COAL&ALLIED

MOUNT PLEASANT MINE COMMISSION OF INQUIRY

Primary Submission

Report No. 98014RP1

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Date:	*29 June 1998*

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Chapter 1

INTRODUCTION

1.1 BACKGROUND

1. Coal & Allied Operations Pty Limited have lodged a development application for approval to establish an operate the Mount Pleasant mine in the Upper Hunter Valley, west of Muswellbrook. The development application was lodged with the Muswellbrook Shire Council on 24 October 1997.

2. Coal & Allied was granted an Authorisation to Prospect under the mining legislation in April 1992 (Authorisation No 459). Since that time the company has undertaken extensive exploration, environmental background surveys and mine feasibility studies in the Authorisation area. Additionally the company has sought to ensure the community are aware of the company's proposals and have an opportunity for input, discussion and feedback. This has been achieved by personal contact, by the company's shop front display and information centre in Muswellbrook and by liaison with the Council and government authorities.

3. The company has been and continues to be keen to involve the Council and the community in resolving issues associated with the proposal. This was particularly demonstrated by the company's involvement with the Council in providing a location for its surface facilities meeting community objectives.

4. The process of preparing the EIS has been characterised by a commitment of the company to best practice environmental management and meaningful public involvement to ensure optimal outcomes.

5. The development application was accompanied by a four volume Environmental Impact Statement prepared by ERM Mitchell McCotter Pty Ltd, environmental consultants. The development application is designated development under Schedule 3 of the Environmental Planning and Assessment Regulation 1994. The development application and the EIS was publicly exhibited between 29 October 1997 and 17 December 1997. In response to the public display a total of 149 submissions were lodged, including five from government and statutory authorities.

1.2 PLANNING PROCESS

6. The principal environmental planning instruments affecting the proposal are the Muswellbrook Local Environmental Plan, 1985, the Hunter Regional Environmental Plan, 1989 and State Environmental Planning Policy No 45 - Permissibility of Mining. The proposal covers lands zoned Rural 1(a) and General Environment Protection 7(L1) Alluvial Areas zone, and under the relevant environmental planning instruments is permissible development subject to development consent.

7. Additionally, the proposal is subject to a direction under Section 101 of the Environmental Planning and Assessment Act, 1979 by virtue of which the determination of the development application is a matter for the Minister for Urban Affairs and Planning following consideration of the report of a Commission of Inquiry.

8. The company's proposal also involves the abstraction of water from the Hunter River at times during the life of the development and hence an application was lodged with the Deaprtment for Land and Water Conservation for a licence under the Wate Act, 1912. The water licence application was publicly exhibited in the Government Gazette and Muswellbrook Cronicle on 20 February 1998. Following this public exhibition, no submissions were received on the company's application for a licence under the Water Act.

9. The company has also lodged an application for a Mining Lease under the Mining Act, 1992. The Mining Act provisions require the grant of a development consent prior to the grant of a mining lease. The Department of Mineral Resources administers the compliance of mining operations with the Mining Act and additionally includes detailed conditions in any mining lease granted. Further the Mining Act provides for compensation for affected land owners and mechanisms for dispute resolution throught the Mining Warden.

10. Following grant of development consent, mining propoals are required to obtain additional approvals for the detailed operations, the most important of which are the various licences from the Environment Protection Authority and consents from the Department of Land and Water Conservation and the National Parks and Wildlife Service. Further approvals are also required to be obtained from the Muswellbrook Shire Council under the Local Government Act, 1993.

11. Coal mining activities form a significant land use in the Upper Hunter, with existing mines at Drayton, Bayswater and Dartbrook and with the Bengalla project being established. Further proposals exist for mine development at Kayuga. The Mount Pleasant project site lies between the Bengalla mining lease to the south and the Kayuga proposal to the north. Of importance to the company in designing the environmental safeguards for the project and identifiying the projected impacts is

the need to account for the Mount Pleasant propoal in the context of neighbouring existing and proposed mining development. The EIS has pioneered assessment of the proposal in this context and together witht the regional assessments undertaken by the Department of Urban Affairs and Planning following the Bayswater No 3 and Bengalla Commissions of Inquiry has provided a basis of ensuring that cumulative impacts can be properly understood and accounted for the assessment process.

1.3 COMPANY PROFILE

12. Coal & Allied forms part of the Rio Tinto group. Coal & Allied has been a long standing participant in the coal industry in the Hunter Valley. Rio Tinto is committed to a long term participation in the coal industry in the Hunter Valley and is keen to include Mount Pleasant in its future bank of mines to supply the market. The Mount Pleasant project can meet the criteria used by Rio Tinto for new investments at a time when the company has been growing its coal investments.

13. The company believes that demand for coal will continue to grow, but considers the market will remain competitive and prices will not dramatically increase. The current Asian financial crisis is seen as a period of financial adjustment, and the company believes that long term coal demand will continue over time.

1.4 SUBMISSION OBJECTIVES

14. The company's primary submission to the Commision of Inquiry has been prepared with the following objectives:

1. To provide a concise introduction and overview of the proposal.

2. To highlight the assessment of the key environmental interactions arising from the project, particularly noise impacts, water management, air quality, visual assessment, transport, biodiversity, cultural resource management and cumulative impacts.

3. To outline the company's approach to environmental management for the Mount Pleasant proposal and how it sees it can implement the proposal in the context of affected landowners.

4. To address key issues and concerns arising out of the submissionsby the community and government authorities on the DA and EIS.

15. It is not proposed in the Primary Submission to repeat extensively material already available in the EIS and other available documents. The Primary Submission has been prepared by the individual experts in each area who will be available to assist the Commision and the public.

Chapter 2

PROJECT DESCRIPTION

2.1 INTRODUCTION

16. This section describes key aspects of the proposed Mount Pleasant Mine. A detailed description of the project was outlined in Chapter Six of the EIS.

2.2 PROJECT OBJECTIVES

17. The aims of developing a new mine at Mount Pleasant are to provide Coal & Allied with long term coal reserves whilst achieving a balance between impacts on the local environment, community needs and economic viability. The objectives of the proposal are categorised into production and operational, environmental and socio-economic objectives.

18. Production and operational objectives focus on the establishment of a world class coal mine which will provide the company with long term coal reserves to supply existing and emerging markets.

19. Environmental objectives aim to minimise impacts on the surrounding environs, including both natural and human environments.

20. Socio-economic objectives aim to ensure that the project does not adversely affect the long-term land capability of the site, local visual amenity, community infrastructure and services, Aboriginal and European heritage, road networks and surrounding residential amenity.

2.3 NATURE AND EXTENT OF COAL RESOURCES

21. The Hunter Coalfield is located in the upper Hunter Valley and represents about 45 per cent of current recoverable coal reserves in New South Wales. These reserves are found in nineteen open-cut and six underground mines. In addition, about six new open-cut and two underground mines are proposed or in the development stage.

22. These coal mines are located between Branxton and Aberdeen forming the largest coal producing area in New South Wales with an annual run-of-mine coal production of about 59 million tonnes.

23. Mount Pleasant coal reserves are relatively shallow with large variations in coal seam thickness. All seams divide into distinguishable sub-seams or splits. In general, seams diverge to the north and west with total thickness of the geological sequence between the Warkworth to Edderton seams increasing in the same direction.

24. The seams best suited to open cut mining, listed in order from top to bottom, with their maximum number of splits, are:

- Warkworth, the upper seam (five splits);
- Mount Arthur (three splits);
- Piercefield (six splits);
- Vaux (five splits);
- Broonie (four splits);
- Bayswater (four splits);
- Wynn (nine splits); and
- Edderton, the lowest seam (four splits).

25. These seams can produce a range of thermal coals from a low to medium ash export product to a higher ash domestic product.

26. The total quantity of coal in the deposit is estimated to be 1,423 million tonnes. It is expected that about 439 million run-of-mine (ROM) tonnes of coal reserve could be recovered by open-cut mining.

2.4 PROJECT EVOLUTION AND NEGOTIATIONS WITH COUNCIL REGARDING SURFACE FACILITIES

27. The Mount Pleasant Authorisation was granted to Coal & Allied in April 1992. Prior to this, some limited geological exploration had been undertaken in the area by the Department of Mineral Resources and two private companies. In 1992 Coal & Allied commenced a three stage exploration program designed to allow an orderly progression through the conceptual, feasibility and detailed mine planning phases.

28. Explorations revealed a relatively shallow coal resource which is highly suited to open-cut mining methods. Several seams considered uneconomic for open-cut mining have potential for extraction by underground techniques.

29. An initial Planning Focus Meeting held in March 1995, gave government authorities and stake-holders a preliminary overview of the proposal and associated environmental issues. Mine planning and environmental impact assessment work advanced during 1995 and early 1996.

30. During this time Muswellbrook Shire Council through its Community Subcommittees expressed concerns about the proposed location of mine infrastructure on the eastern side of the mine. Consequently, a Joint Working Party was established by Coal & Allied under the guidance of an independent facilitator. The working party, which included mine planners and infrastructure designers, sought to reach an outcome that met local community needs while still ensuring the economic viability of the mine.

31. Other infrastructure locations and rail access options on the western side of the site were examined. One of these was a joint user facility with the proposed Bengalla mine, while another connected to the Bengalla mine rail loop by overland conveyor.

32. Approval of the Bengalla project in 1996 paved the way for an immediate commencement of its infrastructure and rail loop. As a consequence, Bengalla was unable to commit to a joint user facility as Mount Pleasant could not be developed in time.

33. Coal & Allied therefore proposed that mining infrastructure be located in the south-west corner of the site. This was about twice as far from Muswellbrook residential areas as the original proposal. Relocating mine infrastructure to the south-west changed access to the pit and lead to a rail loop to the south of the Mount Pleasant infrastructure area. This will be connected to the mine surface facilities by an overland conveyor.

2.5 MINING METHOD AND EQUIPMENT

34. The proposed mine will be built in year -1 with the typical equipment floor nominated in *Table 2.1*. At the same time, constractors will begin coal extraction wihile Coal & Allied's long term equipment is sourced, delivered and constructed. The ultimate vehicle fleet is given in *Table 2.2*.

35. The mine plan is based on a conventional multi-seam dragline operation with pre-stripping by a truck and shovel fleet. Most rock will be loosened by blasting and excavated with a large dragline accompanied by two electric shovels, a large hydraulic excavator and a number of front-end loaders. A fleet of rear dump trucks will haul rock and coal from the mine to emplacement areas and coal preparation facilities, respectively.

36. Run-of-mine coal will be transferred to the coal preparation plant via a hopper or stockpiled. Coarse reject from the washing process will be trucked to emplacements, while fine rejects will be pumped to the fines emplacement area near the south-west corner of the site.

37. Product coal will be stockpiled in the infrastructure area from where it will be conveyed to the rail loop.

38. Initially, coal will be mined by contractors before Coal & Allied's equipment is commissioned. Contractor equipment is likely to include a hydraulic excavator and front-end loaders with a fleet of rear dump trucks, as indicated in *Table 2.3*.

39. After Coal & Allied's equipment is commissioned, coal will be mined by a fleet of front-end loaders and rear dump trucks. Thin coal horizons will be ripped using tracked dozers while thicker seams will be drilled and blasted. Coal will be hauled via a series of temporary in pit high-wall ramps connected to the main western haul road. Haulage will be kept in-pit where practical.

Table 2.1 MINE CONSTRUCTION EQUIPMENT (YEAR -1)

Item	**Example Equipment Description***	**Quantity**
i. Coal Handling and Preparation Area Earthworks		
Tracked Dozer	Cat D10	2
Scrapers	Cat 621	8
Roller	Cat 825C	2
Grader	Cat 16G	2
Water Cart	20 kL	2
Fuel Tender Light Truck		2
ii. Paving Base Material		
Grader	Cat 16G	1
Roller 3 point 10t smooth drum		1
Water Cart	20 kL	1
Roller pneumatic tyre		1
Light Truck		1
iii. Drainage (Infrastructure Area)		
Light Truck	10 t	1
Back Hoe	Cat 436	1
Light Crane		1
Roller smooth drum vibrating		1
iv. Rail Loop		
Tracked Dozer	Cat D10	1
Scrapers	Cat 621	4
Roller	Cat 16G	1
Grader	Cat 16G	1
Water Cart	20 kL	1
Truck for Fuel		1
v. Fine Rejects Emplacement Area		
Self Powered Bowl Scraper	(Cat 631)	3
Water Cart	(20 kL)	1
Small FEL	(Cat996)	1
Tracked Dozer	43 tonne (Cat D9)	1
Compactor	43 tonne	1

Notes: t = tonnes, m^3 = cubic metres, kL = Kilolitres

* *description indicative of size and make only. Other equivalent plant may be used.*

Table 2.2 OPERATIONAL EQUIPMENT INVENTORY

Item	Example Equipment Description*	Project Year							
		1	2	3	4	5	10	15	20
i. Rock Removal									
Dragline	100m³ (Marion 8750)					1	1	1	1
Dozer - Dragline Support	100t (Cat D11)					1	1	1	1
Rope Shovel	44m³ (P&H 4100)	1	1	1	1	1	2	2	2
Large Excavator	530t (Liebherr 996)	1	1	1	1	1	1	1	1
Rear Dump Truck	270t (Dresser 930E)	5	6	6	6	6	11	10	8
Large Drill	(Drillteck D90)	1	1	1	1	2	3	2	2
Medium Drill	(Drillteck D75)	1	1	1	1	1	2	2	2
ii. Rock & Coal Removal									
Front-end Loader	23 wm (L1800)	1	1	1	1	1	1	1	1
Front-end Loader	20 wm (L1400)	2	2	2	2	2	2	2	2
Rear Dump Truck	218t (Dresser 830E)						11	14	14
Rear Dump Truck	190t (Dresser 730E)	8	8	12	11	10			
Drill	(Drillteck D40)	1	1	1	2	2	2	2	2
iii. Miscellaneous									
Dozer - General Operations	100t (Cat D11)	3	3	3	3	4	4	3	3
Dozer - Coal Handling	100t (Cat D11)	2	2	2	2	2	2	2	2
Rubber Tyred Dozer	(Tiger 690)	1	1	1	1	1	2	2	2
Scraper	(Cat 651)	1	2	2	2	2	1	1	1
Water Truck	(70 kL)	3	3	3	3	3	3	3	3
Grader	(Cat 166)	2	2	2	2	2	3	3	3
Cablereeler		1	1	1	1	1	1	1	1
Fuel and Lube Truck		3	3	3	3	3	4	4	4
Low Loader		1	1	1	1	1	1	1	1
Pit Pump		4	4	4	4	4	4	4	4
Mobile Lighting Set		8	8	8	8	10	12	12	12
iv. Fines Rejects Emplacement Area									
Self Powered Bowl Scraper	(Cat 631)	3	3	3	3	3	3	3	3
Water Cart	(20 kL)	1	1	1	1	1	1	1	1
Small FEL	(Cat996)	1	1	1	1	1	1	1	1
Tracked Dozer	43 t (Cat D9)	1	1	1	1	1	1	1	1
Compactor		1	1	1	1	1	1	1	1

Notes: t = tonnes, m^3 = cubic metres, kL = Kilolitres

* *description indicative of size and make only. Other equivalent plant may be used.*

Table 2.3 CONTRACTOR EQUIPMENT

Item	**Example Equipment Description****	**Project Year** -2	-1	1	2
Hydraulic Excavator	various		2		
Front-end Loader	$10m^3$ (Cat 992D)		1		
Rear Dump Truck	135t (Cat 785)		4		
Rear Dump Truck	85t (Cat 777)		5		
Tracked Dozer	(Cat D10)		2		
Rubber Tyred Dozer	(Cat 834)		1		
Rotary Drill	270mm				
Hydraulic Drill	125mm		1		
Grader			1		
Water Cart			2		
Compactor			1		
Roller			1		
Lighting Sets			3		
Fuel & Lube Truck			1		
Pumps			1		
Scraper			3		

Notes: t = tonnes, m^3 = cubic metres, mm = millimetres

** description indicative of size and make only. Other equivalent plant may be used.*

*** larger trucks may be used in the future.*

2.6 EXTRACTION PROCESS AND SEQUENCING

40. Coal will be initially extracted from a small pit in the Warkworth seam adjacent to the coal preparation facilities whilst the permanent mine infrastructure is built. Overburden from this excavation will be used as fill for the coal handling facilities, haul roads and fine reject emplacements. Coal from this pit will be washed at a portable modular plant before the main washery is built.

Year 1	Established coal mining commences. Excavations to the Piercefield and Edderton seam.
Year 3	Coal extraction in the Piercefield Pit concludes. Development of the North Pit commences.
Year 5	Initial box cuts in the North and South Pits complete, dragline commences operation alternating between the two pits.
Year 10	Southern end of the North Pit and the northern end of the South Pit merge to form a joint access system for the upper seam coal in both pits. Continued South Pit development.
Year 15	North Pit approaches final western limits, backfilling of the southern blocks of the North Pit commences.
Year 20	Dragline operations in the North Pit. Truck and shovel operations continue in the South Pit. Upper benches of the South Pit will merge within the Piercefield Pit.

2.7 SURFACE FACILITIES

41. Mining infrastructure will be built in the south-west corner of the site. It will include:

- an industrial area with workshops, administration and employee facilities;
- rail loading area;
- ROM and product coal stockpiles; and
- a coal preparation plant.

2.8 RAIL LOADING FACILITY

42. The proposed rail loop for the Mount Pleasant Mine will be adjacent to the Bengalla Mine Link Road, joining the Ulan Railway Line immediately west of the Bengalla Mine infrastructure area. The rail loop will extend for approximately four kilometres north from the Ulan Railway Line and will receive coal from the Mount Pleasant mine facilities via a conveyor crossing under Wybong Road.

43. The product coal reclaiming system and rail car loading facility will load coal into rail cars at a nominal rate of 5,000 tonnes per hour.

44. The rail loop will have capacity for two 9,000 tonne capacity trains, one being loaded whilst the other waits. Each train could be filled in less than two hours by the proposed loading facilities. Railway signals will be located at the end of the loop to control trains entering the Ulan line.

45. Traffic on the proposed loop is expected to average 3 trains per day (based on the maximum production rate), although the practical maximum usage of the loop is approximately 9 loading operations per day.

2.9 FINES REJECTS EMPLACEMENTS

46. Fine rejects will be pumped to a series of stepped emplacements near the south-west corner of the site. Initially, two emplacement walls will be formed at the top end of the catchment and an environmental dam will be constructed in the centre of the catchment. The central location of the environmental dam will maximise the amount of catchment water to downstream users. Waters from rehabilitated areas in the top of the catchment will be diverted around the centre dam to maximise downstream flows.

47. Emplacement walls will be raised in stages of approximately five metres to suit the operation of the dam and to avoid having to build a large dam wall at once. Emplacement walls will be built from coarse reject and other rock, with provision for a filter area and spillway. The environmental dam will be impermeable to prevent off-site discharges.

48. Fine reject will be pumped into the emplacement as a slurry. Excess water will be returned to the mine water management system for reuse in the coal preparation plant, dust suppression and other site uses. In general, two emplacements will be active at any one time. As each emplacement fills another will be placed immediately downstream. The dams will be designed and constructed to be stable during any future potential underground operations in this area.

