5

CLIMATE

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5 CLIMATE

This section describes the typical climatic patterns of the Ensham Central Project site and surrounds and identifies climatic extremes in relation to natural and other hazards.

5.1 REGIONAL CLIMATIC PATTERNS

The Central Highlands region has a sub-tropical continental climate characterised by high variability in rainfall, temperature and evaporation and can experience droughts, floods, heatwaves and frosts. In general winter days are warm and nights are cool, while summer days are hot and nights are warm. Rainfall is summer dominant with almost half falling from December to February from thunderstorms and tropical lows associated with cyclones.

Climate data has been collected from the Bureau of Meteorology (BoM) Emerald Post Office and Comet Post Office stations, which are the closest BoM long-term meteorological stations. Data has also been collected from the Department of Primary Industries (DPI) Field Station north of Emerald. Local rainfall has been recorded by the proponent since 1997 at the Duckponds Rainfall Station. In addition, shorter term but more detailed wind and associated climate data from the Emerald automatic weather station (AWS) at the Emerald Airport was used for dust modelling in the *Air Quality Assessment* (*Appendix F*). Figure 5-1 identifies the location of these climate stations relative to the project site.

5.2 TEMPERATURE

December and January are the warmest months reaching average high temperatures of 34.8ºC, while June and July are the coolest months with average highs of 22.4ºC. Humidity is relatively consistent throughout the year with mornings ranging from 55%-69% and afternoons ranging from 33%-47% with spring months drier than the rest of the year.

Table 5-1 provides details of long term average temperature and humidity by month including morning and afternoon.

5.3 RAINFALL

Rainfall in the Central Highlands is seasonal and extremely variable with the majority falling during the summer months.

Table 5-1 provides long term averages, together with, highest monthly rainfall recorded at Emerald Post Office Meteorological Station. Average monthly rainfall ranges from around 28 mm/month in winter to 103 mm/month in summer. Most rain between September and December is from thunderstorms with high intensity runoff (*Department of Natural Resources, 2000*). The annual average rainfall is 639.5 mm occurring over about 59 raindays. Almost half (46%) of annual rainfall occurs during the summer months of December to February.

Actual monthly rainfall recorded by the proponent at Duckponds is provided below in Table 5-2. A comparison of climate data between Duckponds and Emerald shows similarities but with variation in rainfall. Variations in rainfall are most likely due to the localised rainfall associated with tropical lows together with topography.

The 108 year average rainfall records from the Comet Post Office have been used for mine water balance calculations described in Section 11 – Mine Water Management.

Table 5-1
Emerald Meteorological Data - Climate Averages

Month	Temperature (°C)		Relative Humidity (%)		Monthly Rainfall (mm)		Average Raindays
	Min	Max	9am	3pm	Average	Highest	
January	21.4	34.2	65	44	103.4	556.3	8.3
February	21.0	33.2	69	47	99.7	470.8	7.7
March	19.4	32.0	67	46	69.3	339.6	6.1
April	15.7	29.4	64	42	35.9	191.1	3.8
May	11.5	25.7	65	44	35.2	258.1	3.7
June	8.4	22.7	68	45	33.9	299.2	3.3
July	6.9	22.4	65	42	28.8	199.8	3.2
August	8.1	24.8	59	37	20.7	131.0	2.8
September	11.8	28.3	56	33	23.5	130.6	2.8
October	16.1	31.6	55	33	39.2	165.6	4.6
November	18.9	33.7	57	35	58.8	246.1	5.8
December	20.7	34.8	60	38	91.0	317.2	7.4
Annual Average	**15**	**29.4**	**62**	**40**	**639.5**	**-**	**59.5**

