
SO XBADJ    DR_Maina    0.00    0.00    0.00    0.00  -81.66  -85.00
SO XBADJ    DR_Maina  -85.76  -85.91  -83.96  -79.46 -121.79 -122.72
SO XBADJ    DR_Maina -119.93 -113.49    0.00    0.00    0.00    0.00
SO XBADJ    DR_Maina    0.00    0.00    0.00    0.00   25.30   28.00
SO YBADJ    DR_Maina   -3.31    7.62   17.47   26.78    0.00    0.00
SO YBADJ    DR_Maina    0.00    0.00    0.00    0.00    0.00    0.00
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SO YBADJ    DR_Maina    0.00    0.00    0.00    0.00   22.59   13.15
SO YBADJ    DR_Maina    3.31   -7.62  -17.47  -26.78   27.75   10.92
SO YBADJ    DR_Maina   -6.25  -23.23    0.00    0.00    0.00    0.00
SO YBADJ    DR_Maina    0.00    0.00    0.00    0.00  -22.59  -13.15

SO BUILDHGT DR_Mainb   19.40   19.40   19.40   19.40    0.00    0.00
SO BUILDHGT DR_Mainb    0.00    0.00    0.00    0.00    0.00   19.40
SO BUILDHGT DR_Mainb   19.40   19.40   19.40    0.00   19.40   19.40
SO BUILDHGT DR_Mainb   19.40   19.40   19.40   19.40    0.00    0.00
SO BUILDHGT DR_Mainb    0.00    0.00    0.00    0.00    0.00    0.00
SO BUILDHGT DR_Mainb    0.00    0.00    0.00    0.00   19.40   19.40
SO BUILDWID DR_Mainb   16.08   21.40   30.63   38.92    0.00    0.00
SO BUILDWID DR_Mainb    0.00    0.00    0.00    0.00    0.00   58.65
SO BUILDWID DR_Mainb   56.99   53.60   48.58    0.00   34.14   25.50
SO BUILDWID DR_Mainb   16.08   21.40   30.63   38.92    0.00    0.00
SO BUILDWID DR_Mainb    0.00    0.00    0.00    0.00    0.00    0.00
SO BUILDWID DR_Mainb    0.00    0.00    0.00    0.00   34.14   25.50
SO BUILDLEN DR_Mainb   57.88   57.59   57.78   56.23    0.00    0.00
SO BUILDLEN DR_Mainb    0.00    0.00    0.00    0.00    0.00   29.63
SO BUILDLEN DR_Mainb   37.63   44.50   50.01    0.00   58.33   59.00
SO BUILDLEN DR_Mainb   57.88   57.59   57.78   56.23    0.00    0.00
SO BUILDLEN DR_Mainb    0.00    0.00    0.00    0.00    0.00    0.00
SO BUILDLEN DR_Mainb    0.00    0.00    0.00    0.00   58.33   59.00
SO XBADJ    DR_Mainb   29.00   29.51   27.40   24.45    0.00    0.00
SO XBADJ    DR_Mainb    0.00    0.00    0.00    0.00    0.00 -107.46
SO XBADJ    DR_Mainb -115.51 -120.05 -120.93    0.00  -82.51  -86.00
SO XBADJ    DR_Mainb  -86.88  -87.09  -85.18  -80.68    0.00    0.00
SO XBADJ    DR_Mainb    0.00    0.00    0.00    0.00    0.00    0.00
SO XBADJ    DR_Mainb    0.00    0.00    0.00    0.00   24.18   27.00
SO YBADJ    DR_Mainb   -3.74    6.87   16.78   26.17    0.00    0.00
SO YBADJ    DR_Mainb    0.00    0.00    0.00    0.00    0.00   30.86
SO YBADJ    DR_Mainb   14.50   -2.31  -19.05    0.00   23.54   13.85
SO YBADJ    DR_Mainb    3.74   -6.87  -16.78  -26.17    0.00    0.00
SO YBADJ    DR_Mainb    0.00    0.00    0.00    0.00    0.00    0.00
SO YBADJ    DR_Mainb    0.00    0.00    0.00    0.00  -23.54  -13.85


SO BUILDHGT DR_Mainc   19.40   19.40   19.40   19.40    0.00    0.00
SO BUILDHGT DR_Mainc    0.00    0.00    0.00    0.00    0.00    0.00
SO BUILDHGT DR_Mainc    0.00    0.00    0.00    0.00   19.40   19.40
SO BUILDHGT DR_Mainc   19.40   19.40   19.40   19.40    0.00    0.00
SO BUILDHGT DR_Mainc    0.00    0.00    0.00    0.00    0.00    0.00
SO BUILDHGT DR_Mainc    0.00    0.00    0.00    0.00   19.40   19.40
SO BUILDWID DR_Mainc   16.26   21.06   30.13   38.28    0.00    0.00
SO BUILDWID DR_Mainc    0.00    0.00    0.00    0.00    0.00    0.00
SO BUILDWID DR_Mainc    0.00    0.00    0.00    0.00   33.97   25.50
SO BUILDWID DR_Mainc   16.26   21.06   30.13   38.28    0.00    0.00
SO BUILDWID DR_Mainc    0.00    0.00    0.00    0.00    0.00    0.00
SO BUILDWID DR_Mainc    0.00    0.00    0.00    0.00   33.97   25.50
SO BUILDLEN DR_Mainc   56.89   56.65   56.92   55.46    0.00    0.00
SO BUILDLEN DR_Mainc    0.00    0.00    0.00    0.00    0.00    0.00
SO BUILDLEN DR_Mainc    0.00    0.00    0.00    0.00   57.34   58.00
SO BUILDLEN DR_Mainc   56.89   56.65   56.92   55.46    0.00    0.00
SO BUILDLEN DR_Mainc    0.00    0.00    0.00    0.00    0.00    0.00
SO BUILDLEN DR_Mainc    0.00    0.00    0.00    0.00   57.34   58.00
SO XBADJ    DR_Mainc   30.01   30.07   27.71   24.51    0.00    0.00
SO XBADJ    DR_Mainc    0.00    0.00    0.00    0.00    0.00    0.00
SO XBADJ    DR_Mainc    0.00    0.00    0.00    0.00  -82.49  -86.00
SO XBADJ    DR_Mainc  -86.90  -86.72  -84.63  -79.97    0.00    0.00
SO XBADJ    DR_Mainc    0.00    0.00    0.00    0.00    0.00    0.00
SO XBADJ    DR_Mainc    0.00    0.00    0.00    0.00   25.14   28.00
SO YBADJ    DR_Mainc   -2.57    6.95   16.94   26.41    0.00    0.00