2.10 PRODUCTION ESTIMATES

49. The Mount Pleasant deposit is capable of producing just under 8Mt per annum of high quality export thermal coal. In total, the mine will extract about 197 million tonnes of run-of-mine coal to produce about 142 million tonnes of saleable coal during its first 21 years. Lower grade products could potentially be supplied to the local power generation industry.

2.11 EMPLOYMENT AND ECONOMIC BENEFITS

50. The mine will operate 24 hours a day, seven days a week. The coal preparation plant, surface facilities and equipment will take two years to build and employ up to 253 people. The average operational workforce over the life of the mine will be 332. There will be a steady build up in the workforce over the first nine years, after which numbers will fluctuate between 364 and a peak of 380 in Year 13.

51. The operational phase of the project will deliver significant economic benefits to the region, the State and Australia through employment, income and output. These direct benefits will generate additional economic activity in other areas. For example, the mine will purchase goods and services from businesses in the region and wages spent by workers and their families will add to the local economy.

52. As a result of the 332 jobs created directly at the mine, it has been estimated that a further 528 jobs may be created in the region, leading to 848 new employment opportunities from the mine. These are most likely to be in related industries such as transport, plant and equipment hire, and maintenance.

53. It has been estimated that wages and salaries paid to the average number of employees at the mine will be around 24.6 million per year. With an income multiplier of 1.66 the flow on effect to the regional economy is expected to be $16.2 million, a total input to the region of $40.8 million.

54. At peak production Mount Pleasant will have an estimated production value of $340 million per year, generating a further $292 million in associated output.

2.12 GENERAL APPROACH TO POLLUTION CONTROL

55. A site-specific Environmental Procedures Manual will be prepared to specify monitoring and operational procedures. The manual will also establish procedures for mine security, complaint reporting and contingency plans to be followed in the event of an emergency. The Mount Pleasant Environment Management Plan was outlined in Sections 12.6 and 12.7 of the EIS.

Chapter 3

PROPERTY ACQUISITION

3.1 INTRODUCTION

56. This chapter addresses key aspects of property acquisition for the proposed mine. Further details are provided in the Environmental Impact Statement.

3.2 OWNERSHIP PATTERNS AND AREA OF POTENTIAL IMPACT

57. The development application area covers 70 properties as shown on *Figure 66* (Appendix H). Of these, 41 are privately owned, 15 are owned by Coal & Allied, 11 by other mining companies with the three remaining properties either Crown Land or owned by the Pastoral Protection Board. Property ownership details are shown on *Figures 24* and *25*.

58. There are 36 residences in the development application area, 11 of which are owned by Coal & Allied, four by other mining companies with the remainder privately owned.

59. These are 74 properties within the criterion dust deposition contour but outside the development application area. Sixty residences potentially affected by dust lie outside the development application area. Of these, 13 are owned by Coal & Allied and 10 by other mining companies. Properties significantly affected by dust are shown in *Figure 43* (Appendix H).

60. There are 81 residences within the criterion noise level contour, 45 of which are located outside the development application area. Nine residences are in addition to those already affected by dust. Of these one is owned by Coal & Allied, five by other mining companies and the remainder privately owned. A summary of noise affected residences is given in *Table H.3* and shown on *Figure 5.0* (Appendix H).

3.3 COMPANY'S APPROACH TO LAND PURCHASES

61. Coal & Allied has provided information to landowners to assist them with decisions about their future in relation to the Mount Pleasant development.

62. Since the granting of Authorisation 439 was granted in April 1992, Coal & Allied has actively assisted landowners within and close to the Mount Pleasant site by detailing current and planned activities.

63. Landowners who considered leaving were provided with a property valuation from registered valuers based on the rural market value (i.e. as unaffected by exploration or mining). Coal & Allied offered to purchase the property for the full market value. This meant landowners could sell without suffering any loss due to the Mount Pleasant Mine.

64. Coal & Allied has purchased about 30 properties representing over 60 per cent of landowners who initially indicated a desire to leave the area.

3.4 ACQUISITION FOLLOWING DEVELOPMENT CONSENT

65. Property acquisition after development approval will be subject to the conditions outlined in the development consent. In general, this will identify an area of affectation within which the Company will be obliged to acquire properties on emand. Usually, acquisition is triggered by a formal request to the Company by a property owner.

66. Coal & Allied will pay the owner an acquisition price which will take into account and/or provide payment for not less than the current market value having regard to:

- the existing and permissible use of the land;
- improvements to the land;
- the presence of any Council approved building or structure;
- the market value before the development commences;
- reasonable compensation for disturbance and relocation costs within the Hunter Valley;
- the owners reasonable costs of obtaining professional advice;
- capital gains tax; and
- the amount of any compensation payable under the Mining Act, 1992.

67. If any owner and Coal & Allied cannot agree on an acquisition price, either party may refer the matter to the Director General who shall appoint an independent valuer.

68. If properties outside the acquisition area are adversely effected by noise, dust emissions or vibrations from mining operations which exceed acceptable levels indicated in the development consent, or the relevant EPA amenity criteria, Coal & Allied will be required to undertake works or change operating practices to meet the criteria. If the EPA considers the Company is unable to meet the criteria then Coal & Allied will be required to purchase the affected lands.

69. Coal & Allied will appoint a qualified independent person to investigate landowner concerns and quantify the impact and sources of the impact. Coal & Allied will bear the cost of these investigations. The appointment of the independent person will be subject to approval by the Director General in consultation with Council, EPA and the relevant owner

70. If the independent investigation finds that relevant EPA amenity criteria are being exceeded, Coal & Allied will modify those areas of the mining operation which are causing the exceedances and undertake other measures, as agreed with the relevant owner to ameliorate the effects of the impact within three months of the investigation being completed.

71. Within six months of a completed investigation the relevant landowner may request Coal & Allied to arrange for further independent investigation. If these investigations reveal that levels from the mine operations continue to exceed relevant EPA amenity criteria, Coal & Allied will offer to purchase the property within six months of receipt of a written request from the relevant owner.

72. A copy of Coal & Allied's land acquisition policies are given in Appendix F.

Chapter 4

AIR QUALITY

4.1 INTRODUCTION

73. This primary submission has been prepared by Dr. Pavel Zib. It outlines the main aspects and findings of a quantitative air quality assessment and additional work undertaken subsequent to the EIS. The specialist air quality report was published as Supplementary Report 6 in Volume 4 of the EIS.

4.2 METEOROLOGICAL DATA

74. Meteorological data were collected on site near Coal Creek Road over a period of 24 months for use in the air quality modelling. The basic recording interval was one hour and mean values of wind speed, wind direction, air temperature and solar radiation were used together with records of sigma theta (standard deviation of horizontal wind direction) to develop input data files for the dust dispersion model.

75. Annual wind roses for the Mt. Pleasant site are reproduced in Appendix E.1. Both annual wind roses (Year 1995 from December 1995 to November 1996) confirmed a general orientation of the prevailing winds along a NW-SE axis which corresponds to the orientation of the Hunter Valley. Winds from the south-eastern quadrant were particularly frequent during the afternoon and evening. Most winds from the north-western quadrant were recorded at night and in the morning.

76. The monitoring location was well exposed to the wind and recorded moderate to fresh winds on many occasions. The frequency of occurrence of winds with mean hourly speeds of, at least, 20 kph in the records obtained over 2 years was 20.1 per cent. Almost 50 per cent (125 hours) of those winds were from the south-east. The duration of winds in excess of 30 kph from NNW was 52 hours, ESE 34 hours, NW 31 hours, and WNW 12 hours per year.

77. The highest daily average (a period of 24 hours) was 31 kph. The strongest winds occurred generally in the afternoon between 3pm and 5pm averaging about 18 kph over the entire monitoring interval.

78. The wind strength in 1996 was generally lower than in 1995. The number of hours with mean wind speeds of more than 30 kph dropped to 222 in 1996 giving an average of 242 hours per year over 1995 and 1996.

79. Generally south-easterly winds dominated the summer season both in terms of frequency of occurrence and strength. About two thirds of all recorded wind directions were from between south and east in summer. These winds also accounted for 85 per cent of the recorded hourly speeds in excess of 30 kph.

80. The frequency of winds from a sector between west and north was approximately 25 per cent in summer. Winds from the remaining directions corresponding to north-eastern and south-western quadrants were infrequent.

81. In winter, the prevailing winds were from a sector between west and north accounting for about 60 per cent of the recorded directions. Night-time and mornings were the times when west to northerly winds were most frequent.

4.3 EXISTING AIR QUALITY

82. A monitoring programme of dust deposition rates was established in 1993. Mean annual rates of dust deposition were consistently less than 2.0 g/m²/month. The only exceptions were sites No.4 near Kayuga with 2.7g/m²/month in 1994 and site No.3 at the leading edge of Muswellbrook which recorded an annual mean of 2.1g/m²/month in 1994.

83. Mean rates of deposition over the entire monitoring period from 1993 to 1996 ranged from 0.5g/m² /month at site No.12 to 1.8 g/m² /month at site No.3 shown on *Figure* 32 of the EIS.

84. The mean fractions of ash remaining in the samples after organic material was removed by combustion varied from about 40 to 70 per cent. These results confirmed that organic material of mainly plant and insect origin represented most of the total atmospheric fallout.

85. Monitoring of total suspended particulates (TSP) and particulate matter with a diameter less than 10 microns (PM10) in the ambient air was undertaken during 1993 and 1994 at seven locations.

86. Mean concentrations of TSP ranged from about 20 to 40 micrograms/m³ in 1993 and about 30 to 50 micrograms/m³ in 1994. The generally higher mean concentration of TSP recorded in 1994 were most likely a result of very dry weather conditions which persisted throughout much of the year.

87. The results of PM10 monitoring supported a view that the ratio of PM10 to TSP particles in the air on site ranges between 40 to 60 per cent. No mining took place in the area during the sampling period and the PM10 particles were mostly the result of other activities including agriculture, power generation and vehicular traffic.

4.4 MODELLING OF IMPACTS ON AIR QUALITY

88. Five individual years of the proposed mining operation were modelled including years 2, 5, 10, 15, and 20 which are representative stages in the development of the mine.

89. Detailed emission inventories of atmospheric dust were prepared for each selected year using a range of dust emission factors for individual types of mining activities. The resulting dust emission rates were divided into three particle size categories corresponding to fine, inhalable and coarse dust.

90. The calculated dust-to-coal ratios of between 0.82 and 1.21 kg/t were in general agreement with the results of dust emission inventories for a number of open cut coal mines in the Hunter Valley. The value of 1.21 kg/t which was calculated for Year 2 reflected an initial stage of project development with a low coal production. The highest total emissions were estimated for years 10 and 15.

91. Monitoring of existing dust deposition rates in the area surrounding the proposed development indicated mean annual levels of less than 2.0g/m^2/month. Hence, the impact of dust emissions from the proposal was assessed by direct reference to the EPA objective for protection of amenity.

4.5 CRITERIA OF ACCEPTABILITY

92. Details of the EPA amenity criteria for dust deposition are given in Appendix E.2. These seek to limit increases in mean annual dust deposition to 2 g/m^2/month (a cumulative total of up to 24 g/m^2/year) as a result of a new development.

93. The amenity criteria are applicable to those residential areas where the existing mean annual rate does not exceed 2 g/m^2/month. For rural, semi-rural and commercial areas, the existing mean annual rate is allowed to reach 3 g/m^2/month before the same incremental value is applied.

94. A list of EPA air quality criteria, which are mostly designed to protect public health, is reproduced in Appendix E.3. The list contains goals for total suspended particulates (TSP) and particulate matter less than 10 microns (PM10).

4.6 ENVIRONMENTAL SAFEGUARDS

95. A range of air quality safeguards will be implemented to minimise atmospheric dust generation from the proposed development. These safeguards will be based on current control techniques as recommended in New South Wales by the EPA and will be prescribed in the licence to operate to be issued following the approval process.

96. Additional dust control measures and safeguards have been incorporated into the mine design and include the provision of bund walls, the placement of haul roads as far west from the site boundary as possible, and the use of terrain to shield the general area to the east of the site from traffic on haul roads and other dust generating activities such as handling of rock material.

97. Mining safeguards will also be implemented which will prevent spontaneous combustion of coal and hence a potential for emission of sulphur oxides and smoke particles, including small particles with a diameter of less than 2.5 microns (PM2.5). Safeguards are described in more detail in Section 11.6 of the EIS document.

4.7 IMPACTS AND AREAS OF MAXIMUM IMPACTS

98. The results of predictive modelling are reported in *Figure 6.2.* (Appendix E.4). The figure shows an envelope of predicted mean annual increments in dust deposition equal to 2 $g/m^2/month$ from the operations at Mt. Pleasant. It indicates that the amenity criterion may be exceeded in a narrow strip of land, approximately 700 to 800 metres wide, outside the eastern boundary of the project site at some stage of the operation.

99. A similar result was obtained for area immediately south of the south-eastern corner of the lease area which contains the Bengalla mine. The highest potential for dust deposition would be in the later years of the Mt. Pleasant operations when Bengalla Mine has progressed further to the west.

100. The results also indicated a potential for increased dust deposition in excess of the amenity criterion outside the north-western corner of the mine site. This generally non-residential area will be directly downwind of mining and out-of-pit emplacement activities in frequent south-easterly winds. The predicted dust deposition rates for this area do not, however, affect non-residential land uses such as grazing.

101. *Figure 6.4* (Appendix E.4) shows an envelope of predicted increases of 50 micrograms/m^3 in mean annual concentration of TSP as a result of mining at Mt. Pleasant. An increase of 50 micrograms/m^3 would be needed to raise the total concentration from the current level of about 40 micrograms/m³ to the NHMRC objective for residential environments of 90 micrograms/m³.

102. The envelope of contour lines in *Figure 6.4* is again a conservative estimate of the area within which there is a potential for the NHMRC objective for residential environments to be exceeded at some stage of the project development. The corresponding contour lines shown in *Figure 6.4* outside the eastern Authorisation boundary indicated that a narrow strip of land up to 300 metres wide could be potentially affected by an annual increase in TSP concentrations.

103. The NSW EPA has also included an annual concentration of 50 micrograms/m³ for that portion of total suspended particulates (TSP) which have an aerodynamic diameter smaller than 10 microns (PM10). The PM10 particles typically form about 50 per cent or less of the TSP particles. As a result, the NSW EPA objective for PM10 particles is likely to be met or bettered in those areas where the TSP objective is met.

4.8 IMPACTS ON MUSWELLBROOK TOWNSHIP

104. Predictive results for the proposed Mt. Pleasant mine alone and, most importantly, for both the Mt. Pleasant and Bengalla mines combined, and Mt. Pleasant and Kayuga mines combined, indicates that dust deposition in the town of Muswellbrook will remain within the EPA amenity criteria at all times.

105. The modelling further showed that in all those locations, including the town of Muswellbrook, where the amenity criteria for dust deposition will be met, the NHMRC and NSW EPA objectives for annual concentrations of TSP and PM10 in the ambient air will also be met.

4.9 RELATIONSHIPS WITH DUST IMPACTS FROM BENGALLA AND KAYUGA

106. The above assessment included the potential for atmospheric dust from all proposed development to the west of Muswellbrook including the Mt. Pleasant project, Dartbrook, Bayswater No.3, Bengalla and Kayuga mines.

107. Isopleths corresponding to a predicted increment of 2.0 g/m²/month in the mean annual dust deposition rate were extracted from the respective EIS documents and transposed on the map reproduced in *Figure 6.5*. (Appendix E.4). Also transposed on the map were the corresponding isopleths for Mt. Pleasant as shown earlier in *Figure 6.2*.

108. Dartbrook and Bayswater No.3 are sufficiently distant not to interact from both within either the Bengalla, Mount Pleasant or Kayuga Mines

109. *Figure 6.6* shows combined isopleths from the Bengalla and Mt. Pleasant mines. The isopleths refer to increments in the mean annual dust deposition rate as determined from the published predictions for operations in Year 14 at Bengalla and the predicted values for Year 10 at Mt. Pleasant. The combined isopleths represent a 'worst-case' scenario combining the two operations at their peak activity.

110. The combined isopleth of 2.0 $g/m^2/month$ is an increment in the mean annual dust deposition rate for the 'worst-case' scenario to the west of Muswellbrook. An increment of about 1.0 $g/m^2/month$ in the mean annual deposition rate was indicated for Muswellbrook and between 1.0 and 1.5 $g/m^2/month$ for South Muswellbrook, should the mining activities at Bengalla and Mt. Pleasant peak at the same time.

111. Kayuga mine has been proposed on the northern boundary of Mt. Pleasant Mine. *Figure 6.7* (Appendix E.4) shows the position and extent of 2.0 $g/m^2/month$ isopleths which were predicted individually for the developments at Mt. Pleasant and Kayuga.

112. The separation between Kayuga and Bengalla Mines means their air quality impacts will not overlap. This finding is consistent with the Upper Hunter Cumulative Impact Study (DUAP, 1997) which found that atmospheric dust accumulations were confined to the vicinity of operating mines.

113. The cumulative effects of Mt. Pleasant and Kayuga were assessed using the same approach as for Mt. Pleasant and Bengalla. Assuming similar starting dates for both projects, the isopleth for Year 2 of both operations were combined in *Figure 6.8 (a)* which is reproduced in Appendix E.4. At this early stage of development, the Kayuga mine would be at its most eastern extent whilst Mt. Pleasant would be operating in the south-eastern section of the Authorisation. Kayuga mine will then progress further west, gradually reducing dust deposition rates in the east as illustrated in *Figure 6.7.* As a worst-case scenario, a combination of Year 5 at Mt. Pleasant and Year 2 at Kayuga was added to *Figure 6.8(a).* If the difference in timing of the projects varies from the above worst-case scenario, cumulative impacts will be reduced.

114. The situation near the completion of the first 20 years of operation at both mines was depicted in *Figure 6.8(b).* The potential to extend the cumulative area of influence from the two mines is far greater in the north-western section after the first 20 years of operation than in the north-east at the early stage of mining. This is because there will be an effective separation of operations in the early years of mining and the presence of SE and NW winds.

4.10 IMPACTS ON HUMAN HEALTH

115. Dust particles from mining are generated by mechanical forces (grinding, breaking) and their shape, size and composition are significantly different from particles emitted by combustion and industrial processes.

116. Recent epidemiological studies reported consistent associations between PM10 concentrations and health effects. PM10 consists of two size fractions which have different physiological as well as source characteristics. Fine size fractions smaller than 2.5 microns in diameter (PM2.5) were specifically responsible for adverse health effects.

117. Mechanically generated particles from mining and related sources are generally larger than 2.5 microns. The epidemiological studies emphasised the need to promote control strategies which target fine particles (PM2.5) as produced by direct emissions from non-mining sources and by secondary reactions of pollutants from combustion.

118. In recognition of those findings, the USEPA promulgated revised national standards for particulate matter in July 1997. New standards were added for PM2.5 which supplemented the existing PM10 standards. There were also changes in the way recorded values are calculated for comparison with the standards. Details of the new USEPA standards are given in Appendix E.5.

119. There is community concern at the intensity of episodic events such as visible blowing dust which occurs on windy days during dry weather and immediately after blasting. A range of air quality safeguards and dust control measures will be specified in EPA licence conditions to minimise the intensity and frequency of episodic events.