Source: Emerald Post Office (*Long Term Average 1882-1992*), BoM, 2004

Table 5-2
Actual Monthly Rainfall Recorded at Duckponds

Month	Rainfall (mm)								
	1997	1998	1999	2000	2001	2002	2003	2004	2005
January	48.0	0.0	93.0	78.5	21.0	20.0	20.0	128.0	92.0
February	91.0	0.0	20.0	112.0	32.5	95.5	84.0	63.0	62.0
March	56.0	0.0	55.0	19.5	67.5	12.0	0.0	0.0	3.0
April	6.0	160.0	14.0	89.0	24.0	0.0	18.0	12.0	0.0
May	32.0	40.0	0.0	41.5	0.0	30.0	0.0	0.0	65.0
June	10.0	50.0	25.0	42.0	43.0	76.0	0.0	0.0	73.0
July	0.0	0.0	13.0	9.0	15.5	0.0	11.0	0.0	4.0
August	13.0	111.0	5.0	33.0	0.0	11.5	43.0	0.0	7.0
September	10.0	100.0	0.0	0.0	6.0	0.0	0.0	0.0	0.0
October	0.0	247.0	38.5	112.0	48.0	0.0	35.0	10.0	108.0
November	52.5	20.0	40.0	89.5	44.0	0.0	16.0	42.0	33.0
December	96.0	232.0	0.0	74.0	15.5	38.5	189.0	106.0	55.0
Annual	**414.5**	**960**	**303.5**	**700**	**317**	**283.5**	**416**	**361**	**502**

Source: Ensham Resources, 2004-2005

5.4 EVAPORATION

The closest meteorological station to the project recording pan evaporation is the DPI Field Station located north of Emerald (Figure 5-1). Table 5-3 provides monthly low, mean and high long term pan evaporation data from the DPI Field Station. Evaporation exceeds mean rainfall during all months with the highest moisture deficit occurring during spring and summer. The average annual evaporation recorded is 2,141 mm indicating a deficit of more than 1,500 mm per year.

Table 5-3
DPI Field Station Pan Evaporation Long Term Averages

Month	Monthly Evaporation (mm)		
	Low	Mean	High
January	127	244	301
February	139	189	263
March	121	199	257
April	108	162	219
May	84	127	155
June	66	102	126
July	81	114	158
August	115	147	186
September	132	191	258
October	174	235	304
November	147	241	345
December	183	257	363
Annual Average	**1,622**	**2,141**	**2,619**

Source: BoM, 2005

5.5 WIND

In winter months, daytime winds are predominantly from the south-east with north and north-easterly winds rare. During the summer months, daytime winds are predominantly from the east, whereas evening and night-time wind is from the north-east to east with winds from the west and south-west rare. The stronger speed winds generally occur during daytime throughout the year. Wind roses indicating the direction and speed of wind are provided in the *Air Quality Assessment* (*Appendix F*).

Careful attention has been paid to the selection of appropriate wind data in the impact assessment process. This is detailed further in the *Air Quality Assessment (Appendix F)* and the *Noise Assessment (Appendix G)*.

5.6 TEMPERATURE INVERSIONS AND EXTREMES OF CLIMATE

Low lying and flat areas in the valleys are affected by frequent strong overnight and early morning temperature radiation inversions during winter months and early spring (*Personal communication with David Millhouse, BoM on 21 March 2005*). The Central Highlands region is also prone to

periodic droughts and, according to David Millhouse of BoM, rainfall patterns are getting drier in eastern Australia including the Emerald region (*Personal communication with David Millhouse, BoM on 21 March 2005*). The impacts of variable rainfall, and in particular drought, on the project's water supply and balance are assessed in Section 11 – Mine Water Management.