SO YBADJ    DR_Mainc    0.00    0.00    0.00    0.00    0.00    0.00
SO YBADJ    DR_Mainc    0.00    0.00    0.00    0.00   22.54   12.75
SO YBADJ    DR_Mainc    2.57   -6.95  -16.94  -26.41    0.00    0.00
SO YBADJ    DR_Mainc    0.00    0.00    0.00    0.00    0.00    0.00
SO YBADJ    DR_Mainc    0.00    0.00    0.00    0.00  -22.54  -12.75

SO BUILDHGT power1     17.50   17.50   17.50   10.00    0.00    0.00
SO BUILDHGT power1      0.00    0.00    0.00    0.00   10.00   17.50
SO BUILDHGT power1     17.50   17.50   17.50   17.50   17.50   17.50
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SO BUILDHGT power1     17.50   17.50   17.50   10.00    0.00    0.00
SO BUILDHGT power1      0.00    0.00    0.00    0.00   10.00   17.50
SO BUILDHGT power1     17.50   17.50   17.50   17.50   17.50   17.50
SO BUILDWID power1     23.81   25.89   27.19   41.37    0.00    0.00
SO BUILDWID power1      0.00    0.00    0.00    0.00   41.62   22.59
SO BUILDWID power1     22.79   22.51   23.19   23.15   22.42   21.00
SO BUILDWID power1     23.81   25.89   27.19   41.37    0.00    0.00
SO BUILDWID power1      0.00    0.00    0.00    0.00   32.04   22.59
SO BUILDWID power1     22.79   22.51   23.19   23.15   22.42   21.00
SO BUILDLEN power1     20.16   21.70   22.59   56.93    0.00    0.00
SO BUILDLEN power1      0.00    0.00    0.00    0.00   52.20   27.19
SO BUILDLEN power1     27.66   27.29   26.09   24.10   21.37   18.00
SO BUILDLEN power1     20.16   21.70   22.59   56.93    0.00    0.00
SO BUILDLEN power1      0.00    0.00    0.00    0.00   23.07   27.19
SO BUILDLEN power1     27.66   27.29   26.09   24.10   21.37   18.00
SO XBADJ    power1    -44.55  -43.74  -41.61  -38.21    0.00    0.00
SO XBADJ    power1      0.00    0.00    0.00    0.00    2.31   31.19
SO XBADJ    power1     32.80   33.42   19.02   22.04   24.39   26.00
SO XBADJ    power1     24.39   22.04   19.02  -18.72    0.00    0.00
SO XBADJ    power1      0.00    0.00    0.00    0.00  -47.94  -58.37
SO XBADJ    power1    -60.46  -60.70  -45.11  -55.71  -45.76  -44.00
SO YBADJ    power1     -9.52  -15.26  -20.53  -24.96    0.00    0.00
SO YBADJ    power1      0.00    0.00    0.00    0.00  -22.93  -16.31
SO YBADJ    power1     -8.81   -0.94  -16.47  -10.05   -3.33    3.50
SO YBADJ    power1      9.52   15.26   20.53   24.96    0.00    0.00
SO YBADJ    power1      0.00    0.00    0.00    0.00   18.14   16.31
SO YBADJ    power1      8.81    0.94   16.47  -16.26    3.33   -3.50

SO BUILDHGT BSPP_Main   33.70   33.70   33.70   33.70   33.70   33.70
SO BUILDHGT BSPP_Main   33.70   33.70   33.70   27.80   33.70   33.70
SO BUILDHGT BSPP_Main   33.70   33.70   33.70   33.70   33.70   33.70
SO BUILDHGT BSPP_Main   33.70   33.70   33.70   33.70   33.70   33.70
SO BUILDHGT BSPP_Main   33.70   33.70   33.70   27.80   33.70   33.70
SO BUILDHGT BSPP_Main   33.70   33.70   33.70   33.70   33.70   33.70
SO BUILDWID BSPP_Main   92.08   94.61   94.96   92.42   87.07   79.07
SO BUILDWID BSPP_Main   68.68   56.19   42.00  162.56   33.99   46.65
SO BUILDWID BSPP_Main   57.88   67.36   74.79   79.95   86.17   90.50
SO BUILDWID BSPP_Main   92.08   94.61   94.96   92.42   87.07   79.07
SO BUILDWID BSPP_Main   68.68   56.19   42.00  162.56   33.99   46.65
SO BUILDWID BSPP_Main   57.88   67.36   74.79   79.95   86.17   90.50
SO BUILDLEN BSPP_Main   26.53   33.99   46.65   57.88   67.36   74.79
SO BUILDLEN BSPP_Main   79.95   86.17   90.50   24.94   94.61   94.96
SO BUILDLEN BSPP_Main   92.42   87.07   79.07   68.68   56.19   42.00
SO BUILDLEN BSPP_Main   26.53   33.99   46.65   57.88   67.36   74.79
SO BUILDLEN BSPP_Main   79.95   86.17   90.50   24.94   94.61   94.96
SO BUILDLEN BSPP_Main   92.42   87.07   79.07   68.68   56.19   42.00
SO XBADJ    BSPP_Main  -44.45  -39.30  -38.16  -35.86  -32.47  -28.09
SO XBADJ    BSPP_Main  -22.86  -20.43  -18.10   50.70  -11.88   -8.18
SO XBADJ    BSPP_Main   -4.22   -0.14    3.94    7.90   11.63   15.00
SO XBADJ    BSPP_Main   17.92    5.31   -8.49  -22.02  -34.89  -46.70
SO XBADJ    BSPP_Main  -57.09  -65.74  -72.40  -75.64  -82.74  -86.78
SO XBADJ    BSPP_Main  -88.19  -86.92  -83.01  -76.58  -67.82  -57.00
SO YBADJ    BSPP_Main  -30.82  -35.43  -39.30  -41.99  -43.39  -43.48
SO YBADJ    BSPP_Main  -42.24  -39.72  -36.00   63.82  -22.30  -14.84
SO YBADJ    BSPP_Main   -6.92    1.21    9.30   17.11   22.66   27.15
SO YBADJ    BSPP_Main   30.82   35.43   39.30   41.99   43.39   43.48
SO YBADJ    BSPP_Main   42.24   39.72   36.00  -63.82   22.30   14.84
SO YBADJ    BSPP_Main    6.92   -1.21   -9.30  -17.11  -22.66  -27.15