120. A recent study by the Department of Urban Affairs and Planning (DUAP, 1997) found that despite the occurrence of short-term dust episodes near operating coal mines there was no evidence to suggest that pollution goals were being exceeded or that public health was being adversely affected.

4.11 IMPACTS ON AGRICULTURE

121. There is continuing evidence from various studies in New South Wales and elsewhere that the current EPA criteria for protecting residential amenity gives an even higher standard of protection for livestock, pastures, cropping, viticulture, horticulture etc. At least one and probably two orders of magnitude (100 times) more dust would be needed to affect pastures and various types of agricultural activities than the levels expected outside the project site at Mt. Pleasant.

4.12 REVIEW OF OTHER AIR QUALITY SUBMISSIONS

122. During a meeting on 3rd December 1997, representatives of Muswellbrook Council requested that additional modelling be undertaken to illustrate the maximum variations in individual monthly dust deposition rates during adverse meteorological conditions. The request specified that the mining stage with the highest dust emission rates should be used together with meteorological data for two 'worst-case' months during each of winter and summer seasons.

123. This additional modelling illustrated possible 'worst-case' variations in the monthly rate of dust deposition within the previously predicted annual means. The increase in dust deposition during the worst month of the year may be, at the most, up to about twice the annual average.

124. Seasonal variations rather than the worst individual monthly variations would be less than that. Variations of up to 50 per cent of the annual mean could be expected from seasonal impacts. The summer season is usually defined as the six months from October to March, while the winter season is the remaining six months from April to September.

125. It is emphasised that the EPA criterion for incremental deposition of 2 $g/m^2/month$ applies to mean annual deposition rates and not to individual monthly or seasonal values.

126. A copy of the advice which the NSW EPA prepared for Muswellbrook Council was received for review just prior to the preparation of this submission. In its advice, the EPA stated that the emission of air pollutants would not be such as to warrant development consent being withheld. Regard has been taken in this statement of the conditions which the EPA can impose under pollution control legislation.

127. The EPA also provided detailed comments concerning the air quality assessment and predictive modelling in the EIS. The results of the modelling were generally confirmed.

128. In relation to short-term dust emissions, the EPA reaffirmed that there was no evidence that such incidents adversely impact on human health or the environment.

129. The EPA recommended that the proponent quantitatively assessed short-term PM10 concentrations. This assessment meant that a substantial amount of additional modelling had to be carried out. The results of this work are outlined in Section 4.13.

4.13 MODELLING OF PM 10 EMISSIONS

Additional modelling of PM10 emissions and short-term concentrations of PM10 particles in the ambient air used the ISC3ST short-term model. This required 12 months of meteorological data to be reprocessed into an ISC3ST format and recalculation of emission inventories to specify PM10 emissions instead of PM15 emissions. The later had been included together with TSP and PM2.5 emissions in original research work in Australia and the United States.

The NSW EPA recommended the ISC3ST model, based on its recent application to modelling particulate emissions from sources such as open-cut mines in the United States. Its performance in Australian conditions has not been tested.

The model requires a large amount of data and , when combined with a similar degree of detail which was included in the modelling of long-term concentrations and deposition rates in the EIS, has very long processing times. Consequently, a model for Year 20 was developed to represent the 'worst' case for the area located to the south-east of the project site. Details of an emission inventory of PM10 particles is provided in Appendix E.6.

Emission factors for PM10 and the corresponding particle size distributions are not as widely supported by experimental data as TSP and PM2.5 particles. Conservative assumptions were therefore used. A summary of the particle size distributions is included in Appendix E.7.

Where available, emission factors and particle size distributions for Australian conditions were used first and adjusted from PM15 to PM10 by factors which were listed in Supplement E to AP-42. Emission factors from the USEPA documentation were used in the remaining cases.

Unlike the EIS modelling, pit retention was not used with the total percentage of PM10 emissions estimated to be about 45 per cent of TSP emissions. This estimate is high and therefore conservative. Emissions of PM2.5 accounted for less than 10 per cent of PM10 emissions.

Despite the conservative modelling approach short-term (24 hr) concentrations of PM10 (99.0 percentiles) did not exceed the guideline level of 150 micrograms (as defined in Appendix E.3 and E.5.) in the residential areas of South Muswellbrook and Muswellbrook.

The main impact of particulate matter in the ambient air on health is from PM2.5 emissions particles. The USEPA set a standard of 65 micrograms/m3 for peak concentrations over an interval of 24 hours. Because PM2.5 emissions would constitute less than 20 per cent of PM10 emissions, the resulting concentrations in the same area would be less than 30 micrograms/m3 and so well within the guideline levels.

A contour map of the predicted PM10 concentrations is shown in Figure 7.1 (*Appendix E.8*). The figure , in fact, indicates 24 hour concentrations of between 70 to 90 micrograms/m3 for PM10 and a maximum of 15 to 20 micrograms/m3 PM2.5 for most of Muswellbrook and South Muswellbrook.

Chapter 5

NOISE

5.1 INTRODUCTION

130. This submission addresses key points of the noise impact assessment for the proposed Mount Pleasant Mine. These and other issues are covered in more detail in the Environmental Impact Statement.

5.2 EXISTING NOISE LEVELS

131. The area surrounding the proposed mine is rural in nature, with measured existing noise levels reflect this. Minimum repeatable background noise levels are relatively low, being approximately 30 dB(A) during both daytime and night-time periods.

132. Somewhat higher noise levels were measured within the township of Muswellbrook. Minimum repeatable background noise levels here were approximately 35 dB(A) during the day and 32 dB(A) at night.

5.3 NOISE LEVEL CRITERIA

133. Criteria for assessing noise from mining activities were generally based on guidelines in the Environment Protection Authority's Environmental Noise Control Manual. However, the criterion for daytime noise in rural areas was set at a higher level, reflecting recent determinations for other mines in the area. This is further discussed in Section 5.9.

134. Criteria for noise and vibration from blasting and for road and rail transport noise, are also as recommended in the EPA's Environmental Noise Control Manual or as otherwise indicated by the EPA.

135. Noise level criteria adopted are set out in *Table 5.1* below.

Table 5.1 NOISE AND VIBRATION CRITERIA

Type of Noise or Vibration	Area	Criterion Level
General Mine Noise - daytime	Outside Muswellbrook	40 dB(A) L_{10}
	Within Muswellbrook	40 dB(A) L_{10}
General Mine Noise - night-time	Outside Muswellbrook	35 dB(A) L_{10}
	Within Muswellbrook	37 dB(A) L_{10}
Blast Overpressure	All	115 dB(Lin)
Blast Vibration	All	5 mm/sec ppv
Road Traffic Noise	Rural	50 dB(A) $L_{eq,1hr}$ or existing + 2 dB(A)
	Suburban	55 dB(A) $L_{eq,1hr}$ or existing + 2 dB(A)
Rail Traffic Noise	All	80 dB(A) L_{max} and 55 dB(A) $L_{eq,24hr}$

5.4 NOISE IMPACTS FROM MINING OPERATIONS

136. The fundamental tool used for noise modelling was the ENM noise prediction model, which gives reliable predictions of noise levels under typical environmental conditions.

137. The noise impact from mining operations will vary as the mine develops with different areas being impacted at different stages of the operation. For the EIS studies, six years of mine operation were modelled using separate equipment locations for the daytime and night-time periods. In addition, two different scenarios were modelled in four of these years, representing different possible locations for the mining equipment. In total, detailed calculations were performed for 20 different layouts of mining equipment. This ensured that the "worst case" for noise from mining operations was considered for all surrounding areas.

138. Noise levels at significant distances from the source will vary depending on meteorological conditions, particularly the wind speed and vertical temperature gradient. The noise criteria in *Table 5.1* have traditionally been applied for noise levels measured or calculated under "still, isothermal" conditions (i.e. no wind or temperature gradient). Initial noise assessment involved determining the area where these criteria would be exceeded under these conditions.

139. However, the EIS assessment also included detailed calculations at three selected locations, representing the expected noise levels under all recorded combinations of wind speed and temperature gradient, as well as the proportion of time when each

of these conditions would prevail. At the request of the EPA, this analysis was significantly extended after the release of the EIS with further results presented in Section 5.8 below.

5.5 NOISE MITIGATION MEASURES

140. The following noise mitigation measures were recommended after preliminary noise modelling.

Noise Emission from Haul Trucks:

141. Trucks hauling overburden on emplacement areas will be the single most important source of noise from this mining project. For this reason, best available technology for noise emission from these vehicles will be used. At the time the EIS was prepared, this appeared to be an emitted sound power level of 117 dB(A). This has recently been achieved in practice by trucks at other locations, and was assumed in calculations for the EIS.

142. More recent information suggests that lower noise emission levels may be achievable from latest-generation equipment, although this has yet to be conclusively demonstrated. If these lower levels are achievable, equipment operating at these levels will be used in the project. This means that noise impacts would be lower than those presented in the EIS.

Times and Location of Operations

143. To control noise during the sensitive night-time period, haul trucks will not operate on overburden emplacement areas which are not shielded from residences between 10 pm and 7 am. This will also apply to the western fines rejects emplacement area.

144. Even where noise sources are shielded from receivers, higher noise levels can sometimes be experienced under adverse weather conditions. Although no formal criteria have been laid down to assess these effects, modelling under adverse conditions indicated a likelihood of significant night-time noise impacts for some residences to the south of the mine. For this reason, during years 7 to 12 of mining, night-time activities in the southern pit will be confined to the second-highest bench.

5.6 NOISE MODELLING RESULTS

145. The EIS presented daytime and night-time noise contours for each of the six chosen years of mine operation. At the request of the EPA, more detailed contours have been prepared showing noise levels in 5 dB steps for each year. These are presented in Appendix C.1.

146. Fifty-nine non-company owned residences lie inside the criterion noise level contour for at least one year and operating scenario. Of these residences, 12 are owned by surrounding mining companies. For the remainder the proponent will offer to install noise mitigation measures or seek to acquire the residences as part of this project.

5.7 CUMULATIVE IMPACT WITH OTHER MINES IN THE AREA

147. Noise from Mount Pleasant Mine could combine with noise from two other approved or proposed projects in the area - Bengalla Mine to the south and Kayuga Mine to the north. In both cases, cumulative impacts were assessed by assuming that the total noise level from all mines should not exceed the criterion established for a single mine. This is a conservative approach.

148. In the case of Bengalla Mine, predicted noise levels were taken from the project's EIS and associated noise report. At the nearest residences considered in that report (apart from those identified as subject to insulation or acquisition due to noise from either mine alone), total noise from the two mines will remain within the relevant criterion at all times. However, there is one further residence (property number 97) which was not explicitly assessed in the Bengalla EIS, but which appears to be subject to total noise levels which may exceed the criterion for some stages of mine operation. This residence will be covered by the proponent's land acquisition policy. (See Appendix F)

149. In the case of Kayuga Mine, total noise levels were determined with the co-operation of consultants for that proposal. A group of residences was identified where total noise levels may exceed the criterion for a single mine at some stages of combined operations. The severity of this combined impact will depend on details of the relative staging of the two mines which cannot be fully determined at this point. However, once the staging is determined these residences would be subject to a combined land acquisition policy for the two mines. (See Appendix F)

5.8 IMPACT ON MORE DISTANT AREAS

150. In areas outside the noise criterion contours, mining will still be audible at some times. Even under "still, isothermal" (SI) conditions, some noise will be audible above the background at times when all other intrusive noise ceases. Under more adverse conditions, the area over which noise would be audible will increase.

151. The impact of noise during periods of enhanced propagation depends on both the level of noise and the frequency with which these events occur. No generally-recognised guidelines are available which allow a quantitative assessment of noise impacts under these conditions. It has, however, been found that if the "minimum repeatable background plus 5 dB" rule is applied under SI conditions, noise under more adverse conditions is generally (but not always) found to be acceptable.

152. In this study, an attempt was made to describe in as much detail as possible the likely noise impact in areas outside the generally-accepted contour boundaries. In the EIS, three locations were chosen for this detailed analysis.

153. Perhaps the most important of these locations is Campbells Corner, on the outskirts of Muswellbrook. Here, calculated daytime noise levels are less than the assumed "SI conditions" criterion of 40 dB(A) at all times. Night-time noise levels exceed the "SI conditions" criterion of 35 dB(A) under adverse meteorological conditions, which occur during approximately 50% of the total night-time period. However, the exceedance is limited to approximately 5 dB(A). Noise during these periods would be definitely audible above the general background in the outskirts of the town, but is less likely to be so within the township itself, both because the distance to the mine is somewhat greater and because the night-time background noise level is higher.

154. At the request of the EPA, substantial further analysis was conducted to determine likely noise levels in areas outside the generally-accepted contour boundaries. Detailed results of this analysis are provided in Appendix C.2. Figures in this Appendix show contours representing the noise level which would be exceeded for ten per cent of the daytime or night-time period, throughout the year. This represents the noise level under relatively adverse meteorological conditions.

155. In general, these "tenth-percentile" levels are approximately 5 dB higher than the levels under SI conditions.

156. As described in Appendix C.2, the production of "tenth-percentile" noise level contours involves extremely detailed and complex noise level calculations. To our knowledge, no comparable analysis has been attempted for any other mine or similar development in Australia. We believe that this detailed description of the

likely noise environment is justified because it provides both regulatory bodies and residents with a more comprehensive understanding of the extent and level of potential noise impacts from the development.

157. However, care must be exercised in deriving noise level criteria to be used to mandate land purchase or other mitigation measures from the results presented. Traditionally, noise level criteria have been set on the basis of the level measured or calculated under SI conditions. In general, this formulation has proved successful in mitigating noise reaction and there is no evidence that a wholesale tightening of traditional criteria is required to prevent annoyance.

158. On the other hand, a number of cases have been noted where residents have shown a significant level of reaction to noise, even though the noise level from the source under SI conditions may be within the usual criteria. Some of these cases have involved noise from mining operations in the Hunter Valley and are therefore particularly pertinent to the present assessment. The number of people affected in these cases is always relatively small, which precludes reliable scientific analysis due to the statistical uncertainties involved in small samples. However, anecdotal evidence indicates that the following factors are often involved:

- a significant difference between the noise level under adverse meteorological conditions and the SI level;
- persistence of these adverse conditions for a significant time (of the order of half to one hour) on a substantial proportion of days; and
- a tendency for increased noise levels to be perceived as more important during the night-time period.

159. The above considerations suggest that it may be useful to supplement traditional noise criteria, which are based on the noise level under SI conditions, with further criteria limiting the extent and frequency of increased noise levels above the SI level.

160. Justification of such additional limits using scientifically-valid social survey data would require large-scale research. However based on experience for noise impact within the Hunter Valley a significant reaction may occur if night-time noise levels exceed about 40 dB(A) on a regular basis. This is 5 dB above the level which would generally be set as a noise criterion under SI conditions. Hence, one possible formulation for additional criteria would be to require that night-time noise levels should not exceed the SI criterion level by more than 5 dB on more than ten per cent of night-time periods throughout a year.

161. The "tenth-percentile" contours shown in Appendix C.2 could be used to determine the acceptability of noise under the notional criteria described above, as well as providing a general indication of the nature of noise exposure due to the proposed mine.

162. Of course, another alternative to the above proposal would be to simply re-interpret traditional noise criteria as applying to tenth percentile noise levels rather than to levels under SI conditions. This would certainly reduce noise impacts. On present indications, in areas similar to the Hunter Valley it would amount to a reduction in the effective noise criterion by at least 5 dB for all important external sources. The impact of this on the mining industry, in particular, would be severe. As indicated above it is considered that the extent of residual noise impacts in locations where traditional criteria are already met is not such as to warrant a wholesale tightening of criteria. The alternative approach identifies locations where residual impacts may be expected, so further controls can be introduced where necessary.

163. One further point should be noted in regard to the above discussion. Noise models, including ENM, are less accurate in predicting noise under adverse conditions than under SI conditions. Hence, any "tenth percentile" noise level contours presented should be interpreted more carefully than traditional noise contours calculated under SI conditions.

5.9 RESPONSE TO EIS SUBMISSIONS

164. The only submission which contained detailed comments on noise was from the EPA. Comments in that submission are discussed below.

i. Noise Criteria

165. The EPA suggest that in the first instance, day-time noise level criteria in rural areas should be set at 35 dB(A), in strict compliance with the guidelines in the Environmental Noise Control Manual. However, the Authority goes on to suggest that if this level is unachievable, a higher criterion may be justifiable after "careful consideration of the potential social/economic benefits of the proposal".

166. In this case, a higher daytime criterion in rural areas was selected to be consistent with the precedent established by Bengalla Mine. This proposal was exhaustively assessed in two Commissions of Inquiry and a number of court cases. The social and economic costs and benefits were discussed in detail in arriving at a day-time

criterion of 43 dB(A). The social and economic benefits of Mount Pleasant Mine would be similar to those from Bengalla. The chosen day-time criterion of 40 dB(A) at Mount Pleasant is lower than the Bengalla criterion, in recognition of the generally higher level of environmental control which can be exercised at Mount Pleasant.

ii. Construction Noise

167. The EPA requested an analysis of construction noise levels under "existing meteorological conditions". The meaning of this phrase is somewhat obscure, since as described above, a wide range of conditions can occur in the area with higher or lower frequency. Analysing construction noise in a similar way to operational noise, taking account of all meteorological conditions as well as their frequency of occurrence, would be quite unreasonable, given the short-term nature of this noise. There are no criteria available to assess construction noise for "existing" meteorological conditions, and hence the results of such an analysis would serve little benefit, while being very difficult and time-consuming to generate.

iii. Operational Noise Modelling

168. To assist in its interpretation of noise level predictions presented in the EIS, the EPA submission requested a list of additional information, largely concerned with noise levels under adverse meteorological conditions. The EPA's requirements were further clarified in subsequent meetings. In summary, the additional information required is:

- noise contours under SI conditions in 5 dB steps (provided in Appendix C.1);
- noise contours under typical adverse meteorological conditions (provided in Appendix C.2);
- assumed locations of equipment used in modelling (provided in Appendix C.3); and
- predicted noise levels, under adverse meteorological conditions, at residences listed in Table 12.7 of the EIS as being affected by noise. This information is presented in Appendix C.4.

iv. Cumulative Noise Impacts

169. It appears that the EPA may have misinterpreted the analysis presented in the EIS. The approach taken in the EIS was to limit total noise from all new mines to satisfy the criterion for a single mine, which is exactly the procedure recommended in the EPA submission. An alternative approach was discussed, but was not used for assessment or in recommending ameliorative measures. The EIS therefore provides all the information necessary to assess cumulative impacts using the EPA's suggested approach.

v. Blasting Impacts

170. Additional information was requested by the EPA to assist in its assessment. This is provided in Appendix C.5.

Chapter 6

WATER MANAGEMENT

6.1 GROUNDWATER

171. Groundwater studies within Authorisation 459 included borehole construction, formation testing and development of computer-based models of the aquifer systems. Coal seams and interburden were insitu tested at more than 20 bore locations using injection, pump out and packer test methodologies. This drilling and testing confirmed the presence of two aquifer regimes - hardrock coal measures (including the shallow weathered zone) and unconsolidated alluvium formed by the Hunter River which overlies the coal measures. Within the hardrock aquifer system the coal seams are the main water transmission zones, albeit at very low flow rates. Interburden materials comprising mostly sandstones and silstones, have extremely low permeabilities which hydraulically isolate adjoining coal seam aquifers.