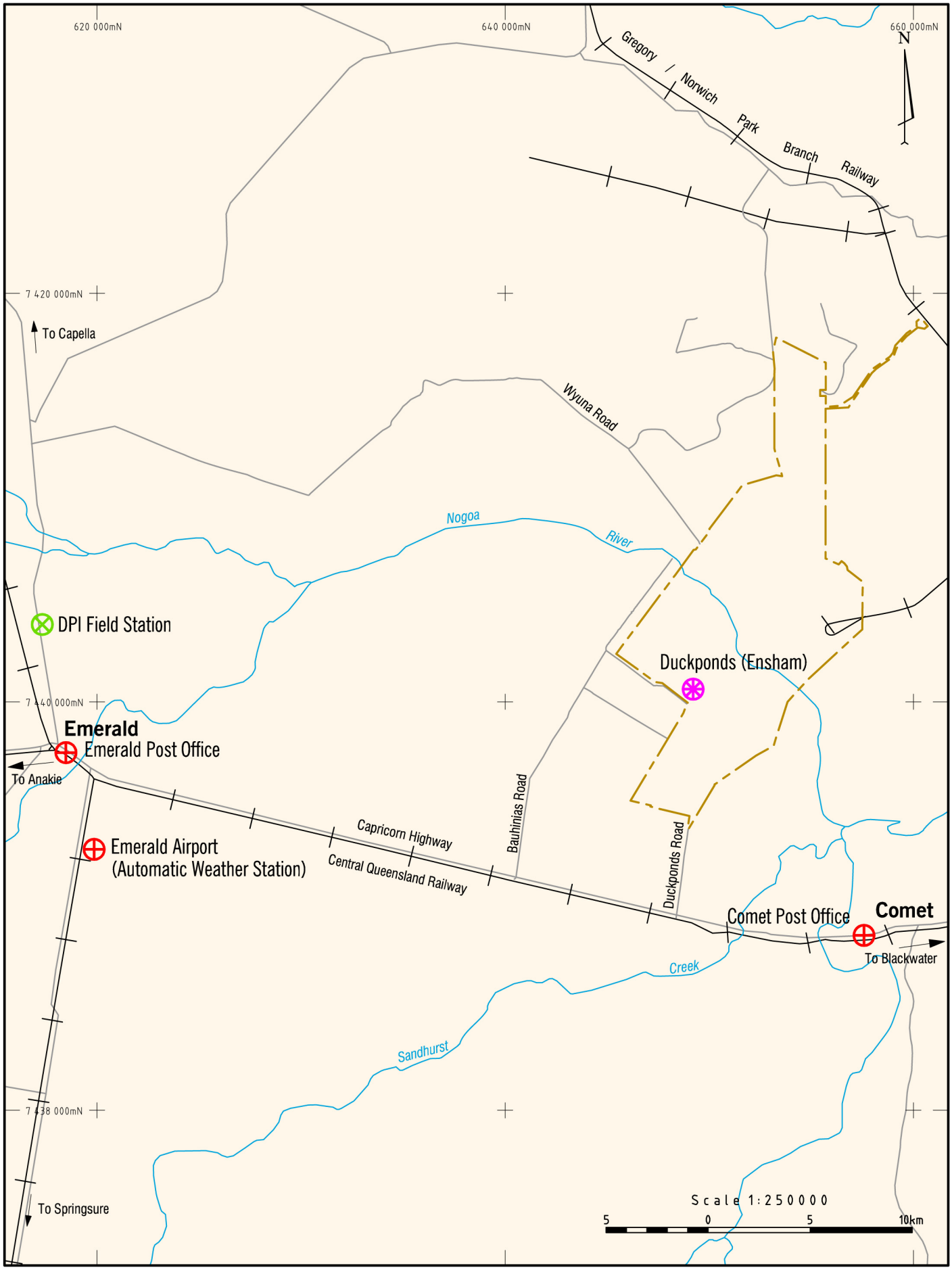
Cyclonic winds have not been identified in the region as they mainly affect Queensland's coastal areas, with the greatest threat north of the Tropic of Capricorn. Given the distance to the coast of almost 200 km, the project is unlikely to experience cyclonic winds. However, rain and flooding associated with ex cyclones have affected the region including ex cyclone Beni in March 2003 (*Department of Emergency Services, 2003*). Flooding is a potential hazard along the Nogoa River. Flooding hazards and water management is described in Section 11 – Mine Water Management and Section 12 – Surface Water.

The predicted increase in extreme weather events in Queensland is discussed in Section 12.7.5 of this EIS. The impact of possible future increases in rainfall intensity on the post-mining landform has been addressed in the Surface Water Study (Section 12 and *Appendix C* of this EIS) and included consideration of the Probable Maximum Flood (PMF) event.

The greatest bushfire danger occurs usually after the dry winter/spring period, before onset of rains in the summer months where the low relative humidity, high winds and lack of rain are common. The Queensland Rural Fire Service prepares Bushfire Risk Maps which indicate the varying risk of bushfire throughout Queensland. These maps indicate that most of the project site is classified as being of low bushfire hazard, with a minority (less than 15%) classified as being of medium bushfire hazard. The areas of medium hazard are predominately located in the central area of the existing mine pits on the northern bank of the Nogoa River. Key strategies to minimise the risk of bushfire are described in detail in Section 20 – Health and Safety.

Queensland is seismically active (University of Queensland [2005] *Earthquake Information).* Earthquakes with a Richter magnitude test scale of 4 M_L have been known to occur in the region. The higher risk areas where earthquakes with a potential to cause serious danger (>5 M_L) are located along and off the east coast and therefore the risk to the project is minor.

FIGURES



Bureau of Meteorology Meteorological Station
Ensham Resources Rainfall Station
Department of Primary Industries Meterological Station
Mining Lease and Mining Lease Application Area

ENSHAM CENTRAL PROJECT

Location of Relevant Meteorological Stations

Ensham RESOURCES HANSEN CONSULTING

FIGURE 5-1