SO BUILDHGT BSDR_Main   19.40   19.40   19.40   19.40    0.00    0.00
SO BUILDHGT BSDR_Main    0.00    0.00    0.00    0.00    0.00    0.00
SO BUILDHGT BSDR_Main    0.00    0.00    0.00    0.00   19.40   19.40
SO BUILDHGT BSDR_Main   19.40   19.40   19.40   19.40   19.40   19.40
SO BUILDHGT BSDR_Main   19.40   19.40    0.00    0.00    0.00    0.00
SO BUILDHGT BSDR_Main    0.00    0.00    0.00    0.00   19.40   19.40
SO BUILDWID BSDR_Main   15.91   20.72   29.63   37.63    0.00    0.00
SO BUILDWID BSDR_Main    0.00    0.00    0.00    0.00    0.00    0.00
SO BUILDWID BSDR_Main    0.00    0.00    0.00    0.00   34.32   25.50
SO BUILDWID BSDR_Main   15.91   20.72   29.63   37.63   46.03   51.75
SO BUILDWID BSDR_Main   55.89   58.33    0.00    0.00    0.00    0.00
SO BUILDWID BSDR_Main    0.00    0.00    0.00    0.00   34.32   25.50
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SO BUILDLEN BSDR_Main   57.13   58.53   58.65   56.99    0.00    0.00
SO BUILDLEN BSDR_Main    0.00    0.00    0.00    0.00    0.00    0.00
SO BUILDLEN BSDR_Main    0.00    0.00    0.00    0.00   56.36   57.00
SO BUILDLEN BSDR_Main   57.13   58.53   58.65   56.99   52.96   48.08
SO BUILDLEN BSDR_Main   41.75   34.14    0.00    0.00    0.00    0.00
SO BUILDLEN BSDR_Main    0.00    0.00    0.00    0.00   56.36   57.00
SO XBADJ    BSDR_Main   28.63   27.39   25.31   22.47    0.00    0.00
SO XBADJ    BSDR_Main    0.00    0.00    0.00    0.00    0.00    0.00
SO XBADJ    BSDR_Main    0.00    0.00    0.00    0.00  -81.66  -85.00
SO XBADJ    BSDR_Main  -85.76  -85.91  -83.96  -79.46 -121.79 -122.72
SO XBADJ    BSDR_Main -119.93 -113.49    0.00    0.00    0.00    0.00
SO XBADJ    BSDR_Main    0.00    0.00    0.00    0.00   25.30   28.00
SO YBADJ    BSDR_Main   -3.31    7.62   17.47   26.78    0.00    0.00
SO YBADJ    BSDR_Main    0.00    0.00    0.00    0.00    0.00    0.00
SO YBADJ    BSDR_Main    0.00    0.00    0.00    0.00   22.59   13.15
SO YBADJ    BSDR_Main    3.31   -7.62  -17.47  -26.78   27.75   10.92
SO YBADJ    BSDR_Main   -6.25  -23.23    0.00    0.00    0.00    0.00
SO YBADJ    BSDR_Main    0.00    0.00    0.00    0.00  -22.59  -13.15

   SRCGROUP  ALL
SO FINISHED

RE STARTING
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   gridcart XYINC 400000 45 500 7655000 55 500
   GRIDCART elev 1 27  25  27  27  28  28  30  30  29  30  30  32  31  32  33  33  32  33  32  32  34  35  36
37  38  40
   GRIDCART elev 1 41  43  44  46  48  54  55  61  54  57  61  64  67  84  75  83  90  98 114
   GRIDCART elev 2 26  24  25  27  27  28  29  29  29  30  31  30  29  32  33  32  31  32  33  32  33  34  35
37  38  40
   GRIDCART elev 2 41  43  45  46  47  50  51  52  59  68  68  69  70  73  74  82  84  97 116
   GRIDCART elev 3 25  25  25  25  26  27  28  29  30  30  32  29  30  31  32  30  31  32  31  31  33  35  36
37  39  40
   GRIDCART elev 3 40  43  44  45  47  48  50  50  53  60  68  78  83  76  78  87 102 121 114
   GRIDCART elev 4 24  23  25  24  25  26  26  28  29  31  27  29  31  30  31  29  30  30  31  30  33  34  35
36  38  39
   GRIDCART elev 4 40  42  43  45  46  47  48  50  59  70  74  98  92  73  77  82  93 106 126
   GRIDCART elev 5 23  24  24  25  25  26  28  28  29  29  27  30  29  30  30  31  30  29  30  31  32  32  33
36  37  38
   GRIDCART elev 5 41  42  42  45  46  47  48  51  57  74  86  78  77  72  81  89  95 101 132
   GRIDCART elev 6 22  23  24  24  25  26  29  29  29  29  24  31  35  29  30  28  28  30  29  31  31  33  35
35  37  38
   GRIDCART elev 6 40  41  42  43  45  44  46  48  57  65  78  79  66  74  94  85  89  99 126
   GRIDCART elev 7 22  22  23  25  25  26  28  29  29  28  26  29  29  29  28  28  30  28  29  29  31  32  34
35  36  38
   GRIDCART elev 7 39  40  40  42  42  45  46  49  51  56  63  69  68  73  73  82  86  95 101
   GRIDCART elev 8 21  22  23  24  25  26  27  34  35  30  25  29  28  37  26  28  28  28  28  30  31  32  35
34  36  37
   GRIDCART elev 8 38  38  39  41  43  44  46  48  51  53  55  60  72  66  75  73  79  89  94
   GRIDCART elev 9 21  23  25  25  26  25  25  26  30  35  27  28  28  27  26  28  27  28  28  31  32  33  33
34  35  37
   GRIDCART elev 9 37  39  40  45  44  43  45  48  49  51  53  55  64  60  67  72  79  84  94
   GRIDCART elev 10 21  22  23  25  24  24  24  25  26  28  25  26  26  26  26  26  27  36  30  30  30  32  33
34  34  34
   GRIDCART elev 10 37  43  44  53  49  48  46  47  49  49  53  55  58  61  66  79  78  80  87
   GRIDCART elev 11 21  22  22  22  23  23  24  25  27  27  28  25  24  25  28  33  32  38  31  32  31  31  32