172. The shallow weathered zone acts as a thin aquifer system providing a conduit for rainfall recharge to the deeper coal measures. The alluvium, in contrast to the coal measures, is a highly transmissive aquifer system consisting of gravels, sands and silts, hydraulically coupled to the Hunter River and other waterways. The alluvium acts as a major groundwater storage system, being recharged by the river during high river flows and discharging to the river via bank seepage during low flows.

173. Water quality in the coal measures is generally poor, with salinities ranging from 2,000 mg/L to more than 5,000 mg/L. Water quality in the alluvium is variable. Near the river, salinity is reduced and the quality is similar to the river. In areas closer to the hills and where alluvium permeability is reduced by silts, salinity generally increases. Where upward leakage from the coal measures is prevalent, localised water quality is significantly impaired. Water quality in three observation bores sunk in the alluvium varied from 485 mg/L to 587 mg/L, while Department of Land and Water Conservation records indicate salinities as high as 1,300 mg/L.

174. Groundwater levels were monitored for more than two years at test bores in the coal measures and alluvium. These indicated that groundwater movements broadly correlate with rainfall. The extended drought since 1992 caused a steady decline in aquifer pressures in coal measure bores but generally stable or slightly declining levels in the alluvium. The water table geometry derived from monitoring data showed a regional aquifer flow regime consistent with topography; pressure gradients developed in the coal measures allow south easterly flows towards the alluvium while groundwater levels in the alluvium are consistent with flows in the

Hunter River. Elevated pressures in the coal measures allow possible upward leakage into the alluvium.

175. Computer-based simulation models were developed to understand the many complex groundwater flow processes which evolve during mining. These models necessarily simplify the geology so to ensure findings are broadly acceptable for planning purposes, a conservative approach was used in these models. Computer simulation of mine seepage indicates rates from zero at the commencement of mining to approximately 1.9 ML/day at year 21 (maximum extent of pit development). The cumulative effects of Bengalla and Dartbrook mines reduce pit seepage rates at year 21 to approximately 1.6ML/day. The predicted rates of influx are consistent with other mines and generally reflect the very low permeabilities within coal measures.

176. Pit development will ultimately depressurise coal measures to a depth greater than 150 metres. This is likely to reduce aquifer pressures beneath alluvial areas immediately east of the Mt. Pleasant site and west of the Hunter River. The change in aquifer pressures will initiate flow reversal beneath the alluvium which may cause leakage from the alluvium to the coal measures. The rate of leakage will be approximately 0.1 litres per square metre of alluvium per day. Since flow rates in the alluvium are orders of magnitude higher these rates, this will not be perceptible with rapid replacement by river seepage.

177. After mining, seepage will reverse when final void water levels exceed groundwater levels in the alluvium. This will cause groundwater to leak upwards from the coal measures to the alluvium. However the rate of upward leakage will be substantially lower than the pre-mining situation since aquifer pressures in the coal measures will not recover to original levels.

178. Regional groundwater depressurisation will affect borehole water levels in coal measures close to the mine. Water levels in boreholes located within 5 kilometres of the pit will progressively decline over the mine life and may not recover. Boreholes in the shallow weathered zone or localised alluvium along creeks within the hardrock environment may not be affected, provided rainfall runoff is sufficient to recharge localised storages. Twenty eight bores were identified with water level losses exceeding 5 metres. Regular monitoring throughout the mine life will be undertaken. Where economic loss of yield is demonstrated, water supplies will be replaced in accordance with Coal & Allied's Water Policy for Mt. Pleasant (Appendix G). Bores and groundwater resources in the alluvial lands east of the site will generally not be affected.

179. Emplacement of spoils can generate leachate from unshaped or rehabilitated areas and a slowly recovering water table. Tests and analyses indicate that leachate will not mobilise trace elements or metals due to the low acid generating potential of

interburden and the presence of bicarbonates. Groundwater and leachate are likely to be saline.

180. Since an inward regional hydraulic grade towards the mine pit will persist for more than 80 years after mining ceases, leachate will be contained within the pit. Following water table recovery, spoil water quality will have a maximum dissolved solids content of less than 4,900 milligrams per litre. After groundwater flow regimes are re-established the mixing of spoils groundwater and existing groundwater will not significantly affect coal measures water quality.

181. Groundwater studies in the rejects emplacement area included borehole construction and laboratory and insitu testing of interburden at six locations. Drilling confirmed a shallow weathered zone at depths of 3 to 10 metres which comprise mostly weathered siltstones overlying unweathered siltstones and occasional sandstones. Laboratory tests confirmed very low intrinsic siltstone and sandstone permeabilities while insitu testing indicated low bulk permeability with transmission pathways most likely related to occasional jointing and/or bedding in partings. Groundwater quality was poor with total dissolved solids ranging from 2,500 to 9,600 mg/L.

182. Seepage from beneath the rejects storages will be impeded by the low permeability of tailings and coal measures. Seepage during early mine development is predicted to range from zero to 26 kilolitres per day depending on the rate of filling and accumulation of fines at the storage base. Leachate will have moderate salinity with high alkalinity due to the widespread presence of bicarbonates. Trace metals normally associated with acid mine drainage are unlikely to be present due to the relatively low sulphur content of seams and the high alkalinity of both tailings seepage and natural groundwaters. Since predicted salinity will be less than or equivalent to natural waters, overall existing groundwater quality will not be adversely affected.

183. Seepage through the weathered zone beneath impoundments will migrate towards the valley axes and may emerge in the environmental dam constructed downslope. Seepage pathways will be altered to an easterly direction as the mine develops. Within five years subsurface flow will be eastward towards the mine pits and will remain that way for more than 80 years. Monitoring bores will be installed downstream of the fine rejects emplacement area. Any leakage will be contained by constructing interception trenches, pumping-capture wells or selective grouting of conduit structures.

6.2 SURFACE WATER

184. The mine will affect 30 to 70 per cent of drainage catchments in Authorisation 459. Runoff from undisturbed areas will be diverted around mining operations via contour banks, channels and engineered diversion dams before re-entering natural watercourses. Channel and bank grades will be designed to ensure non erosive flow velocities. Runoff from disturbed areas will be collected by the mine water system. Runoff estimations from affected areas have been calculated using the analytical (Rational) method. A catchment simulation model was developed to estimate runoff from different catchments including pre-strip areas, pits, spoil and rehabilitated areas. The model used daily rainfall data and daily soil moisture accounting. Model parameters were calibrated from other catchments in the region and runoff monitoring at other mine sites.

185. Loss of runoff from the catchments may alter recharge conditions at the interface between coal measures and alluvium. Pre-mining catchments will be reduced from about 16 square kilometres to 12 square kilometres, representing a 28 per cent long term reduction in eastward runoff. Runoff flows east to the Hunter River along an eight kilometre frontage via various gullies in the alluvial lands. Runoff recharge will maintain a weak groundwater hydraulic grade to the river. Runoff from the single north east draining catchment in the Authorisation (near Kayuga township) will be reduced by about 75 per cent from 12 to three square kilometres. Runoff will be concentrated in the creek immediately south west of Kayuga township and will be unlikely to sustain a long term hydraulic grade towards the river. Reduced groundwater levels in this area are unlikely to fall below local river levels and hence groundwater supply should be maintainable through bore deepening if necessary. Surface water quality will not be adversely affected.

186. The fine reject areas west of Mt. Pleasant will reduce catchment runoff over the mine life. The north western sub-catchment will be reduced by approximately 43 per cent (measured at the confluence with Sandy Creek) during years 1 to 9, and 34 per cent during Years 10 through 20. In the southern sub catchment, 30 per cent of the catchment will be lost during the final years of mining. In the greater Sandy Creek catchment above the confluence with the southern sub catchment, approximately 3.6 per cent of runoff will be lost during the mine life. Runoff will be restored following mining and surface water quality will not be adversely affected.

6.3 WATER MANAGEMENT

187. Comprehensive water management studies determined the operating water budget/balance over the mine life. The mine water system was assessed on a daily basis for various climatic conditions. Water requirements included the coal

preparation plant, dust suppression and truck wash down together with other minor provisions, while water supply included runoff from all mine water catchments. Various storage volumes were tested against Muswellbrook rainfall records, to determine suitable mine storages based on runoff containment from all catchments. Rainfall histories included both an extreme drought and extreme wet period to explore storage responses. Findings indicate a water deficit over the mine life, so make up water will have to be drawn from the Hunter River.

188. Total storage requirements for mine water (including sumps, transfer dams, coal preparation plant dams, staging dams etc.) will range between 1,000 and 2,000 megalitres (ML), depending upon prevailing climatic conditions and the rate of rehabilitation. This assumed 500 ML are retained in the system at all times as a contingency in the event of pumping system failures. A storage of 1,500 ML may require mine water to be periodically released during the 20 year mine life, depending upon climatic conditions. Mine water would be released within appropriate opportunity windows during Hunter River floods periods in accordance with the Salinity Trading Scheme. Releases may also occur during high flow periods in accordance with any assigned salinity credits. Storage requirements will be confirmed during mine development in response to improved catchment yield data from runoff monitoring.

189. Make-up water will be drawn from the Hunter River at a rate from 9.4 ML/day at the commencement of mining to approximately 7.5 ML/day during Years 20 and 21, depending upon climatic conditions. Water will be sourced through a number of options including transfer of high and low security allocations from Coal & Allied's other Hunter Valley Mines or through purchase of additional allocations from DLWC or the open market.

190. An application for a licence to abstract water from the Hunter River was lodged with the Department of Land and Water Conservation on the 16 February 1998. The application was advertised in the Government Gazette and Muswellbrook Chronicle on the 20 February 1998. No submissions regarding the application were received by the DLWC.

6.4 ENVIRONMENTAL MONITORING

191. A comprehensive surface and groundwater monitoring programme will form part of the mine environmental monitoring plan. This will expand current monitoring activities to cover all dams and watercourses, additional groundwater bores and real time mine water management through computer-based systems. Data will be regularly reviewed with baseline values and alert conditions will be continually updated. Compliance monitoring will be maintained throughout the mine life and

post-mining periods. Pit water and spoil leachate will be regularly monitored and the data used to develop an optimal strategy for salt minimisation. This may include accelerated or retarded leaching though enhanced percolation of rainfall.

192. The water monitoring strategy will be part of an overall water management plan following development approval. This will be progressively updated during the life of the mine.

6.5 RESPONSE TO EIS SUBMISSIONS

193. Ninety-nine submissions out of 149 identified water management as a key issue. However, the majority of these did not raise specific issues about water management. The most common issues related to the effects of the project on surface and groundwater supplies. Specifically these included:

- potential contamination of groundwater supplies and their effect on the Hunter River and surrounding areas;
- alteration of topography and the resultant effects on surface water quality; and
- potential loss of groundwater supplies and replacement procedures.

194. One submission also identified a drainage pathway that will require additional design considerations not outlined in the EIS.

195. The company will prepare a detailed mine water management plan for the site. This will support an application for a pollution control licence from the EPA for discharges from the site.

196. The EPA submission received in February 1998 considered the proposals outlined in the EIS to minimise surface and groundwater pollution to be satisfactory.

197. The water management system will have two distinct circuits, a clean water circuit and mine water circuit. As outlined in Sections 6.4 and 9.5 of the EIS, clean runoff from undisturbed areas will be diverted around disturbed areas and returned to natural watercourses through sedimentation dams. Mine water will be managed through a series of interconnected dams that provide pollution control and water storage.

198. Potential groundwater losses from the mine were discussed in Section 6.1. As outlined in Section 9.6 of the EIS, boreholes within a five kilometre radius of the mine will be regularly monitored to assess any water loss or degradation of water

quality. Where reductions of water yields from either surface water catchments or groundwater boreholes causes economic loss, Coal & Allied will offer to replace water supplies either by deepening borehole or providing alternative water sources.

199. Additional issues raised by NSW Agriculture, National Parks and Wildlife Service, EPA and Department of Land and Water Conservation included:

- the amount of rainwater entering the final voids and subsequent effects on regional water tables;
- the quality of water in the final voids and the long-term use and management of voids including the potential for eutrophication and thermal stratification;
- criteria for supplementing water supplies; and
- leachate seepage from fine rejects emplacements.

200. Runoff contributions to the final void have been incorporated into long-term modelling of regional water tables outlined in Section 6.1.

201. A worst-case final void water quality of about 4,900 mg/L was determined based on instantaneous leaching of the mobilised salt load. This is a worst-case estimate since leaching efficiency is less than 100 per cent and occurs over a long period rather than instantaneously. It is likely that the 4,900 mg/L total dissolved solids will be dominated by the ionic species listed in *Table 6.1*.

Table 6.1 ANTICIPATED IONIC CONCENTRATIONS IN VOID WATER (MILLIGRAMS/LITRE)

Ca	Mg	Na	K	HCO_3	Cl	SO_4
160	220	1120	1.7	1500	1700	40

202. Phosphates and nitrates are uncommon in spoil material and soils found on site. Reference to the Soil Landscapes of the Singleton 1:250,000 Sheet (Kovac and Lawrie,1991) indicated that the soil types mostly form part of the Roxburgh soil landscape. This has low nutrient levels including a recognised phosphorus deficiency. Rainfall will also dilute void water salinity, which may increase bicarbonate levels and chlorides. However, as outlined in Section 6.5.7 of the EIS, it is proposed to continue mining in the South Pit beyond Year 21. A final void management plan will be prepared in the last seven year mine sequence. It will address in detail:

- Public safety;

- Access;
- Long-term void water quality; and
- Long-term void water management strategies.

203. Long-term void water management strategies will include measures to prevent eutrophication and thermal stratification. This may include mechanical destratification using a motor driven propeller system or air injection which have proved successful in preventing thermal stratification in Manly Dam. Eutrophication depends on a number of factors including total phosphorus and total nitrogen concentrations as well as dissolved oxygen levels. As previously discussed phosphate and nitrate levels are very low in soils and spoil material and consequently are not expected to concentrate in the final void water.

204. Supplementing of surface and groundwater supplies was discussed previously.

205. Monitoring and control of leachate from the fine rejects emplacements were discussed in Section 6.1.

Chapter 7

VISUAL IMPACTS

7.1 EXISTING LANDSCAPE CHARACTER

206. The local landscape is formed by largely cleared foothills either side of the broad Hunter River floodplain with more rugged, forested terrain to the west.

207. The proposed mine site is mostly grassland with patches of woodland and is characterised by a series of ridgelines descending generally west to east and ending abruptly at the edge of the floodplain. The western part of the site features Mount Pleasant with a north-south aligned ridge system extending from it.

208. After the analysis of visual resources for the Mount Pleasant EIS was finished, work began on the adjacent Bengalla Mine which altered some aspects of the rural landscape setting in the area.

7.2 LANDSCAPE CHANGES CAUSED BY THE MINE

209. The existing landscape will be changed by the mine and infrastructure development, and by some aspects of the mining operations.

210. These changes will include:

- excavations associated with the 'Piercefield', 'Warkworth South', North and South Pits;
- four new emplacement landforms to the east and west of the North and South Pits;
- earth bunds as a screening device; and
- a series of smaller, low-profile emplacements associated with the fine rejects areas in the south-west of the mine area.

211. Infrastructure development will include:

- structures associated with the coal preparation plant;

- the administration and industrial area;
- structures and earthworks for the rail facility and powerline relocation; and
- new roadworks.

212. Changes caused by mine operations will include;

- some views of mine vehicles and the upper parts of the dragline boom;
- nightlighting; and
- ephemeral changes such as small dust clouds from blasting.

7.3 BUNDING PROPOSAL

213. A large earth bund is proposed to the east of the South Pit from Castlerock Road to Wybong Road which will reduce potential visual impacts. A smaller bund is proposed along Wybong Road adjacent to the mine facilities area while a series of localised bunds are proposed for parts of the new western access road.

7.4 VEGETATION MANAGEMENT

214. Proposed vegetative measures to minimise visual impacts include:

- the retention of existing woodland vegetation not affected by the proposed mine development;
- the early planting of many key ridgelines not affected by the proposed mine development. Many of these are currently cleared or only have sparse vegetation;
- early vegetation of protective bunds;
- progressive revegetation of all new emplacement landforms; and
- revegetation around the main mine facilities.

215. Experience with rehabilitation and stabilisation techniques gained from Hunter Valley No. 1 Mine will be applied to the Mount Pleasant site.

216. Trees will generally be concentrated along the upper parts of ridgelines as this is where visual screening is most effective and is otherwise an aesthetically appropriate area of emphasis.

7.5 OTHER MEASURES TO MINIMISE VISUAL IMPACTS

217. As with existing woodland vegetation, key ridgelines unaffected by the proposed development will be retained. These include the 'Glenmore' ridge and part of the 'Negoa' ridge, the 'Broomfield' ridge and the main south easterly-trending ridge of Mount Pleasant.

218. Other mitigation measures proposed for the site include:

- siting the main infrastructure facilities mostly within natural valleys and siting haul roads on the western side of ridges and revegetation areas as much as possible;
- emulating, as much as possible, the existing topographic character in the design of new emplacement landforms;
- using appropriate design, colours and surface materials for the tallest structures; and
- applying particular design and operational criteria to nightlighting.

7.6 VISIBILITY FROM KEY PUBLIC VANTAGE POINTS

219. Within the visual catchment there is a large number of view opportunities. Key locations were selected as representative views for different public areas. These included the following:

- Lexia Street, Muswellbrook (RL 200);
- Campbell Street, Aberdeen (RL 235);
- Kayuga Road, Kayuga (RL 180);
- New England Highway (between Muswellbrook and Aberdeen; and near Black Hill);
- Main Northern Railway;

- Denman Road;
- Wybong Road;
- Roxburgh Road; and
- Dorset Road.

220. Of these public vantage places the most sensitive area to potential visual impact is Muswellbrook in the most elevated and recent residential subdivisions. However, views from these areas will diminish as street and allotment vegetation matures.

7.7 SUMMARY OF VISUAL IMPACT

7.7.1 Muswellbrook

221. Initially the eastern bund, the 'Piercefield' Pit highwall, upper areas of the south-western emplacement, a small section of the South Pit, the upper sections of the tallest coal preparation plant structures and the top of the workshop block may be visible over a distance of about 8.5 km.

222. From Years 5 to 10 of mining, potentially visible features will include:

- completion of the eastern bund and establishment of vegetation;
- upper parts of the North Pit; and
- north-western and south-eastern emplacements.

223. By about Year 15 the following will potentially become visible:

- southern batters of the North Pit emplacement;
- sections of the North Pit highwall;
- upper sections of the South Pit emplacement; and
- some of the pre-strip sections above the South Pit highwall.

224. Throughout the life of the mine anticipated nightlighting effects will include a soft light haze as well as small areas of intermittent and localised light from mine vehicles.

225. By Year 20 the bund and emplacement landforms will have established rehabilitation vegetation and these will be the most noticeable long-term mine features from this location.