33  34  34
   GRIDCART elev 11 36  38  43  49  52  54  50  52  48  52  52  53  55  59  65  72  74  78  84
   GRIDCART elev 12 21  20  21  21  22  23  24  25  24  25  28  25  23  26  27  43  45  45  37  33  33  33  31
32  33  35
   GRIDCART elev 12 38  42  41  48  58  58  67  54  51  52  59  54  57  60  65  68  74  75  81
   GRIDCART elev 13 20  20  21  22  22  22  23  23  24  25  25  25  23  22  25  38  43  46  41  35  36  36  32
29  32  35
   GRIDCART elev 13 38  44  41  47  58  69  62  56  54  56  58  57  61  60  63  64  69  72  79
   GRIDCART elev 14 19  20  21  21  23  24  21  23  23  23  27  24  24  21  24  27  36  35  40  39  35  39  32
29  31  33
   GRIDCART elev 14 36  43  37  46  59  63  77  62  60  63  72  60  63  59  62  63  66  70  74
   GRIDCART elev 15 19  21  20  20  22  22  22  21  21  23  25  25  23  20  24  23  26  27  34  43  32  38  29
28  29  31
   GRIDCART elev 15 33  34  35  41  47  58  71  72  62  65  88  68  65  73  83  65  64  67  72
   GRIDCART elev 16 19  19  19  20  21  21  21  22  21  24  22  24  22  22  23  23  22  24  33  46  32  30  27
26  28  30
   GRIDCART elev 16 30  34  35  40  45  60  70  67  93  66  88  78  71  87  94  74  63  68  71
   GRIDCART elev 17 19  19  19  19  19  21  21  20  22  22  21  23  21  22  22  22  20  21  33  44  32  27  28
26  27  28
```

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   GRIDCART elev 17 31  33  36  38  43  70  68  66  90 105  78  76  92  96  98  74  66  64  68
   GRIDCART elev 18 17  16  17  19  19  20  19  19  20  23  20  23  20  21  22  21  21  20  25  42  35  25  26
25  26  27
   GRIDCART elev 18 28  32  35  38  42  50  70  69  96  91  72  72 103  94  86  74  71  67  67
   GRIDCART elev 19 17  17  18  18  18  19  20  19  20  22  21  22  23  18  21  21  20  20  23  38  30  23  23
25  25  27
   GRIDCART elev 19 29  31  34  36  41  51  58  62  79  84  74  74  84  98  87  74  71  70  73
   GRIDCART elev 20 16  17  17  18  18  18  18  19  20  22  22  21  21  19  21  20  20  20  20  29  27  23  23
24  25  26
   GRIDCART elev 20 30  30  33  35  38  46  58  63  62  77  65  69  79  90  89  76  72  72  78
   GRIDCART elev 21 15  16  17  17  17  17  16  18  19  20  19  22  21  18  19  20  20  21  18  27  27  21  21
23  25  26
   GRIDCART elev 21 30  33  34  36  37  41  58  53  53  60  61  73  77  73 107  79  74  75  86
   GRIDCART elev 22 16  17  17  17  17  17  17  18  18  19  19  20  19  17  17  19  19  19  17  24  22  19  22
24  24  27
   GRIDCART elev 22 29  33  34  36  39  41  45  48  52  56  62  65  64  77  87  81  83  78  86
   GRIDCART elev 23 15  17  15  16  17  16  16  17  18  20  16  19  19  17  19  18  18  17  16  22  18  20  35
25  26  28
   GRIDCART elev 23 28  31  34  36  39  40  49  54  73  61  86  77  66  89  78  72  83  89  93
   GRIDCART elev 24 14  15  15  15  15  16  16  17  17  20  17  18  17  18  17  17  17  17  18  17  18  22  43
36  27  28
   GRIDCART elev 24 29  32  34  36  37  40  45  57 119  90  71 101  71  73  81  68 101  82  91
   GRIDCART elev 25 15  14  14  15  15  14  15  16  17  19  18  17  17  17  16  17  16  16  16  17  17  26  34
39  33  28
   GRIDCART elev 25 29  30  37  36  35  40  46  54  78  88  73  90  83  69  81  65  89  76  84
   GRIDCART elev 26 11  14  13  14  15  14  15  15  15  18  17  17  15  16  16  16  15  15  16  15  19  33  42
43  47  33
   GRIDCART elev 26 30  29  32  37  33  41  56  56  62 102  70  83  88  81  69  62  84  81  74
   GRIDCART elev 27 14  13  13  14  14  14  15  15  15  16  15  16  12  17  15  15  14  14  16  17  20  26  38
43  55  37
   GRIDCART elev 27 29  27  30  35  38  38  47  70  62  73  64  63  86 111  67  59  64  76  69
   GRIDCART elev 28 11  13  13  12  13  13  15  14  15  15  16  16  13  14  14  12  13  14  13  16  19  29  42
51  52  41
   GRIDCART elev 28 30  26  27  29  38  42  42  69  90 103  53  60  74  90  74  62  55  58  68
   GRIDCART elev 29 12  11  13  14  12  13  14  14  15  14  15  16  12  15  14  13  12  14  14  14  18  27  37
44  53  43
   GRIDCART elev 29 31  22  25  26  29  47  38  55  88  76  50  58  63  81  74  61  54  55  65
   GRIDCART elev 30 11  11  12  12  12  12  14  13  12  13  14  14   9  14  13  12  11  14  12  13  16  22  34
37  46  32
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   GRIDCART elev 31 12  11  11  11  12  11  12  12  12  11  13  13  11  14  12  12   9  12  12  11  15  21  28
31  43  34
   GRIDCART elev 31 22  20  23  23  27  33  33  34  41  44  44  48  52  56  59  55  54  50  52