7.7.2 *New England Highway in the vicinity of 'Dartmouth'*

226. By about Year 5 of mining the construction and rehabilitation of the North Pit emplacement will be visible, together with possible limited glimpses of the extreme northern end of the North Pit highwall.

227. By about Year 10 the north-western emplacement will be visible from six kilometres away.

228. Nightlighting effects and long-term mine visibility will be similar to those described for Muswellbrook.

7.7.3 *Denman Road in the vicinity of 'Delhaven'*

229. Earlier visible changes will include;

- the 'Warkworth South' Pit highwall;
- south-western emplacement landform;
- southern part of the eastern bund; and
- possibly the top of the rail loadout facility.

230. From about Year 10 the North Pit emplacement will become visible and by about Year 15 to 20 the uppermost parts of the southern batters of the North Pit may be visible.

231. Long-term views of the site from this location will mostly consist of the rehabilitated emplacement landforms with the intervening Bengalla emplacement obscuring views of the central section of the mine.

7.8 LIGHTING IMPACTS

232. Visible nightlighting effects will be either a soft light haze or a small area of localised direct light or both. In the case of surrounding settlements such as Muswellbrook, there is already a light haze from street lights and other urban developments.

233. Specific measures to reduce the potential impact of lighting include;

- lowering fixed lighting for operational areas;
- directing work lights away from settlements;
- providing only sufficient lighting for safe and efficient operation;
- time delay automatic switch-off for access lighting where suitable;
- enclosing all buildings, most elevated conveyor galleries and parts of the conveyor transfer stations; and
- using topographic features and vegetation to screen lighting.

7.9 RESPONSE TO EIS SUBMISSIONS

234. No submissions raised potential visual impacts of the project specifically as a major issue. Where it was mentioned it was included with other potential environmental impacts such as noise and dust.

235. Many of the submissions came from properties covered by the proposal, dwellings on adjacent mine sites or in the zone of affection. Several others were already specifically addressed in the EIS.

Chapter 8

TRANSPORT

8.1 IMPACTS ON THE RAIL CORRIDOR

236. All product coal will be transported by rail to the port of Newcastle. In the event of disruption to rail services product coal will be stockpiled at the mine.

237. The rail system which will be used by the mine extends over approximately 135 kilometres and consists of the following sections:

- 4 kilometres - Mount Pleasant Loop and Branch Line;
- 9 kilometres - Ulan Branch Line from Muswellbrook; and
- 122 kilometres - Main Northern Line and Kooragang Island Branch from Muswellbrook to the port of Newcastle.

238. The existing rail line comprises four tracks from Maitland to the Port of Newcastle, two tracks from Maitland to Antiene (about 15km from Muswellbrook), and a single track north of Antiene. Passing loops are situated between St Helieus and Grasstree and at Muswellbrook Station.

239. The rail line is busiest during weekdays and carries a combination of passenger traffic, coal and other freight, primarily general freight and grain. Rail traffic is heaviest at the southern end between Maitland and Newcastle, where there is significant local passenger traffic in addition to coal traffic south of Newdell and rail traffic from the north coast line to Brisbane.

240. The current levels of coal, passenger and other freight traffic on the sections of the rail line near Muswellbrook are much lower. In 1995/96 only about 10 to 15 per cent of the total Hunter Valley export coal tonnage originated from mines in the Muswellbrook Area and those north and west of Muswellbrook.

241. The capacity of the rail system is broadly defined by the number of tracks but is also influenced by the timetabling of trains which is currently under the control of the SRA (SRA Network Control). This may in the future be transferred to the Rail Access Corporation.

242. The capacity of all sections of the rail system is generally consistent with current demand and includes significant spare capacity to accommodate increases in train movements on peak days.

243. The rail authorities will only consider augmenting the capacity of the rail system in response to actual demand and currently there are no major proposals to increase the line capacity.

244. The assessment of rail track capacity in the EIS was based on a Department of Urban Affairs and Planning study (DUAP; 1995, DUAP, 1996) which indicated that the current capacity for coal trains between Muswellbrook and Antiene (the last remaining single track section south of Muswellbrook) was between 11 and 12 train paths per day. A more recent study (Muswellbrook Council, 1998) found that due to timetable changes after the DUAP study, the capacity for coal trains between Muswellbrook and Antiene has now been increased significantly. For operational reasons there are more train paths programmed in the down (northbound) direction, up to 24 coal train paths per day compared to the up (southbound) direction which has up to 19 coal train paths per day on weekdays.

245. With further changes to timetabling, the maximum coal train paths which could in the future be made available over the single track Muswellbrook to Antiene section of the rail line is considered to be 21 per day in each direction.

246. For the Mount Pleasant Project the major potential issue for rail transport is the capacity of the rail system to accommodate additional coal production, not only from the Mount Pleasant Mine, but also from other developing mines such as Bengalla and Kayuga. These will also access the rail system to the north or west of Muswellbrook.

247. Other related rail transport issues include the need to avoid disruptions to passenger train services with increased coal train operations and future noise implications of additional rail operations in the Muswellbrook area.

8.2 RAIL TRANSPORT IMPACTS

248. Export coal from the Hunter Valley coal field must generally be transported by rail because this is considered by the relevant government authorities and local communities in the region to be safer, more environmentally acceptable and more cost effective than road transport.

249. The most recent capacity assessment of the rail line (Muswellbrook Council, 1998) indicated that for the remaining single track section of the rail line south of Muswellbrook, the estimated limit of 21 coal trains per day with normal day to day fluctuations corresponded to an effective export coal capacity limit of about 27 Mtpa for mines in the Muswellbrook Area or to the north and west of Muswellbrook in the Ulan or Gunnedah coal fields.

250. The current year export coal production from these mines is currently approximately 8.5 Mtpa from the following sources:

- 5 Mtp.a. Ulan Mine;
- 2.5 Mtp.a. Dartbrook Mine; and
- 1 Mtp.a. Gunnedah Coalfield.

251. New mines in the Muswellbrook Area could add 16.8 Mtpa from the following mines:

- 7.9 Mtp.a. Mount Pleasant;
- 6.7 Mtp.a. Bengalla; and
- 2.2 Mtp.a. Kayuga.

252. The cumulative production from all these mines would be 25.3 Mtp.a. which would be close to the current estimated capacity limit for the Muswellbrook to Antiene section of the railway line. This means that future flexibility to run widely varying tonnages of coal on the line from day to day would be constrained.

253. While this increased production north and west of Muswellbrook would not specifically require duplication of the Muswellbrook to Antiene section of the railway line, the recent study (Muswellbrook Council, 1998) indicated that there would be strong economic grounds to duplicate the line by the year 2002/3 to reduce costly future train delays which would result from single track operations.

254. The typical operating costs for large coal trains result in waiting time costs of over $1,000 per hour when trains are delayed. As the frequency of coal trains increases, the potential savings in operating costs from reduced train delays will significantly outweigh the capital costs of duplicating the remaining single track sections of the line south of Muswellbrook by a factor of at least two to one.

255. Passenger train services in the Muswellbrook Area, one Countrylink and four Cityrail (Newcastle to Muswellbrook/Scone) services in each direction, are not currently affected by coal or other rail freight operations. Passenger trains have

priority over all freight services and because of their requirements for faster running speeds, they effectively occupy the line for between five and six hours each day between Muswellbrook and Singleton.

256. The assessment of line capacity in the Mount Pleasant EIS and the subsequent study (Muswellbrook Council, 1998) assumed that existing passenger train services would be fully retained.

257. Potential noise implications of increased coal train operations in the Muswellbrook area were also examined in the EIS.

8.3 LOCAL ROAD NETWORK

258. The existing local road network near Mount Pleasant is constrained by bridges crossing the Hunter River.

259. Additionally, most local roads adjacent to Mount Pleasant, Bengalla and Kayuga Mines will need to be closed in the future as these mines are developed. However Muswellbrook Council in a recent study (Muswellbrook Council, 1997) identified a future network of local roads which will provide acceptable alternative routes for all local traffic to the west of Muswellbrook.

260. This new network will include a number of mine "link roads" which will be public roads. These will carry the majority of future traffic travelling to and from the mines, thereby minimising traffic increases on any existing roads.

261. Also, two new bridges access the Hunter River which will become available to the public with the extensions of the Dartbrook and Bengalla Mine link roads. These will in many cases improve accessibility for local traffic travelling west of the Hunter River.

262. The following summarises future road network changes:

i. *Completion of the Bengalla Mine Link Road*

263. This would connect with Wybong Road, approximately 400 metres west of the Roxburgh Road intersection.

ii. Construct a 500 metre extension to the Dartbrook Mine Link Road

264. This would connect directly into Kayuga Road. The road would then be dedicated as a public road.

iii. Close Dorset Road within Kayuga Mine and construct the Kayuga Mine Northern Link Road (to be undertaken by Kayuga Mine)

265. This diverts Dorset Road traffic to the north to Dartbrook or Kayuga Roads. This would reduce travel distances by 2.5 kilometres for journeys to and from the north (50 per cent of movements) and increase travel distances by 0.4 kilometres for journeys to and from the south (approximately 50 per cent of movements).

iv. Close Castlerock Road within Mount Pleasant Mine and construct the Mount Pleasant Northern Link Road (Year 3 of Mine Operations)

266. This diverts traffic to the eastern end of Dorset Road which would remain open. This increases travel distances on Castlerock Road by 1.6 kilometres for journeys to and from the south (approximately 80 per cent of movements) but reduces travel distances by 2.0 kilometres for journeys to and from the north (approximately 20 per cent of movements).

v. Close Wybong Road, adjacent to Mount Pleasant Mine and construct the Mount Pleasant Western Link Road (Year 9 of Mine Operations)

267. This is a longer term proposal which provides an alternative route for Wybong Road traffic travelling to and from the north. Completion of the Bengalla Mine Link Road to connect with Wybong Road will give an alternative route for Wybong Road users travelling to and from Muswellbrook or the south. These detours reduce travel distances by approximately 2.5 kilometres in each direction for traffic travelling to and from the north, but increase travel distances via the Bengalla Mine Link Road by approximately 2.4 kilometres in each direction from Muswellbrook.

8.4 CONSTRUCTION TRAFFIC

268. Construction traffic would be generated during a 16 to 18 month construction period prior to the commencement of mine operations. It would continue at a lesser rate during the first year of mining, construction of mine haul roads and also during year 3 and year 6 of mine operations, when a dragline and second electric shovel are assembled.

269. The peak construction workforce of 250 employees would bring approximately 206 cars to and from the site each day. There would also be about 25 light vehicle "courier" deliveries each day.

270. The number of heavy vehicles required to transport construction materials to the site was also estimated. During the 16 to 18 month construction of the mine facilities and infrastructure, the average daily truck deliveries to the site would be approximately 34. There would also be approximately 24 daily truck movements delivering gravel for haul roads during the first year of mining.

271. Traffic impacts during construction will be different to the operations period because not all the road network improvements will be implemented, in particular Wybong Road will still be open to traffic and significant construction traffic could use the Kayuga Bridge which crosses the Hunter River near Muswellbrook.

272. To prevent any significant increases in existing Kayuga Bridge traffic, the following minimum road improvements will be implemented before work begins on Mount Pleasant Mine:

- complete the Bengalla Mine Link Road, either to Wybong Road as proposed in the Bengalla Mine EIS or to Wybong Road near Roxburgh Road; and
- construct the Dartbrook Mine Link Road extensions to link with Kayuga Road and open this road to public traffic.

273. In the short to medium term, the company will prevent either construction or operations heavy vehicles from the mine using the bridge during existing school bus and commuter periods (between 6.45am to 8.45am and 3.15pm to 5.15pm on weekdays).

8.5 OPERATIONS TRAFFIC

274. Traffic impacts were assessed for both Mount Pleasant Mine traffic and for the cumulative impacts from the Bengalla, Mount Pleasant and Kayuga Mines. Traffic increases are generally only significant on the future mine link roads. Impacts are minimal on most existing roads.

275. The future peak mine workforce of 380 employees will bring an estimated 314 cars to and from the site each day. There would also be miscellaneous daytime delivery and courier vehicle traffic bringing an estimated 20 cars, light vans or utilities to the site each day.

276. The major truck movements during mine operations would be fuel deliveries. Established mine operations will typically consume 24 million litres of diesel fuel each year, requiring an average of three tanker deliveries per day. Additional truck movements for land and road maintenance, explosives deliveries and other miscellaneous deliveries would increase this total to approximately ten truck deliveries per day on average.

277. Predicted daily traffic generated by each mine west of the Hunter River is summarised in *Table 8.1*.

Table 8.1 FUTURE MINE TRAFFIC MOVEMENTS

Mine	Future Total Employees	Car Driver Percentage	Daily Employee Car movements	Other Daily movements	Total Daily movements
Dartbrook (Existing)	180	82.5	296	40	336
Dartbrook with (Kayuga Expansion)	280	82.5	462	60	522
Bengalla	258	82.5	426	60	486
Mount Pleasant	380	82.5	627	60	687

278. After all proposed road network changes are completed including the closure of Wybong Road adjacent to the site, the major approach direction of traffic will be via the Bengalla Link Road. Near the site approach directions will be as follows:

- 66% to and from the south via Bengalla Link Road;
- 27% to and from the north via Mount Pleasant Western Link Road; and
- 7% to and from the west via Wybong Road and Roxburgh Road.

279. The corresponding distribution of traffic movements on roads further away from the site is listed in *Table 8.2* below.

Table 8.2 TRAFFIC DISTRIBUTION TO APPROACH ROUTES

Overall Direction	Proportion	Approach Route (to/from)
South via Bengalla Link Road	38%	Muswellbrook via Denman Road (E)
	25%	via Thomas Mitchell Drive (S)
	3%	Edderton Road via Denman Road (W)
North via Mount Pleasant Western Link Road	7%	Scone via Blairmore Lane
	5%	Scone via Dartbrook Road
	9%	Aberdeen via Dartbrook Link Road
	3%	local rural areas via Dartbrook Link Road
	3%	local rural areas via Kayuga Road
West via Wybong Road	4%	Denman via Roxburgh Road
	3%	Sandy Hollow via Wybong Road (W)

280. Mount Pleasant mine traffic to and from the south will impact on three sections of road, namely:

- The Bengalla Mine Link Road (61% increase);
- Denman Road east of the Bengalla Mine Link Road (10% increase); and
- Thomas Mitchell Drive to the south (10% increase).

281. The greatest traffic increases will be on the Bengalla Mine Link Road. However, this road is specifically being constructed to access coal mines and to serve as a detour for Wybong Road when it is closed. These increases confirm that this road will serve its intended purpose.

282. Traffic to and from the north will increase on a number of roads. However most of these roads are specifically planned to provide for future mine access and local traffic diversions, namely:

- the Mount Pleasant Western Link Road;
- the Mount Pleasant Northern Link Road; and
- the Dartbrook Mine Link Road.

283. Traffic increases on Blairmore Lane will be significant in percentage terms (26 per cent for Mount Pleasant Mine traffic and 45 per cent for all future mines). However overall volumes will remain below 500 vehicles per day and would not affect the current high level of service for this road. Also these increases highlight the general benefits of opening the Dartbrook Link Road for public traffic use, without which the increases on Blairmore Lane would be more significant.

284. Traffic increases for the routes to and from the west, Wybong Road and Roxburgh Road, would be relatively minor ranging from four to six per cent for Mount Pleasant Mine and six to twelve per cent for all future mines. These increases would not be significant. The overall volumes on these roads will remain below 1,000 vehicles per day and the high current level of service will not be adversely affected.

285. Peak hour traffic increases were addressed at 16 intersections on traffic routes affected by the proposal.

286. A number of roads including, Wybong Road, Kayuga Road, Dorset Road, Castlerock Road and the future Mount Pleasant Northern Link Road will all be affected by temporary closures when blasting occurs within 500 metres of the road. At least 24 hour's notice will be provided for all temporary road closures and highly visible signs will advise traffic of alternative routes.

287. Dangerous goods such as explosives or fuel will generally be transported to and from the south via the Thomas Mitchell Drive route to the New England Highway. This route effectively bypasses Muswellbrook township and other residential areas in the Shire.

8.6 MITIGATION MEASURES

288. The following summarises safeguards and works to be implemented by the Mount Pleasant Mine. A commitment to future roadworks is made on the basis that these works will be completed at specified stages of mine operations and their implementation may be delayed until such time as that stage of development proceeds.

i. *Kayuga Bridge Traffic Safeguards (Mount Pleasant Mine)*

- Contractual arrangements to prevent heavy vehicles from Mount Pleasant mine using the bridge (during the hours of 6.45 to 8.45am and 3.15pm to 5.15pm on weekdays); and

- Signs to be erected on the bridge, subject to approval from Muswellbrook Shire Council, in both directions to specify the above requirements.

ii. Management of Temporary Road Closures due to Blasting (Mount Pleasant Mine)

- Minimum 24 hours notice of all road closures to be provided;
- Solar powered signs to be installed to advise traffic of road closures and alternative routes; and
- Blasting at Bengalla, Mount Pleasant and Kayuga Mines to be co-ordinated to minimise traffic disruption from road closures on Wybong Road, Castlerock Road, Dorset Road and the proposed Mount Pleasant Northern Link Road.

iii. Intersection Improvements (Mount Pleasant Mine)

- Future intersection for Mount Pleasant Mine Access from Mount Pleasant Western Link (Year 9 of mine operations);
- Future intersection of Mount Pleasant Western Link Road with Bengalla Mine Link Road (Year 9 of mine operations);
- Future intersection of Mount Pleasant Western Link Road with Mount Pleasant Northern Link Road and Castlerock Road (Year 3 of mine operations);
- Future intersection of Mount Pleasant Western Link Road with Kayuga Road (Year 3 of mine operations); and
- A 65 per cent contribution towards the cost of future intersection improvements at the Denman Road and Thomas Mitchell Drive intersection.

iv. Roadworks Improvements (Mount Pleasant Mine)

- Construction of a bridge to carry the Bengalla Mine Link Road over the proposed Mount Pleasant Rail Loop;
- Closure of Castlerock Road and construction of Mount Pleasant Northern Link Road to Dorset Road (Year 3 of mine operations);
- Closure of Wybong Road in conjunction with Muswellbrook Shire Council and construction of Mount Pleasant Western Link Road (Year 9 of mine operations);
- All roads to be constructed to 100 km/hr design standard to Council and RTA requirements;

- A contribution of 50 per cent to be made to the annual road maintenance costs for the section of the Bengalla Mine Link Road between Denman Road and the western limit of the 1 in 100 year flood limit; and

- From the commencement of mine construction, any additional annual maintenance costs for Wybong Road between the mine access and Kayuga Road (including the Rosebrook Bridge) are to be met by the Mount Pleasant Mine. The calculation of these additional costs is to be based on historic maintenance costs to Council for this section of road for the three year period July 1994 to June 1997.

8.7 RESPONSE TO EIS SUBMISSIONS

289. Thirty seven submissions commented on traffic issues out of a total of 149 submissions. The most common issues raised related to proposed closures and diversions of Castlerock Road and in the long-term Wybong Road, namely:

- restricted future access to properties on Castlerock Road;

- increased future travelling time between properties for some landholders; and

- impaired access for emergency services vehicles in the future.

290. These submissions were primarily from residents along Castlerock Road including five submissions from persons residing at the "Mirrabooka" property. There were no submissions from either the RTA or the rail authorities. In responding to these submissions, it should be noted that the timing and effects of proposed closures and diversions of roads to the west of Muswellbrook were extensively considered in the EIS and the Muswellbrook Shire Council Western Roads Strategy Study.

291. The actual traffic detour distances and costs for Castlerock Road residents will be relatively minor, adding no more than one or two minutes typically to a journey to or from Muswellbrook which would currently take between 10 and 15 minutes.

292. For Wybong Road traffic, the potential increase in travel time would be proportionally less significant as this traffic would currently be travelling greater distances to Muswellbrook than the Castlerock Road traffic.

293. It is apparent from submissions that many criticisms of these road diversions were generally associated with objections to other issues such as an overall dislike of coal mining or perceived impacts on the value of rural properties for rural tourism or related ventures.

294. There were other issues raised by the NSW Department of Mineral Resources and The Bengalla Mining Co. in submissions, namely:

- the need to consider school bus movements in future traffic management plans for traffic control during blasting; and

- numerous issues were raised in the Bengalla Mining Co. submission relating to the proposed location of the rail loop, alterations to the originally proposed alignment of the Bengalla Link Road and a request for cost sharing of future road construction and maintenance costs where road access routes are to be shared between the Bengalla and Mt. Pleasant mines.

295. In response to these issues it is acknowledged that there will be a need for a road closure traffic management plan which contains road closures to specified times of the day so as not to adversely affect school bus services. Special arrangements should be made to minimise potential delays to emergency services vehicles during blasting by maintaining radio contact between traffic control and blasting personnel.

296. The issues relating to shared funding and usage of the Bengalla Mine Link Road, the Mt. Pleasant Rail Loop Corridor issues and amendments to the originally identified route of this road are acknowledged by both the Bengalla and Mt. Pleasant mine owners and are intended to be resolved to the satisfaction of both parties.

297. In the EPA submission received in February 1998, the impacts from increased rail transport of coal from Hunter Valley coal mines is discussed. It is acknowledged in the EPA submission that the current Hunter Valley Railway Programs Task Force recommendations will need to be implemented by the rail transport authorities on a "holistic" basis to address the overall implications of future mining throughout the Hunter Valley.

Chapter 9

BIODIVERSITY

9.1 CONSERVATION OF AFFECTED PLANT COMMUNITIES

298. Vegetation communities of the Hunter Valley have been highly modified since pre-European occupation. Extensive clearing and grazing has resulted in extremely low species diversity, reduced natural values and open woodland with few links between vegetated areas.

299. The four vegetation communities identified on the project site were:

- Grassland;
- Spotted Gum - White Box Open Forest;
- White Box - Narrow Leaved Ironbark Forest; and
- Bull Oak Woodland.

300. Conservation significance was determined by:

- size of an area and links to other natural areas;
- representativeness;
- existence of rare or endangered species;
- diversity;
- degree of naturalness; and
- presence of special natural features.

301. Based on an assessment of these values the overall conservation value of vegetation communities on site is moderate. The species found on site are common in the region but are inadequately conserved in national parks and nature reserves (Specht, *et al.*, 1995; Benson, 1989). Bulloak Woodland is increasingly becoming common in the Upper Hunter region because less intensive grazing is allowing regeneration, however it is poorly conserved in reserves. Spotted Gum is common on the valley floor and is widely distributed along the east coast, however is poorly

conserved in the Hunter region. White Box Woodland in the Hunter region is predominantly an intergrade with Grey Box (*Eucalyptus moluccana*) with a grassy understorey. As a community, the Box-Spotted Gum association is poorly conserved in the Hunter region (Specht, 1995; Benson, 1989; T. Peake, pers. comm.). The communities on-site have been highly disturbed and do not have any special natural features. The project site is unlikely to link other vegetated areas due to the highly modified and open nature of the vegetation.

302. Species of conservation significance that have been recorded in the Muswellbrook region are:

- *Bothriochloa biloba;*
- *Eucalyptus pumila;*
- *Lasiopetalum longistamineum; and*
- *Prostanthera cineolifera.*

303. The species requirements and status of these species were assessed to determine the likelihood of their presence on site. It was found that the site was suitable habitat for *Bothriochloa biloba,* however, it is unlikely that this species would occur on site due to intensive grazing and the introduction of pastoral species over many years.

304. The rehabilitation plan has taken the highly fragmented and modified nature of vegetation communities of the Hunter Valley region into account. Rehabilitation will use species either already growing on site or those that were part of the original vegetation cover. These include, but are not limited to the species listed in *Table 9.1*.

Table 9.1 NATIVE FOREST SPECIES

	Common Name	Scientific Name
Trees		
	Forest Red Gum	*Eucalyptus tereticornis*
	White Box	*Eucalyptus albens*
	Narrow Leaved Ironbark	*Eucalyptus cerebra*
	Spotted Gum	*Eucalyptus maculata*
	Kurrajong Tree	*Brachychiton populneum*
	Bull Oak	*Casuarina luehmannii*

Table 9.1 NATIVE FOREST SPECIES

	Common Name	Scientific Name
Shrubs		
	Cooba	*Acacia salincina*
	Fan Wattle	*Acacia amblygona*
	Peach Heath	*Lissanthe strigosa*
	Native Cherry	*Exocarpus cupressiformis*
	Native Blackthorn	*Bursaria spinosa*
		Pultenaea cunninghamii
Native Grasses		
	Spear Grass	*Stipa sp*
	Wallaby Grass	*Danthonia sp*
	Barbed Wire Grass	*Aristida vagans*
	Threeawn Speargrass	*Cymbopogon refractus*

305. Where possible seed collected from the site will be used in planting programs. The final form will have a mixture of pasture and timbered areas, with forest species planted to form wildlife corridors. Approximately 660 hectares of native vegetation is proposed to be revegetated, representing about 40 per cent of the rehabilitation area. At the end of the mine life it is proposed that vegetation will include 922 hectares of native forest and 2,407 hectares of pasture. This is an overall increase of 9.5% in woodland and forest areas compared to pre-mining conditions.

9.2 EIGHT POINT TEST UNDER THREATENED SPECIES CONSERVATION ACT

306. An eight point Test of Significance as per section 5A of the EPA Act has been conducted for each known threatened species (flora and fauna) which may potentially use the site. The tests indicated that no significant impact from the proposed mine development was anticipated on any species. The results of this test have been recorded in the EIS document.

9.3 MEASURES TO AUGMENT BIODIVERSITY CONSERVATION

307. Coal & Allied appreciates the importance of maintaining and increasing biodiversity on the site both during and after the completion of mining activities. At present species diversity on the site is extremely low, with limited vegetation communities, fauna species and fauna habitat. The rehabilitation plan and mitigation measures proposed were specifically designed to augment biodiversity conservation.

308. As previously mentioned the rehabilitation plan involves mass planting of native flora species in a form that will provide linked wildlife vegetation corridors and overall increased habitat for native fauna.

309. Mitigation measures designed to minimise impacts on local flora and fauna species, and enhance the overall natural value of the site include:

- minimising vegetation removal;
- retaining vegetation on Mount Pleasant and other small pockets on the site for ecological purposes;
- checking potential habitat logs and hollows prior to clearing;
- staged replanting programs to keep pace with mining sequence;
- control of feral species in consultation with the Rural Lands Protection Board;
- maintenance of rehabilitation areas to control weed invasion;
- creation of several large waterbodies consisting of final voids to be used as a water source by native fauna;
- overall increased areas of woodland / forest for fauna; and
- fencing of native vegetation during mining to increase habitat value by decreasing grazing pressure.

9.4 RESPONSE TO EIS SUBMISSIONS

i. Hunter Environment Lobby

310. A submission from the Secretary of the Hunter Environment Lobby (HEL) expressed concern regarding the impact of mining activities on biodiversity. These concerns were summarised as follows:

- The application of the principle of no nett loss of biodiversity - the HEL believed that the development does not meet this test;
- The level of detail of survey of fauna and flora - HEL believed that the survey was inadequate, referring to Mount Owen survey which lasted for two years;
- Loss of native vegetation - HEL was concerned that there is no evidence to support the proposition that "cumulative impacts from vegetation clearing and habitat loss will be offset by habitat enhancement of proposed rehabilitation areas";
- Attention to invertebrate biodiversity - HEL expressed concern over lack of attention;
- Rehabilitation programs - HEL generally supported the program, though it suggested that not less than 20% of the project area should be maintained for nature conservation in the long term. That habitat should also be provided throughout mining operations; and
- Biodiversity monitoring programs - HEL believed that a monitoring program should form part of the rehabilitation and land management plan.

311. Coal & Allied offers the following responses to the concerns of the Hunter Environment Lobby:

- Pockets of existing native vegetation will be retained on site and conserved. Vegetation cleared as a part of the mining process will be removed in stages. Mined areas will be correspondingly rehabilitated with plant species native to the site and/or local area. In total 922 hectares of woodland and open forest will be created through such rehabilitation. This will be a 9.5% increase in this vegetation compared to the original site. Rehabilitation and management plans will therefore maintain or enhance the existing biodiversity of the site. The plant and animal species and the vegetation communities that occur on site will be maintained in the long term;

- Field investigations were carried out in November 1994, July 1995, November 1996 and February 1997. These investigations were structured to include seasonal variability and fauna movement. Investigations were extensive at the Mount Owen project site due to its location within a State Forest, where a much higher diversity of species was expected and where expected conservation values were higher;

- Coal & Allied has undertaken extensive research into rehabilitating open-cut mines. It has developed a number of techniques which have proven to be successful at Hunter Valley No.1. These techniques include establishing forests by direct seeding, growing pastures on rock emplacements with and without topsoil, developing a pasture mix that provides year round grazing capacity and continuing management of rehabilitation areas. The proposed rehabilitation plan commits Coal & Allied to the planting of 922 hectares of native forest and woodland, and 2,407 hectares of native pasture, which accounts for 88% of the total project site;

- At present there is no legal requirement to assess invertebrate biodiversity, however the replanting of native vegetation and the continued provision of habitat area for native fauna will mitigate the effect of mining activities on invertebrate species in the long term;

- As previously mentioned habitat areas will be fenced during mining to provide continued access for fauna throughout the mining program and to maintain native vegetation. This will have the additional benefit of reducing pressure on native vegetation communities from grazing; and

- The Director's requirements for the EIS specified that an outline of an Environmental Management Plan (EMP) must be provided for the management and mitigation of environmental impacts for the construction and operation of the mine. Coal & Allied has adopted an Environmental Monitoring Program that will be part of a procedural framework provided by the EMP. Rehabilitation surveys will consider species selection, rehabilitation methods, fauna diversity and habitat values.

ii. NSW National Parks and Wildlife Service

312. The submission received from the NSW National Parks and Wildlife Service (NSW NPWS) covered the following matters:

- Assessment of the conservation significance of vegetation communities found in the study site - NPWS believed the assessment was not comprehensive and suggested that further assessment is required to substantiate the position that vegetation on the study site does not have conservation significance; and

- NPWS suggested that to ameliorate vegetation loss in the area, rehabilitation should re-establish as quickly as possible the current mix of native vegetation in particular, the re-establishment of Bull Oak woodlands.

313. The concerns of the NSW NPWS have been addressed in Section 9.1 and 9.3 of this report.

iii. NSW Agriculture

314. NSW Agriculture passes rehabilitation and the final land use of the site including:

- ensuring the continuation of agricultural operations in areas acquired as part of the mine development;

- maximising the agricultural potential of rehabilitated areas; and

- excluding mining from the more valuable (prime) agricultural areas.

315. Coal & Allied has committed to maximising the rate of progressive rehabilitation. As outlined in the EIS, areas not required for mining will be available for continued agricultural operations. This includes the more valuable agricultural lands in the eastern part of the site. Notwithstanding this, a significant security deposit will be required by the Department of Mineral Resources to ensure rehabilitation commitments.

316. It should be noted that detailed rehabilitation plans will form part of open cut approvals under the *Mining Act*, 1992. The rehabilitation strategy outlined in the EIS was designed to maximise the potential land capability of the post-mining landform. As outlined in Section 7.2.5 of the EIS, the rehabilitation strategy will maintain the more valuable (prime) agricultural lands. The void will change post mining land capability which may have some potential benefits for future generations. Comparison of pre-mining and post-mining land capabilities indicates a significant

increase in the proportion of Class VII and VIII lands. However, it should be acknowledged that the percentage increase is disproportionately large due to the fact that equivalent pre-mining land capabilities are very limited. Consequently, any increase in these land capability classes will be perceived as significant when viewed independently from overall changes.

317. As outlined in Section 6.5 it is planned to continue operations beyond Year 21. This will give an opportunity to reduce the size of the final void and improve the overall land capability of the site. If the void has no beneficial future use, it is an unavoidable consequence of recovering the coal resource. Dams on site were principally located to manage surface waters. By default these dams will also provide replacement supply for agricultural activities.

Chapter 10

CULTURAL HERITAGE

10.1 ABORIGINAL HERITAGE

10.1.1 Survey History

318. Archaeological investigations have been undertaken in a number of stages over the mine authorisation area, out-of-pit emplacements and adjoining fines emplacement area. In addition, a small portion of the proposed rail link west of the Bengalla mine site which was not subject to previous archaeological survey was examined.

319. Field surveys of the mine Authorisation area were initially carried out over eight days between 25 May 1995 and 3 June 1995. Fifty person days were spent in the field. The field team was divided into three sub-teams of two persons each. Each sub-team walked parallel transects recording all exposures, artefact finds and sites as encountered. Teams were equipped with a 1992 colour aerial photograph, topographic and land holding maps. Recording was completed on standardised forms. To ensure consistency of definition each person worked with every other person on different days.

320. Additional surveys were undertaken by ERM Mitchell McCotter in 1996 and 1997. These surveys covered the north west emplacement area and fine rejects emplacement area.

321. The north west emplacement area was surveyed in May 1996. Sample units were selected for archaeological investigation according to local environmental and geographic factors, ground surface exposure, potential site locations and location of drainage lines, ridges, hillslopes and gullies. Sampling also included vegetated areas where ground visibility was low, to maximise the identification of Aboriginal archaeological sites.

322. The fine rejects emplacement area was surveyed over 17 days in five stages between 11 December 1996 and 7 May 1997. The survey team consisted of an archaeologist, an assistant and two representatives from the Land Council and the Tribal Council. Sample survey areas were chosen from information gathered from the literature review, previously determined site location patterns for Aboriginal site, and an assessment of land use impact within the study area. Transects were covered on foot with the survey team working at spaced intervals.

323. The purpose of all investigations was to record items of Aboriginal heritage, identify impact to sites and items, and to provide management recommendations and safeguards to protect sites of archaeological significance.

10.1.2 Consultation with Aboriginal Communities

324. Aboriginal communities were consulted throughout all archaeological investigations.

325. Mr Barry French from the Wanaruah Local Aboriginal Land Council took part in the initial survey (Rich, 1995) on all days and participated in discussions concerning the management of Aboriginal finds. There was no report identifying sites of special significance to the Land Council.

326. A change of personnel occurred during the survey and the Wonnarua Tribal Council was established. An on-site inspection was held between the 4 and 5 July, 1996 with representatives from both organisations.

327. The additional surveys by ERM Mitchell McCotter involved both the Wanaruah Local Aboriginal Land Council and the Wonnarua Tribal Council Incorporated. Regular discussions were held on-site during the investigations on the conduct of fieldwork, survey results and potential impacts.

10.1.3 Significance Of Cultural Resources

328. Archaeological significance depends on the potential to define or expand knowledge of earlier human occupation, activities and events through archaeological research. Items of significance can be relics, archaeological deposits and landscapes. Aboriginal sites provide important information about the prehistory and settlement of Australia including the processes of cultural adaptation in a changing environment. In general terms, it is usual to assess individual sites as significant if:

- they have large, dense artefact concentrations;
- they can potentially be dated; or
- they show signs of particular activities.

329. Aboriginal sites and relics can also be assessed by their cultural heritage values, as well as their traditional, historic and social Aboriginal significance.

330. In Australia, all sites have some significance to Aboriginal people. The antiquity of a site is not necessarily a guide to significance for Aboriginal people. Aboriginal significance is a matter for the Local Aboriginal Land Council or other recognised representatives of the traditional community to determine.

331. This is discussed in more detail within the Mount Pleasant Mine EIS.

10.1.4 Impact On Cultural Resources

332. A total of 441 artefact locations or sites consisting of 5,439 artefacts were recorded during field surveys. Most artefact locations were single isolated finds. A large concentration of artefacts was recorded in the northern catchment of the fines emplacement area, accounting for almost 4,000 of the total artefacts recorded.

333. The most significant location is the site of the proposed environmental dam in the western-most part of the northern catchment. This location will not be affected until Year 10 of operations, when construction of the dam commences. Continued consultation with the Wanaruah Local Aboriginal Land Council and the Wonnarua Tribal Council Incorporated will determine appropriate options for managing this area.

10.1.5 Response to EIS Submissions

334. Issues relating to Aboriginal heritage were raised in a number of submissions, including a comprehensive submission by the National Parks and Wildlife Service. A copy of this submission is provided in Appendix D.1 and issues raised are addressed below. Issues regarding the Rich (1995) report are responded to in Appendix D.2.

i. Wonnarua Tribal Council

335. A letter from the Wonnarua Tribal Council withdrawing support for a consent to destroy any site within the lease area was received after the EIS had gone to print. Previous reports and comments from the Land Council and Tribal Council were incorporated into the document as stated in Section 10.26 of the EIS. The subsequent views of both the Tribal Council and the Land Council have been the subject of discussion with Coal & Allied. However, discussions are continuing with The Tribal Council to resolve the issues raised.

ii. Integration of Information from Three Reports

336. Two reports were written as stand alone studies, as required by the National Parks and Wildlife Service; Rich (1995) and ERM Mitchell McCotter (1997) The third report, ERM Mitchell McCotter (1996) was written as an addendum to the Rich study and was not intended to be read as a stand alone report.

337. The ERM report of the fines project area incorporated the contextual information of the landscape and archaeology, the analysis method and significance assessment method outlined in the Rich (1995) study. The recommendations were area -and site- specific, avoiding broad, insupportable management and conservation strategies covering the whole lease landscape.

338. The addendum report was by definition integrated with the Rich (1995) report.

iii. Environmental Context

- The descriptions of soils, vegetation and past impacts exceeded the level of detail suggested in the NPWS guidelines of the time. The description of the past and present impacts of the study area reflects the information available.
- In general, surface artefacts were almost exclusively found in exposures caused by erosion. Erosion is the main factor in the Hunter Valley for exposing archaeological material. It was not considered necessary to state or qualify the main site detection factor, however this comment is noted.
- Figures 3 and 4 of Supplementary Report 5 (ERM Mitchell McCotter, 1997) showed the three land form units identified on site and site locations at the same scale, enabling observation of site and landform trends. The suggestion that area calculations be provided is noted.

iv. Archaeological Context

339. There are published articles on the unreliable nature of surface survey to indicate assemblage and distribution patterns within a landscape. Surface assemblages are also often poor indicators of subsurface conditions. Archaeologists work with small, incomplete and often skewed data, however, models should be designed as part of research. These models should not be too specific when based on such incomplete data sets.