   GRIDCART elev 32 12  10  11  12  11  11  12  12  12  10  11  12   8  14  11  12  10   9  11  10  15  21  25
24  28  24
   GRIDCART elev 32 18  19  20  24  24  26  29  32  36  37  41  44  51  53  53  56  54  50  48
   GRIDCART elev 33 11  11  11  10  11  10  11  12  12  11   9   9  11  12  11  11   8  10  10  11  14  15  19
23  21  17
   GRIDCART elev 33 16  17  19  21  23  26  27  31  33  47  63  50  55  68  54  52  51  50  48
   GRIDCART elev 34 10  10  10  11  10  11  10  10  11  10  10  11  11  11  12  11  10   7  10  10  10  12  16
15  14  14
   GRIDCART elev 34 15  15  20  22  23  25  27  29  34  54  83  73  53  73  55  50  48  47  47
   GRIDCART elev 35  7   8   9  10   9  10  10  10  10  10   9   9  10   5  11   9   9   8   8   8   9   9  13
11  13  14
   GRIDCART elev 35 13  15  17  19  22  22  24  28  33  61  70  80  62  73  61  53  52  44  42
   GRIDCART elev 36  3   6   7   8   9   9   9   9   9   9   9   9   9   6   8  10   9   8   8   7   8   7  10
10  11  15
   GRIDCART elev 36 13  14  16  18  20  21  22  26  29  40  57  63  63  86  71  64  94  47  40
   GRIDCART elev 37  3   4   6   5   7   8   8   8   7   9   8   9   9  10   6   8   9   7   8   7   6   8   7
9   9  13
   GRIDCART elev 37 15  13  16  16  18  20  20  24  29  36  56  68  79  75  75  73  78  48  41
   GRIDCART elev 38  4   5   5   6   4   4   4   6   5   8   7   8  10   7   4   9   8   7   8   8   6   6   6
8  11  25
   GRIDCART elev 38 17  14  17  16  18  19  21  25  28  32  38  49  67  65 105  71  85  50  43
   GRIDCART elev 39  5   5   6   5   4   6   4   4   6   5   7   9   8   8   6   8   8   8   7   8   6   5   5
7  13  27
   GRIDCART elev 39 30  20  16  16  17  18  19  24  26  30  36  52  61  62  91  63  84  47  43
   GRIDCART elev 40  7   7   6   6   7   5   5   6   5   5   5   9   5   5   6   8   7   7   6   6   4   5   7
8  17  30
   GRIDCART elev 40 37  32  19  18  16  18  20  22  23  28  35  41  51  56  81  56  71  45  40
   GRIDCART elev 41  0   4   8   9   7   6   6   5   5   6   7   7   6   8   5   7   7   6   6   5   5   4   4
8  10  22
   GRIDCART elev 41 29  26  21  18  16  18  18  21  29  29  33  37  42  58  80  56  58  43  38
   GRIDCART elev 42  0   0   0   0   7   4  12   8   6   6   6   5   4   5   5   5   6   5   6   6   5   5   2
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   GRIDCART elev 43  0    0    0    0    0    0    0    3    8    8    7    7    6    6    5    7    7    6    5    6    5    5    5
8  19  21
   GRIDCART elev 43 29   19   17   14   13   14   16   19   21   30   39   38   60   58   55   48   42   38   34
   GRIDCART elev 44  0    0    0    0    0    0    0    0    0    2   10    8    6    7    7    8    8    6    6    5    4    5    3
8  19  24
   GRIDCART elev 44 29   17   17   12   12   13   15   19   21   32   47   51   66   55   45   43   38   37   35
   GRIDCART elev 45  0    0    0    0    0    0    0    0    0    0    0    6    7    4    7    8    6    9    6    7    4    5    4
3  11  15
   GRIDCART elev 45 30   20   10   11   10   11   16   14   23   49   45   64   69   51   48   38   35   35   32
   GRIDCART elev 46  0    0    0    0    0    0    0    0    0    0    0    0    2    3    6    4    1    4    8    5    5    3    6
4  10  17
   GRIDCART elev 46 33   23   13    7    9    9   12   13   20   31   48   48   48   48   46   39   31   31   32
   GRIDCART elev 47  0    0    0    0    0    0    0    0    0    0    0    0    0    2    0    0    0    0    0    0    0    4   10
7  11  26
   GRIDCART elev 47 19   28   10    4    6    7   12   10   19   22   31   46   45   39   43   51   33   30   29
   GRIDCART elev 48  0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    6
8  16  26
   GRIDCART elev 48 19   13    6    5    1    5    9   11   14   24   25   46   32   36   42   43   32   29   28
   GRIDCART elev 49  0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0
7  13  13
   GRIDCART elev 49 12    6    4    3    3    3    5    9   13   15   25   38   30   34   33   42   30   27   26
   GRIDCART elev 50  0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0
0   6   9
   GRIDCART elev 50  8    5    2    5    7    3    7   10   12   14   22   24   37   46   33   30   31   25   24
   GRIDCART elev 51  0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0
0   0  13
   GRIDCART elev 51 14    3    5    4    4    5    6   10   14   16   20   27   30   42   36   30   26   24   23
   GRIDCART elev 52  0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0
0   0   2
   GRIDCART elev 52 12    2    0    0    1    4    6    9   12   13   24   32   40   52   50   33   29   24   23