340. The omission of the Glennies Creek Late Pleistocene site in the chronological section of the report is noted. Older assemblages were considered.

- Comments relating to dating of open sites are noted.

- Chapter 3 is intended to provide a synthesis of the archaeological findings of the region rather than the site itself. Regional experience indicates that open artefacts are the likely site type to be encountered.

v. Field Investigation

- The reviewers attention is drawn to Section 4.1 (ERM Mitchell McCotter, 1997) paragraphs three and four where the location and extent of the sample units are explained.

- It is noted that a graphic depiction of the area covered by the survey would assist the reviewer.

- Identification of scarred trees can be problematic in some instances.

- It is noted that the written site description should be included to aid the interpretation of the results. It is also noted that an explanation of the values of column 6 and 7 of Table 4.1 (ERM Mitchell McCotter, 1997) would be useful.

- As shown in Section 4.6 (ERM Mitchell McCotter, 1997), 'Analysis', the resulting data were interpreted and presented in terms of site types, artefact numbers, site location, type site location, artefact characteristics, assemblage characteristics in relation to raw material and location. This analysis was presented in written and tabular form, and summarised in the discussion (Section 4.8). This was a thorough analysis of the result data and exceeded the minimum recommendations set out in the NPWS guidelines.

- It is noted that the glossary of terms could have been expanded and definitions simplified.

- It was not the intention of this survey to address all analysis issues such as reduction strategies. These and other more detailed issues would be best addressed after further, detailed archaeological investigations. The section referred to (4.6.4. iii) commented that reduction sequences can be indicated in the survey assemblage by artefact indicators.

- Of the 146 modified artefacts identified, 126 were found in gullies. This was over 86% of all modified artefacts.

- The paragraphs preceding *Table 4.12* (ERM Mitchell McCotter, 1997) stated that the total number of artefacts found with cortex was 143 (3.6% of the assemblage). As the total number of artefacts represented in *Table 4.12* was 143, it was clear that the percentages related to both modified and unmodified artefacts.

- This comment refers to divergent occupation patterns between ERM Mitchell McCotter (1997) survey and the Rich survey of the main lease area (Rich; 1995). This observation was based on the available data as observed in exposures. Written and tabulated information in the report supported this conclusion.

vi. Significance Assessment

341. The significance assessments of the Aboriginal cultural heritage components in the subject areas were supportable by the published data. Both the Rich and ERM studies were within guidelines of international and national best practices. Both cited the ICOMOS Charter for the Conservation of Places of Cultural Significance (The Burra Charter), as the bases for significance assessment and design of the conservation recommendations. This document included nationally recognised and clearly defined criteria:

- 'Research potential' was based on the surface assessment of the sites 'nature' (dense or large open camp site for instance), and state of preservation (integral nature of the site on the horizontal and vertical plane);

- The rarity was assessed in the context of state, region or local levels and was illustrated in Table 5.1 (ERM Mitchell McCotter, 1997) by the insertion of 'state', 'region', or 'local' in the rarity column.

- The method of assessing 'representativeness' was set out in the ICOMOS Burra Charter referred to in Section 5.1 (ERM Mitchell McCotter, 1997). This was briefly explained in paragraph 2 and 3 on page 5.2; and

- Density and size were two attributes of a site which should be considered together. One value should not be viewed without the other. On paper a site may appear to be very dense, for instance 17 artefacts per square metre. However, the site may only be one square metre. Conversely a site may seem to have a low density for instance 1.2 artefacts per square metre but the site may be very extensive.

342. In *Table 5.1* (ERM Mitchell McCotter, 1997) the cross signified that the site was judged to have a low density of artefacts and diminutive dimensions. With all tables and results, cross referencing was designed to be as easy as possible for the reader.

vii. Impacts and Safeguards

343. ERM Mitchell McCotter (1997) was a stand-alone report with the results, impacts and recommendations specific to the area studied in 1996. No attempt was made to generalise management strategies with areas and assemblages not covered by this investigation.

344. The main lease area and the fines rejects emplacement area have different proposed impacts, slightly different topography and different patterns of archaeological sites. It was, therefore, not considered appropriate to group the conservation and management recommendations together.

345. The information presented in Chapters 5 and 6 (ERM Mitchell McCotter, 1997) identified any area of archaeological potential. The recommendations were designed to ensure that the identified archaeological resource within the study area is conserved or managed in such a way as to minimise the destructive impact on the resource at a local and regional level.

viii. Survey of the North Western Emplacement Area.

346. This report was never intended to be read as a stand alone study, rather as an addendum to the Rich 1995 study.

10.2 EUROPEAN HERITAGE

10.2.1 Survey Undertaken

347. National and state heritage inventories held and curated by the Australian Heritage Commission and the Heritage Council of NSW were reviewed. In addition the local LEP document was referenced.

348. No items of European heritage significance were identified during this search and as a result no field investigation or further study was carried out at the time.

10.2.2 Response to EIS Submission

349. A response was received from Mr. Robert Tickle, Heritage Officer of the Muswellbrook and Upper Hunter Historical Society (MUHHS). On behalf of the Society, Mr Tickle objected to the proposed development of the mine lease area. The objection was based on a belief that the heritage study was superficial and inadequate. He stated that no experts were used in the assessment process and the quoted reference sources were scant and outdated.

350. These comments were noted and a meeting between Mr Tickle and ERM's historical archaeologist. The following key issues and recommendations resulted from this meeting.

i. Issues

- Heritage items identified by the Muswellbrook & Upper Hunter Historical Society (MUHHS) in the Mount Pleasant mining lease and immediate surrounds;
- research and surveying strategies to adequately record these heritage items and places;
- oral history of residents of the area;
- inclusion of the MUHHS in the process, and
- required resources and likely timeframes.

ii. Recommendations

351. Mr Tickle compared the original study with the Kayuga investigation undertaken in 1996 (Appendix 12 of the Kayuga Environmental Impact Statement) which was much more detailed. The following actions were discussed as reasonable requirements for an effective study:

- a member of Muswellbrook and Upper Hunter Historical Society would be given access to monitor progress of work carried out and condition of buildings retained. This could be an ongoing process, possibly with biannual visits;
- an accurate map of the mining lease would be prepared showing all past and present sites;

- aerial photographs of the above area to support the map;
- photographs of archival quality would be taken of all structures and sites in the lease area;
- professional archaeologists/historians would be engaged to study the history of the area and investigate all buildings and sites that will be affected by the mine;
- a management plan would be developed for sites and structures. Consideration would be given to whether a site is preserved, relocated, recorded or an archaeological study carried out;
- a qualified would person be engaged to prepare an oral history of the area before local residents are displaced;
- copies of all reports and studies would be made available to interested parties; and
- all tasks would be undertaken in consultation with a member of the Muswellbrook and Upper Hunter Historical Society.

352. The Historical Society will donate its time and agreed that the recommended actions above could be undertaken following development consent.

Chapter 11

CUMULATIVE IMPACT

11.1 STATUS OF LEASES AND MINING PROPOSALS

353. Currently there are four operational open cut mines in the Upper Hunter, one operational underground mine, four proposed open cut mines (including Mount Pleasant) and one proposed open-cut / underground mine.

- Muswellbrook No.2 located 6km north-east of Muswellbrook is an open-cut mine with underground operations completed in March 1997;
- Bayswater No.2 is an open-cut mine located 10km south of Muswellbrook with production expected to cease in 1998;
- Drayton is an open-cut mine located 10km south of Muswellbrook;
- Bayswater No.3 is an open-cut mine located 12km south of Muswellbrook which commenced in January, 1995;
- Dartbrook is an underground operation located 10km north west of Muswellbrook which commenced production in October, 1994;
- Kayuga is a proposed open-cut mine located 6km north west of Muswellbrook;
- Bengalla is an open-cut mine under construction located 5km west of Muswellbrook. Production is expected to commence in late 1998;
- Mount Arthur North is a proposed open-cut mine located 5km south west of Muswellbrook; and
- Saddlers Creek is a proposed open-cut and underground mine located 15 km south west of Muswellbrook. This site is currently an exploration area only.

11.2 CUMULATIVE IMPACTS IN THE UPPER HUNTER

354. The Department of Urban Affairs and Planning (DUAP) conducted a study into cumulative impacts in the Upper Hunter which was published in 1997. The study was considered necessary due to rapid growth in natural resource development, mining, energy and related activities in the area.

355. One of the objectives of the study was to determine "the effects of cumulative impacts of various existing and major proposed land uses and activities". It was found that in general air quality meets community health standards but blasting from mine operations can cause temporary nuisance.

356. Water quality and its decline was identified as the area of greatest concern. However, this issue is currently being addressed by initiatives in total catchment management.

357. It was also noted that the assessment of cumulative impacts was limited by the existing environmental monitoring network and data which are not geared towards monitoring cumulative impacts.

358. However, the study did determine that there were no major cumulative impacts which necessitated additional regulatory intervention or major restrictions on development. However, cumulative impacts on water were highlighted as requiring further investigation.

11.3 INTERACTIONS WITH BENGALLA AND KAYUGA

359. The Mount Pleasant Mine adjoins the proposed Kayuga Mine in the north and Bengalla Mine in the south. Coal barriers will occur between these respective operations.

360. The barriers between Mount Pleasant and the proposed Kayuga Mine will contain the corridor for the diverted Castlerock Road with open cut mining not intended in this area. The barrier between Mount Pleasant and Bengalla Mine will be mined, subject to ongoing negotiations between the two companies.

361. Mount Pleasant will liaise with Bengalla mine and the proposed Kayuga Mine to ensure road closures are kept to a minimum.

362. Product dispatching with joint user facilities at the Bengalla site were not feasible due to the difference in timing of the two projects.

11.4 CUMULATIVE IMPACTS ON MUSWELLBROOK

363. Disturbing 2,109 hectares of vegetation will contribute to the cumulative impacts of vegetation clearance and habitat loss in the Hunter Valley. However, none of the proposed mines will disturb any unique ecosystems or habitats of conservation significance.

364. Cumulative operations from the Mount Pleasant, Dartbrook, Bengalla and Kayuga Mines will depressurise hardrock coal measures, resulting in lower pit inflow rates at each mine.

365. With regard to socio-economic impacts, substantial increases in direct employment, income and output will result. This will provide a larger economic base, capable of fostering community growth, development and expanded services.

366. Mount Pleasant will interact with the Bengalla and Kayuga developments. Significant increases in cumulative dust levels will be confined to an area west of Muswellbrook.

367. One residence south west of the Mount Pleasant Infrastructure area could be cumulatively affected by noise from the Mount Pleasant and Bengalla Mines. A number of properties in Kayuga village will receive less than 40dB(A) daytime noise from either the Mount Pleasant or Kayuga Mines alone, but more than this value for the two combined.

368. Cumulative landscape changes will be evident over 11 kilometres from the southern part of Bengalla mine to the northern part of Kayuga mine. The most evident effect would be the rapid development of spoil emplacements.

369. Cumulative traffic from the Bengalla, Mount Pleasant and Kayuga Mines will be limited to significant increases on future mine link roads, with minimal increases on existing roads.

11.5 MEASURES TO AMELIORATE CUMULATIVE IMPACTS

370. While 2,109 hectares of vegetation on the Mount Pleasant site will be disturbed, 1,638 hectares will be rehabilitated. If Bengalla and Kayuga mines are also considered, then 3,169 hectares will be cleared and 2,197 will be rehabilitated. Although there is a deficit formed by pit voids, rehabilitated land will be more diverse and capable of supporting more varied habitats.

371. A number of mitigation measures were devised to avoid potential negative socio-economic impacts. These included maintaining a high level of consultation with local residents, liaising with training and educational bodies to increase the local skills base, monitoring demand for temporary accommodation and assessing the need for community services and development programmes.

372. A number of safeguards were developed to protect local heritage items, including surveying buildings to assess their ability to withstand vibration and overpressure and where necessary providing temporary reinforcement. These properties will be monitored and where necessary repaired. Discussions were also held with the Muswellbrook and Upper Hunter Historical Society on a detailed heritage assessment of the site and a management plan.

373. Dust was identified as an area of concern. To control this, a number of mitigation measures will be applied during development and operation of the mine. This will be accomplished by incorporating a number of measures in the design of the mine such as minimising the length of haulage routes, the use of bunding, enclosing conveyers and the use of water sprays. A number of operational procedures will also be followed such as watering working services, limiting exposed areas and the collection of dust during drilling.

374. Although the cumulative impacts of noise are expected to be minimal, a number of mitigation measures were developed to reduce noise levels. These related to blasting activities and the containment of noise from general site activities. Where noise levels exceed the criteria for residences, Coal & Allied will offer a choice of noise abatement modifications or fair acquisition terms to properties.

375. Emplacement landforms will be constructed to address cumulative visual impacts of the development. This will effectively screen the developments. Emplacement landforms will be reshaped as they are built.

376. Although cumulative impacts on transportation are expected to be minimal, a number of improvements to the road and rail network will be required. A list of improvements to be implemented by Mount Pleasant and other mines in the area were given. These improvements were staged over the operating period of the mine.

11.6 EIS SUBMISSIONS ON CUMULATIVE IMPACTS

377. A number of submissions were made from residents and various authorities about the Mount Pleasant Mine proposal. Many of these submissions addressed issues of cumulative impacts from the proposal.

378. Ninety four submissions included concerns over cumulative impacts. In particular, residents voiced concerns over the following areas:

- general degradation of lifestyle;
- impacts upon tourism;
- impacts of increased dust levels on vineyards;
- loss of land for horse breeding;
- impacts on flora and fauna;
- risks to personal health;
- increased noise levels; and
- impacts upon Aboriginal and cultural heritage.

379. Submissions from various authorities are summarised below:

- the National Parks and Wildlife Service raised cumulative impacts on flora removal, in particular small patches of Bulloak Woodland and Spotted Gum communities. Issues were also raised over Aboriginal heritage;
- NSW Agriculture raised concerns over the cumulative impacts of noise on non-company owned residences. The impacts of removing land from agricultural production and alterations to the road network were also seen as affecting rural families and farming businesses. NSW Agriculture also highlighted impacts on water resources and the accuracy of predictions that the mines will have on water resources;
- Department of Land and Water Conservation identified the cumulative impacts of mining on the local and regional groundwater regime as an issue;
- Scone-Parkville Environment Watch objected to the cumulative impacts of mining on groundwater and air quality; and

380. NSW Environment Protection Authority stated that the assessment of long term cumulative impacts on air quality was reasonable. However, concerns were raised over the cumulative impacts of rail noise on residents living along the line to Newcastle. Issues also related to cumulative noise impacts from more than one development starting around the same time.

Chapter 12

ENVIRONMENTAL MANAGEMENT

12.1 CORPORATE ENVIRONMENTAL POLICY

381. Coal & Allied is committed to the principles of sound environmental management at all its mine sites and facilities. It has a four tiered approach to ensuring compliance with best practice environmental management. The Company's Environmental Policy, which is the first of these tiers, states in part:

> *"This commitment requires the application of strict environmental safeguards during all coal mining, processing and transportation operations. Compliance with the requirements of all environmental legislation is mandatory.*
>
> *It is the responsibility of management to inform employees of the legislative requirements and to provide the means with which to attain compliance."*

382. A detailed Environmental Policy and Responsibilities Statement is the second tier in the environmental management system. This statement commits Coal & Allied to the concept of sustainable development in establishing and operating its coal mines and associated facilities.

383. The third tier is a comprehensive Site Environmental Procedures Manual which forms the framework for the fourth and final tier, individual management plans and procedures which detail the specific actions, checks and accountabilities which apply to environmental management of a site.

384. A Company-wide environmental training course based on the Site Environmental Procedures Manual is currently planned.

385. Coal & Allied was recognised for its rehabilitation and environmental commitment with the following awards:

- NSW Soil Conservation Service Jubilee Award;
- inaugural Hunter Rural Tree Award (mine site section);
- inaugural NSW Minerals Advisory Council Award for Environmental Excellence;

- NSW Landcare Award (business section); and
- Environment Performance Award (highly commended) from the Hunter Catchment Management Trust.

12.2 CORPORATE ENVIRONMENTAL MANAGEMENT SYSTEM

386. The Rio Tinto Coal NSW (RTC) head office is located adjacent to Hunter Valley No.1 Mine south east of Muswellbrook. A part of the head office function is the RTC Environmental Service group which provides environmental expertise to the RTC managed mines.

387. The Environmental Services group has six experienced environmental managers, scientists, engineers and land care experts. A range of functions is provided to the sites including:

- Rehabilitation planning, design, implementation and monitoring;
- Water management planning, design, implementation and monitoring;
- Preparation of environmental management plans;
- Hydrocarbon management;
- Waste management;
- Environmental monitoring including air quality, water quality, noise including ambient and from blasting, and vibration from blasting;
- Environmental training;
- Commitments under the RTC Greenhouse Gas Abatement programme ;
- Aboriginal heritage;
- Community and statutory authority consultation;
- Environmental approvals and licensing;
- Environmental Reporting;
- Landcare management of company property; and
- Environmental compliance management through the Rio Tinto 24 hour Environmental Hot Line.

388. Rio Tinto Coal is currently developing an ISO14001-based Environmental Management System which will be completed in the second half of 1998. ISO 14001 is the International Standard on environmental management systems. The system draws together key elements of the Coal & Allied and Novacoal environmental management systems and provides a common approach to environmental management across all RTC sites.

389. A set of minimum standards, to which all sites must comply, forms the foundation of the RTC Environmental Management System. These are supported by guidelines to assist in the implementation and operation of the system, and detailed environmental procedures to support environmental training of mine personnel and to minimise environmental impacts.

390. RTC's environmental management standards cover all aspects of ISO 14001, as well as the key environmental aspects for operating a large open cut mine site (eg: mine rehabilitation, water management and control of dust and noise). This means that the system not only supports a comprehensive corporate environmental management structure, but also provides the operations with a set of minimum environmental outcomes.

391. The RTC EMS will ensure that Rio Tinto Coal continues to achieve best practice environmental management, and will position the company to gain full ISO 14001 certification at an appropriate time in the future.

12.3 COLLECTION OF BASELINE DATA

392. Collection of baseline environmental data commenced when Coal & Allied was granted an exploration licence in April 1992 and continued through to the preparation of the environmental impact statement in 1997. These data were used during the planning of the mine to locate sensitive areas and minimise the impacts of the proposal. They were also used in preparing the EIS to assess the potential environmental impacts of the proposal and identify appropriate mitigation measures.

393. Baseline studies conducted by independent consultants were based on primary and secondary research. Studies focused on a number of key areas as described below.

12.3.1 *The Physical Environment;*

- Land use: a survey was conducted into current site activities including productivity and the resulting contribution to the economy. Land ownership and private residences were also surveyed.

- Land capability: soil investigations mapped soils and determined stripping depths and rehabilitation suitability. This included a combination of aerial photographs, field inspections and laboratory analysis.

- Climate: an on site weather station was established in the north of the site in 1992. The local climate was described, incorporating climatic patterns, rainfall, temperature, evaporation and wind. A second weather station was erected south east of the site on the floodplain to understand meteorological variation in the area.

- Bushfire: bushfire hazard was assessed using the methodology outline in The Department of Planning Circular C10 "Planning in Fire Prone Areas".