   GRIDCART elev 53  0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0
0   0   0
   GRIDCART elev 53  1    0    0    0    0    2    3    8    9   15   19   23   56   54   46   44   27   23   21
   GRIDCART elev 54  0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0
0   0   0
   GRIDCART elev 54  0    0    0    0    0    0    4    5    9   12   19   29   42   58   52   50   32   23   21
   GRIDCART elev 55  0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0
0   0   0
   GRIDCART elev 55  0    0    0    0    0    0    4    3    5   13   21   33   39   46   63   62   57   29   21
   GRIDCART hill  1 27   25   27   27   28   28   30   30   29   30   30   32   31   32   33   33   32   33   32   32   34   35   36
37  38
   GRIDCART hill  1 40   41   43   44   46   48   54   55   61   54   57   61   64   67   84   75   83   90   98 114
   GRIDCART hill  2 26   24   25   27   27   28   29   29   29   30   31   30   29   32   33   32   31   32   33   32   33   34   35
37  38
   GRIDCART hill  2 40   41   43   45   46   47   50   51   52   59   68   68   69   70   73   74   82   84   97 116
   GRIDCART hill  3 25   25   25   25   26   27   28   29   30   30   32   29   30   31   32   30   31   32   31   31   33   35   36
37  39
   GRIDCART hill  3 40   40   43   44   45   47   48   50   50   53   60   68   78   83   76   78   87 102 121 114
   GRIDCART hill  4 24   23   25   24   25   26   26   28   29   31   27   29   31   30   31   29   30   30   31   30   33   34   35
36  38
   GRIDCART hill  4 39   40   42   43   45   46   47   48   50   59   70   74   98   92   73   77   82   93 106 126
   GRIDCART hill  5 23   24   24   25   25   26   28   28   29   29   27   30   29   30   30   31   30   29   30   31   32   32   33
36  37
   GRIDCART hill  5 38   41   42   42   45   46   47   48   51   57   74   86   78   77   72   81   89   95 101 132
   GRIDCART hill  6 22   23   24   24   25   26   29   29   29   29   24   31   35   29   30   28   28   30   29   31   31   33   35
35  37
   GRIDCART hill  6 38   40   41   42   43   45   44   46   48   57   65   78   79   66   74   94   85   89   99 126
   GRIDCART hill  7 22   22   23   25   25   26   28   29   29   28   26   29   29   29   28   28   30   28   29   29   31   32   34
35  36
   GRIDCART hill  7 38   39   40   40   42   42   45   46   49   51   56   63   69   68   73   73   82   86   95 101
   GRIDCART hill  8 21   22   23   24   25   26   27   34   35   30   25   29   28   37   26   28   28   28   28   30   31   32   35
34  36
   GRIDCART hill  8 37   38   38   39   41   43   44   46   48   51   53   55   60   72   66   75   73   79   89   94
   GRIDCART hill  9 21   23   25   25   26   25   25   26   30   35   27   28   28   27   26   28   27   28   28   31   32   33   33
34  35
   GRIDCART hill  9 37   37   39   40   45   44   43   45   48   49   51   53   55   64   60   67   72   79   84   94
   GRIDCART hill 10 21   22   23   25   24   24   24   25   26   28   25   26   26   26   26   26   27   36   30   30   30   32   33
34  34
   GRIDCART hill 10 34   37   43   44   53   49   48   46   47   49   49   53   55   58   61   66   79   78   80   87
   GRIDCART hill 11 21   22   22   22   23   23   24   25   27   27   28   25   24   25   28   33   32   38   31   32   31   31   32
33  34
   GRIDCART hill 11 34   36   38   43   49   52   54   50   52   48   52   52   53   55   59   65   72   74   78   84
   GRIDCART hill 12 21   20   21   21   22   23   24   25   24   25   28   25   23   26   43   43   45   45   37   33   33   33   31
32  33
   GRIDCART hill 12 35   38   42   41   48   58   58   67   54   51   52   59   54   57   60   65   68   74   75   81
   GRIDCART hill 13 20   20   21   22   22   22   23   23   24   25   25   25   23   22   38   38   43   46   41   35   36   36   32
29  32
```

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   GRIDCART hill 13 35  38  44  41  47  58  69  62  56  54  56  58  57  61  60  63  64  69  72  79
   GRIDCART hill 14 19  20  21  21  23  24  21  23  23  23  27  24  24  21  24  27  36  35  40  39  35  39  32
29  31
   GRIDCART hill 14 33  36  43  37  46  59  63  77  62  60  63  72  60  63  59  62  63  66  70  74
   GRIDCART hill 15 19  21  20  20  22  22  22  21  21  23  25  25  23  20  24  23  26  27  34  43  32  38  29
28  29
   GRIDCART hill 15 31  33  34  35  41  47  58  71  72  93  65  88  68  65  73  83  65  64  67  72
   GRIDCART hill 16 19  19  19  20  21  21  21  22  21  24  22  24  22  22  23  23  22  24  33  46  32  30  27
26  28
   GRIDCART hill 16 30  30  34  35  40  45  60  70  67  93 105  88  78  71  87  94  74  63  68  71
   GRIDCART hill 17 19  19  19  19  19  21  21  20  22  22  21  23  21  22  22  22  20  33  33  44  32  27  28
26  27
   GRIDCART hill 17 28  31  33  36  38  70  70  68  66  90 105  78  76  92  96  98  74  66  64  68
   GRIDCART hill 18 17  16  17  19  19  20  19  19  20  23  20  23  20  21  22  21  21  20  42  42  35  25  26
25  26
   GRIDCART hill 18 27  28  32  35  38  42  50  70  69  96  91  72  72 103  94  86  74  71  67  67
   GRIDCART hill 19 17  17  18  18  18  19  20  19  20  22  21  22  23  18  21  21  20  20  38  38  30  23  23
25  25
   GRIDCART hill 19 27  29  31  34  36  41  51  58  62  79  84  74  74  84  98  87  74  71  70  73
   GRIDCART hill 20 16  17  17  18  18  18  18  19  20  22  22  21  21  19  21  20  20  20  38  29  27  23  23
24  25
   GRIDCART hill 20 26  30  30  33  35  38  46  58  63  62  77  65  69  79  90  89  76  72  72  78
   GRIDCART hill 21 15  16  17  17  17  17  16  18  19  20  19  22  21  18  19  20  20  21  27  27  27  21  21
23  25
   GRIDCART hill 21 26  30  33  34  36  37  41  58  53  53  60  61  73  77 107 107  79  74  75  86
   GRIDCART hill 22 16  17  17  17  17  17  17  18  18  19  19  20  19  17  17  19  19  19  17  24  22  35  35
24  24
   GRIDCART hill 22 27  29  33  34  36  39  41  45 119 119  56  62  65  64  77  87  81  83  78  86
   GRIDCART hill 23 15  17  15  16  17  16  16  17  18  20  16  19  19  17  19  18  18  17  16  22  43  43  35
43  26
   GRIDCART hill 23 28  28  31  34  36  39  40 119 119 119 119  86  77  66  89  78  72  83  89  93
   GRIDCART hill 24 14  15  15  15  15  16  16  17  17  20  17  18  17  18  17  17  17  17  18  17  43  43  43
36  27
   GRIDCART hill 24 28  29  32  34  36  37  40 119 119 119  90  71 101  71  73  81 101 101  82  91
   GRIDCART hill 25 15  14  14  15  15  14  15  16  17  19  18  17  17  17  16  17  16  16  16  17  33  26  34
39  33
   GRIDCART hill 25 28  29  30  37  36  35  40 119 119 119  88  73  90  83  69  81  65  89  76  84
   GRIDCART hill 26 11  14  13  14  15  14  15  15  15  18  17  17  15  16  16  16  15  15  16  33  33  33  42
43  47
   GRIDCART hill 26 33  30  29  32  37  33  41  56  56 102 102  70  83  88  81  69  62  84  81  74
   GRIDCART hill 27 14  13  13  14  14  14  15  15  15  16  15  16  12  17  15  15  14  14  16  17  20  38  38
43  55
   GRIDCART hill 27 55  29  27  30  35  38  38  70  70  62  73  64  63  86 111 111  59  64  76  69
   GRIDCART hill 28 11  13  13  12  13  13  15  14  15  15  16  16  13  14  14  12  13  14  13  16  29  29  42
51  52
   GRIDCART hill 28 41  30  26  27  29  38  42  69  69  90 103 103  60  74  90  74  62  55  58  68
   GRIDCART hill 29 12  11  13  14  12  13  14  14  15  14  15  16  12  15  14  13  12  14  14  14  27  27  37
44  53
   GRIDCART hill 29 43  31  22  25  26  47  47  88  88  88  76 103  58  63  81  74  61  54  55  65
   GRIDCART hill 30 11  11  12  12  12  12  14  13  12  13  14  14  14  14  13  12  11  14  12  13  16  34  34
37  46
   GRIDCART hill 30 32  27  21  24  25  49  49  88  88  61  53  47  64  53  63  71  59  57  51  58
   GRIDCART hill 31 12  11  11  11  12  11  12  12  12  11  13  13  11  14  12  12   9  12  12  11  15  21  28
31  43
   GRIDCART hill 31 34  34  20  23  23  49  49  33  88  61  44  44  48  52  56  59  55  54  50  52
   GRIDCART hill 32 12  10  11  12  11  11  12  12  12  10  11  12  14  14  11  12  10   9  11  15  15  21  25
43  43
   GRIDCART hill 32 43  34  19  20  24  24  26  29  32  36  37  63  44  51  53  53  56  54  50  48
   GRIDCART hill 33 11  11  11  10  11  10  11  12  12  11   9   9  11  12  11  11   8  10  10  11  14  15  19
23  21
   GRIDCART hill 33 43  16  17  19  21  23  26  27  31  83  83  63  50  55  68  54  52  51  50  48
   GRIDCART hill 34 10  10  10  11  10  11  10  10  11  10  10  11  11  11  12  11  10   7  10  10  10  12  16
23  21
   GRIDCART hill 34 14  15  15  20  22  23  25  27  29  83  83  83  73  53  73  55  50  48  47  47
   GRIDCART hill 35  7   8   9  10   9  10  10  10  10  10   9   9  10  11  11   9   9   8   8   8   9  16  13
11  13
   GRIDCART hill 35 14  13  15  17  19  22  22  24  61  61  61  70  80  62  73  61  94  94  94  42
   GRIDCART hill 36  7   6   7   8   9   9   9   9   9   9   9   9   9  10   8  10   9   8   8   7   8  13  10
10  11
   GRIDCART hill 36 15  13  14  16  18  20  21  22  61  61  61  57  63  63  86  71  94  94  94  94
   GRIDCART hill 37  6   6   6   8   7   8   8   8   7   9   8   9   9  10  10   8   9   7   8   7   6   8  25
25  25
   GRIDCART hill 37 25  15  13  16  16  18  20  20  24  29  56  56  68  79  75  75  73  78  94  41
   GRIDCART hill 38  4   5   5   6   7   8   8   6   8   8   7   8  10   7   9   9   8   7   8   8   6   6  27
25  25
   GRIDCART hill 38 25  30  30  17  16  18  19  21  25  28  56  68  49  67 105 105 105  85  85  43
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   GRIDCART hill 39  5   5   6   5   7   6   6   6   6   8   7   9   8   8   6   8   8   8   7   8   6  30  30
30  27
   GRIDCART hill 39 27  30  32  32  16  17  18  19  24  26  30  36  52  61  91  91  63  84  84  43
   GRIDCART hill 40  7   7   6   9   7  12  12   6   5   5   9   9   9   8   6   8   7   7   6   6   8  30  30
30  30
   GRIDCART hill 40 30  37  32  32  18  16  18  20  22  23  28  35  41  51  56  81  56  71  84  40
   GRIDCART hill 41  7   8   8   9   7  12  12  12  12   6   7   7   6   8   8   7   7   6   6   5   5  30  30
30  30
   GRIDCART hill 41 22  29  26  21  18  16  18  18  21  29  29  33  37  42  58  80  56  58  43  38
   GRIDCART hill 42  8   8   8   9   7  12  12  12   6   6   6   5   8   8   5   5   6   5   6   6   5  19  19
19  14
   GRIDCART hill 42 27  27  28  28  19  15  15  17  20  28  28  31  45  54  53  72  72  46  40  38
   GRIDCART hill 43  8   8   9   9  12  12  12  12   8   8   7   7   6   6   5   7   7   6   5   6   5  19  19
19  19
   GRIDCART hill 43 21  29  29  17  14  13  14  16  19  49  30  39  60  60  58  55  48  42  38  34
   GRIDCART hill 44  8   8   9  12  12  12  12  12   8  10  10   8   6   7   7   8   8   9   6   5  19  19  19
19  19
   GRIDCART hill 44 24  29  29  17  12  12  13  15  49  49  49  47  51  66  55  45  43  38  37  35
   GRIDCART hill 45  8   8   9  12  12  12  12  12  10  10  10   6   7   7   7   8   9   9   9   7   7  19  19
19  33
   GRIDCART hill 45 30  30  30  33  11  10  11  16  49  49  49  45  64  69  51  48  38  35  35  32
   GRIDCART hill 46  8   9  12  12  12  12  12  10  10  10  10  10   7   6   6   8   9   9   8   8   5  10  26
26  33
   GRIDCART hill 46 33  33  23  28  28   9  49  49  49  49  49  48  48  48  48  46  39  31  31  32
   GRIDCART hill 47  8  12  12  12  12  12  12  10  10  10  10  10   7   6   6   8   9   8   8   8  10  10  10
26  26
   GRIDCART hill 47 26  33  28  28  28  28  49  49  49  49  48  48  46  45  39  43  51  51  30  29
   GRIDCART hill 48  8  12  12  12  12  12  12  10  10  10  10   7   7   6   6   6   8   8   8   8  10  10  26
26  26
   GRIDCART hill 48 26  19  28  28  28  28  49  49  49  48  24  46  46  32  36  42  43  32  29  28
   GRIDCART hill 49 12  12  12  12  12  12  10  10  10  10  10   7   7   6   6   6   8   8   8  26  26  26  26
26  26
   GRIDCART hill 49 26  26  28  28  28  28  49  49  24  24  46  46  38  30  34  33  42  30  27  26
   GRIDCART hill 50 12  12  12  12  12  12  10  10  10  10  10   7   6   6   6   6   8   8   8  26  26  26  26
26  26
   GRIDCART hill 50 26  26  28  28  28   7   7   7  10  12  38  38  38  37  46  33  30  31  25  24
   GRIDCART hill 51 12  12  12  12  12  12  10  10  10  10  10   7   6   6   6   8   8   8  26  26  26  26  26
26  13
   GRIDCART hill 51 13  14  14  14  28   7   5  10  10  14  16  20  27  52  42  36  30  26  24  23
   GRIDCART hill 52 12  12  12  12  12  10  10  10  10  10  10   7   6   6   6   8   8  26  26  26  26  26  13
13  13
   GRIDCART hill 52 13  12  12  14  14   7  10   9   9  12  56  56  56  40  52  50  50  29  24  23
   GRIDCART hill 53 12  12  12  12  12  10  10  10  10  10  10   6   6   6   6   8  26  26  26  26  26  13  13
13  13
   GRIDCART hill 53 12  12  12  12  12   9  56  56  56  56  56  56  56  56  54  46  44  44  57  21
   GRIDCART hill 54 12  12  12  12  10  10  10  10  10  10  10   6   6   6   6   8  26  26  26  26  13  13  13
13  12
   GRIDCART hill 54 12  12  12  12  12  56  56  56  56  56  56  56  56  42  58  52  50  57  57  57
   GRIDCART hill 55 12  12  12  12  10  10  10  10  10  10  10   6   6   6   6  26  26  26  13  13  13  13  13
12  12
   GRIDCART hill 55 12  12  12  12  12  56  56  56  56  33  33  33  33  39  46  63  62  57  57  57

RE GRIDCART C500 END

RE FINISHED

ME STARTING
   SURFFILE  3km.sur FREE
   PROFFILE  3km.up
   SURFDATA  54321   1999  UNK
   UAIRDATA  99999   1999  UNK
   PROFBASE  0.0
ME FINISHED

OU STARTING
   RECTABLE 1  FIRST-SECOND
   RECTABLE 24 FIRST
   PLOTFILE 1 ALL 1st all2_nox_1h.dat
   PLOTFILE 1 ALL 2nd all2_nox_2h.dat
   PLOTFILE 24 ALL 1st all2_nox_24.dat
   PLOTFILE PERIOD ALL all2_nox_an.dat
OU FINISHED
```