12.3.2 *Flora and Fauna*

- Flora: site vegetation communities were examined, described and mapped. This was done by reviewing literature, interpreting aerial photographs, accessing the NPWS Wildlife Atlas and Rare or Threatened Australian Plants database records, conducting field investigations and consulting the NPWS in Muswellbrook.

- Fauna: site fauna habitats were identified through studying vegetation communities and conducting four fauna surveys between 1984 and 1997.

12.3.3 *Surface Water and Groundwater Conditions*

- Surface water quality was monitored at the Mount Pleasant site at monthly intervals from January 1993 to December 1994. This determined baseline water quality in the area. Samples were taken from the Hunter River at four locations both upstream and downstream of the site. The Dartbrook tributary was sampled at one location and another six sampling points were located in various drainage lines on or near the site.

- Groundwater management studies were completed for the site. These included drilling, sampling, testing and monitoring the groundwater environment and detailed assessment and computer simulation modelling of proposed groundwater management.

12.3.4 *The Social Environment*

394. A socio-economic profile of the area provided an understanding of population trends, economic activity, employment, accommodation and community facilities. This involved extensive consultation with local community representatives and service providers.

395. Archaeological investigations and surveys were conducted in 1995, 1996 and 1997. The Wanarauh Local Aboriginal Land Council and the Wonnarua Tribal Council Incorporated were consulted during these investigations.

12.3.5 *Air Quality*

396. A monitoring programme was carried out between 1993 and 1996 to determine existing background dust levels. Settleable dust levels (dust deposition), total suspended particulates and fine PM10 dust particulates were monitored. Dust deposition was monitored at 15 different locations. Total suspended particulates were measured at six locations.

12.3.6 *Background Noise*

397. Existing noise levels were monitored at seven locations during 1994 and 1995. Monitoring was also conducted at three locations remote from built up areas in 1993. Existing noise came mainly from existing mining activities, farming and road traffic.

12.3.7 *Visual Character*

398. A detailed visual assessment of the proposal was completed by an independent consultant. This included an assessment of the regional landscape setting and visual catchment.

12.3.8 Transportation Networks and Volumes

399. A number of road and rail transport issues were identified in consultation with Muswellbrook Shire Council and government authorities. Traffic volumes for individual roads were gathered from RTA surveys.

12.4 DEVELOPING THE EIS

400. Under the *Environmental Planning and Assessment Act, 1979* an environmental impact statement must accompany a development application for a proposal of this nature. In the interests of objectivity, the EIS was carried out by an independent third party. In this case ERM Mitchell McCotter was commissioned to conduct the study.

401. Coal & Allied maintained an open dialogue with the community during the planning of the mine and the preparation of the environmental impact statement. Muswellbrook Shire Council and government agencies were extensively consulted to ensure that key issues were addressed early in the process.

402. This consultative approach led to a project which was more acceptable to the community. Mine infrastructure was relocated from the eastern side of the site to the south west because Council and local residents felt these facilities were too close to the township of Muswellbrook.

403. As described in the previous section, comprehensive baseline studies helped define the environmental characteristics of the area. Details of the proposed project were then considered in relation to these characteristics to determine any positive or negative impacts on physical and human environments. Where negative impacts were identified corresponding mitigation measures were developed for the proposal. Finally the draft EIS was fully reviewed by another consultant to critically scrutinise every major finding.

404. Through this process, an objective decision can be made whether overall benefits at the local, state and national levels outweigh negative impacts of the proposed project.

12.5 APPROACH TO ESD PRINCIPLES

405. The principles of ecologically sustainable development (ESD) are fundamental to impact assessment. In broad terms, ESD can be viewed as ensuring that current generations bequeath a natural environment that functions as well as or better than the one they inherited.

406. In incorporating the principles of ESD into the EIS, four main principles were considered and addressed:

i. *The precautionary principle - 'if there are threats of serious or irreversible damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation'.*

407. In conducting the study no threats of serious or irreversible environmental degradation were identified. As such the proposal does not compromise the precautionary principle.

ii. *Social equity including intergenerational equity - 'ensuring that the basic needs of all sectors of society are met and there is a fairer distribution of costs and benefits' but also that 'present generations should ensure that the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations'.*

408. The study showed that the proposed mine will have a minimal effect on the above principle. Effects on flora and fauna will be minimal, economic consequences will be beneficial and the resulting landform will be capable of supporting an equivalent variety of land uses. However, it is unlikely that groundwater levels within the backfilled mine pits will return to pre-mining levels and there is a small possibility that seepage from spoils may potentially affect water quality in localised areas.

iii. *Conservation of biological diversity and maintenance of ecological integrity - including the diversity of genes, species, populations, communities and ecosystems and the linkages between them.*

409. Based on the assessment of flora and fauna studies at Mount Pleasant it was concluded that the final landform will support a more diverse ecosystem than the current predominantly grazing landuse.

iv. *Improved valuation and pricing of environmental resources - so as to reflect the true 'cost' of such commodities.*

410. In encompassing the above principle, negative impacts of the project were identified and corresponding amelioration measures established. The cost of these measures are one measure of the cost these environmental resources. As such, these costs have been incorporated into the Company's economic analysis of the project.

12.6 ENVIRONMENTAL MANAGEMENT PLANS

411. Environmental management plans play an important role in managing and mitigating the environmental impacts of activities. By taking a pro-active stance, environmental management plans assist in identifying potential environmental impacts and establishing procedures and actions for avoiding these impacts or mitigating the results should an incident occur.

412. Through formalising the system, a consistent approach can be adopted throughout the entire organisation, which facilitates co-ordination between personnel. By allocating responsibility within the organisation, accountability is also improved. Environmental management plans provide feedback on performance, which can help identify potential problems before they materialise and direct attention to where it is most needed.

413. In short, environmental management plans help an organisation to understand its interrelations with the surrounding environment, conduct its activities in a controlled manner and identify and mitigate any negative impacts from its activities. As such, a well implemented environmental management plan can provide assurance to interested parties of sound environmental practices.

12.7 THE EMP FOR MOUNT PLEASANT

414. Due to the nature of this project, two environmental management plans will be prepared; one for the construction phase and one for the operation phase. The plans will be updated throughout both phases to ensure that they are relevant and they incorporate operating experience.

415. During construction a variety of issues will be addressed. The main areas of concern will be noise, traffic, dust, erosion, water management and waste. Each will be considered individually by imposing controls and monitoring the scale of any impacts. In addition, any problems will be rectified through rehabilitating the area once this phase has been completed. To minimise disturbance, working hours will be strictly controlled. All required approvals and/or licenses will be obtained and development approval conditions will be enforced.

416. An outline of the environmental management plan was prepared for the second phase, being the operation and maintenance of the mine. An Environmental Procedures Manual will be compiled based on site-specific environmental procedures. Responsibilities within the organisation will also be described.

417. More specifically the manual will consist of procedures which address the following areas:

- Waste Management - to ensure waste is responsibly disposed of on the site itself and at approved off-site locations. Waste volumes will be minimised through proper segregation;

- Water Management - to ensure that all water management systems are functioning effectively and that water is efficiently recycled. All discharges will be controlled in accordance with consents and licences.

- Noise and Air Quality Management - to minimise dust, to pay due regard to environmental considerations when operating equipment and blasting, and to consider the impacts of lighting on the surrounding community;

- Land Management and Rehabilitation - to preserve the quality of topsoil removed for final rehabilitation purposes, to consider sites of Aboriginal and European heritage, to minimise soil erosion and to ensure landscaping complies with plans and approvals;

- Environmental Monitoring - to ensure that various environmental parameters comply with approvals, licences, standards and legislation. Also to provide feedback on any problems which may develop so that swift corrective action can be implemented;

- Environmental Management Systems - to regulate mine production areas, surface facilities and the coal preparation plant and coal handling facilities;

- Environmental Reporting - to prepare annual environmental reports to regulatory bodies, ensure appropriate action is taken if environmental statutes are breached, to preserve good working relationships with the surrounding community and deal effectively with complaints;

- Training and Awareness - to promote compliance with environmental procedures and practices amongst company employees;

- Administration - to update environmental management plans by developing standardised recording and reporting methods and by auditing the environmental management system;

- Emergency Response - to ensure spillages are dealt with in the prescribed manner and that emergency response equipment is available and in working order.

418. In addition to the above areas the environmental management programme will address site security. A complaints procedure will also be established to respond to concerns within the community so that communication channels between the organisation and interested parties are clear and effective.

REFERENCES

Australia ICOMOS (Inc) (1987)
The Australia ICOMOS Charter for the Conservation of Places of Cultural Significance: The Burra Charter.

(DUAP, 1995/96)
Upper Hunter Cumulative Freight Transport Study, Stage 1 Report November 1995 and Supplementary Report, October 1996.

(DUAP, 1997)
Upper Hunter Cumulative Impact Study. Draft Air Quality Analysis. Unwelt Australia Pty Ltd.

ERM Mitchell McCotter (1996)
Addendum: Aboriginal Heritage. Prepared for Coal & Allied Operations Pty Limited.

ERM Mitchell McCotter (1997)
Mount Pleasant Coal Mine EIS. Prepared for Caol & Allied Operations Pty Limited.

Muswellbrook Shire Council, (1998)
Muswellbrook Rail Strategy Study, February 1998.

Muswellbrook Shire Council, (1997)
Muswellbrook Western Roads Strategic Traffic Study., April 1997.

Benson, J, (1989)
Establishing priorities for the conservation of rare of threatened plants and plant associations in New South Wales. In *The Conservation of Threatened Species and their Habitats.* Ed Hicks, M and Eiser, P. Proceedings of a National Conference, March 1987. Australian Committee for IUCN Occasional Papers 2. Pp 17 - 82

Kovac, M and Lawrie, J.W (1991)

"Soil Landscapes of Singleton" Soil Landscape Series, Singleton, 1:250 000

Rich, E., (1995)
Mount Pleasant Coal Lease, near Muswellbrook, New South Wales: Archaeological survey for Aboriginal sites. Prepared for ERM Mitchell McCotter Pty Limited and Coal & Allied Operations Pty Limited.

Specht, R. L, A, Whelan, M. B., and Hegarty, E.E. (1995)
Conservation Atlas of Plant Communities in Australia. Centre for Coastal Management, Lismore in association with Southern Cross University Press.

APPENDICES

Appendix A

QUALIFICATIONS AND EXPERIENCE

QUALIFICATIONS AND EXPERIENCE

1. Air Quality - Pavil Zib (P Zib & Associates)

Pavel Zib is the principal of P Zib & Associates Pty Ltd, Air Quality Consultants in Newcastle, New South Wales. He has over 25 years of experience in air quality assessment, dispersion meteorology and air quality safeguards. A brief curriculum vitae of Pavel Zib is included in Appendix B.

2. Noise - Dr. Rob Bullen (ERM Mitchell McCotter)

Dr Robert Bullen is a Senior Acoustic Engineer with 20 years experience in environmental noise assessment. His qualifications include a Bachelor of Science (hons), Doctor of Philosophy (Acoustics) and Post Doctoral Studies conducted at the Institute of Sound and Vibration Research, Southampton. Dr Bullen has conducted large-scale research on community reaction to noise and provided significant input into the framing of government policy and guidelines for aircraft, road traffic and rail traffic noise throughout Australia. For eight years he has provided consulting services in noise assessment and control, having been responsible for noise assessment for the M2 and M5 motorways, the entire Sydney suburban rail network, Brisbane Airport and numerous coal mines, quarries and other developments throughout Australia. He has provided advice in a number of projects involving significant community concern, notably in the preparation of the Draft Noise Management Plan for Sydney Airport.

3. Water Management - Colin Mackie (Mackie Environmental Research)

Col Mackie is highly experienced in design and management of large scale projects for groundwater supply, dewatering, contaminated site assessment and water management studies. He is conversant in geophysics, data and image processing techniques supported by computer programming background for global data management, computer simulation of aquifers, database and GIS capability. His formal qualifications are Bsc (Geophysics and Geology), Master of Science (Groundwater Hydrology) and has PostGrad trianing in computer systems and electronics. Colin has extensive experience in water supply (groundwater supply, modelling and simulation), Dewatering (dewatering Hunter Valley floodplain and large scale dewatering of mines), Water Management, Contaminated sites, Planning and monitoring and instrumentation. Colin has had several peices of work published and is the Prinviple of Mackie Environmental Research.

4. Visual - Geoffrey Britton (Heritage & Design Consultant)

Geoffrey Britton has a Bachelor of Landscape Architecture from the University of Canberra. He has been involved with many resource visual assessment studies since the 1970's. He was an integral part of the team who researched, adapted and implemented the state-wide visual landscape management system for Victoria's Forests Commission in the 1980's. Geoffrey has also been involved with the examination of visual resources for various EIS's completed for the NSW Department of Public Works. He has also completed several visual assessment studies concerning urban planning projects. At present Mr Britton is undertaking a major study of the visual context and curtilages of significant colonial landscapes in the Cumberland Plain and Camden area for the National Trust of Australia (NSW).

5. Transport - Dr Tim Brooker (ERM Mitchell McCotter)

Dr Tim Brooker, carried out the traffic investigations for this project. He is a Road and Traffic Engineer with ten years experience in road, traffic and transport design, planning and research. He is the senior transport planner at ERM Mitchell McCotter and is engaged on a range of traffic, transport and economic assessment projects. He has undertaken traffic impact analysis, traffic studies, road condition surveys and transport assessments for a number of industry projects and government authorities

6. Biodiversity - David Robinson (ERM Mitchell McCotter)

David Robertson is a senior ecologist with more than 17 years experience in ecological survey and research. He has bachelor of science with majors in both botany and zoology, and a PhD in ecology. Since 1980 he has gained extensive experience in a range of ecological research and consultancy projects, including both aquatic and terrestrial projects. David has previously worked as a senior ecologist/project director with the Australian Museum where he was responsible for the management of ecological consultancy projects undertaken by the museum. He also worked for eight years as a lecturer in ecology and aquatic biology at Charles Sturt University. Currently he maintains a general expertise in biodiversity management. He has specialised competence in both aquatic and terrestrial flora and fauna inventory, management of threatened species, biological monitoring and ecological research for environmental impact assessment.

7. Aboriginal Archaeology - Alison Nightingale (ERM Mitchell McCotter)

Alison Nightingale (BA Honours) is a qualified archaeologist with experience in Aboriginal cultural heritage assessment. Alison has conducted archaeological investigations as part of multi-disciplinary environmental assessments and prepared archaeological reports. She has an applied understanding of legislation including the National Parks and Wildlife Act (1974) and the Heritage Act (1977), and the guidelines for assessing the significance of heritage items outlined in The Australia ICOMOS Charter for the Conservation of Places of Cultural Significance: The Burra Charter.Protection Works EIS. Apart from his expertise in pollution control and environmental assessment, he is an experienced expert witness at courts and Commissions of Inquiry.

8. Cumulative Impact - Bob McCotter (ERM Mitchell McCotter)

Bob McCotter was the Project Director for this project. He is an experienced environmental engineer with a proven record in the successful completion of major environmental impact statements. He was the project principal for the Mitchells Flat Coal Mine EIS, the St Georges Basin/Jervis Bay Regional Effluent Management Scheme EIS, the Bulahdelah to Nabiac Tollway EIS and the Warragamba Dam Major Flood Protection Program. He has been involved in the environmental assesment of more than 50 quarries, open cut and underground coal mines.

9. Environmental Management - Rory Gordon (Rio Tinto)

Rory Gordon is responsible for Rio Tinto Coal (NSW) environmental management programmes at the Company's mining operations and associated infrastructure. He holds a Bachelor of Natural Resources degree and Diploma of Business Studies. Rory has more than 19 years experience in the Hunter Valley coal industry with involvement in the design and implementation of rehabilitation and mine site pollution control programmes.

10. Project Description and Property Acquistion - John Dwyer (Coal & Allied)

John Dwyer has been the project Manager for Mount Pleasant since 1992. He has a Bachelor of Mining Engineering and Master in Mineral and Energy Economics. John has over 20 years experience in the Hunter Valley coal industry in production, mine management, planning and development.

Appendix B

CURRICULA VITAE

P. Zib & Associates Pty. Ltd. (A.C.N. 002 577 782)

CONSULTANTS

AIR QUALITY AND POLLUTION CONTROL

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P.O. Box 662
Warners Bay NSW 2282

A.H.: 02 49 428820

- Air Quality Modelling/Monitoring
- Air Pollution Safeguards
- Expert Evidence
- Odour Assessment
- Surveys of Air Pollution Meteorology
- Processing of Field Data

CURRICULUM VITAE

Name:	Pavel Zib
Birthdate:	1943
Citizenship:	Australian
Affiliation:	Principal, P.Zib & Associates, Air Quality and Pollution Control Consultants, P.O. Box 662, Warners Bay N.S.W. 2282
Qualifications:	M.E.(Mech.) (Czechoslovakia) Ph.D. (Env.Sci.) (University of Witwatersrand)
Association memberships:	Member, Clean Air Society of Australia and New Zealand Member, Air & Waste Management Association, U.S.A.
Experience:	Dr. Zib has over 25 years of experience in environmental matters with emphasis on air quality, air pollution safeguards and dispersion meteorology. His past activities included research, industry, government service and consulting. His work has been published in technical and scientific journals in several countries.

Dr. Zib has directed air quality and meteorological studies in New South Wales, Tasmania, Victoria, South Australia, Western Australia and Queensland. He has participated in public enquiries under the N.S.W. environmental legislation and has given expert evidence in court cases in NSW, Victoria, Tasmania and Queensland.

Dr. Zib's experience with air quality assessment includes major industrial sources ranging from aluminium and steel production to power generation, chemical and ceramic industries, and extraction of mineral deposits. A full list of representative projects is available on request.

NAME:	ROBERT BULLEN
ACADEMIC QUALIFICATIONS:	Bachelor of Science (Honours), Department of Physics, University of Sydney, 1975. Doctor of Philosophy, Acoustics, University of Sydney, 1978. Post Doctoral Studies, Institute of Sound and Vibration Research, Southampton, UK, 1979.
PROFESSIONAL AFFILIATIONS AND QUALIFICATIONS:	Member of Australian Acoustical Society (MAAS).
CAREER & SPECIALISED COMPETENCE:	Sixteen years professional experience in acoustics. Special skills in environmental acoustics and community reaction to noise.

PROFESSIONAL EXPERIENCE:

1992 to Present: **ERM MITCHELL McCOTTER PTY LTD**

Principal, Acoustics. Has overall responsibility for all noise impact assessment studies and acoustic designs prepared by the firm. Major projects to date include:

Sydney (Kingsford Smith) Airport Noise and Air Quality Management Plans (FAC)
Principal consultant on all aspects of development of the Plans, including provision of technical information, community consultation and program planning. Responsible for production of technical working papers and the Draft Noise Management Plan itself.

Noise Control Design, M2 Motorway (NSW RTA)
Responsible for designing noise control measures, including noise barriers, to meet RTA requirements along this 20 km urban motorway.

Road Traffic Noise Policy (Main Roads WA; NSW EPA, NSW RTA)
Significant input into the framing of road traffic noise policies for all these organisations. In particular, development of methodologies for accurately assessing the impact of noise from heavy vehicles at night.

Rail Traffic Noise Impact Assessment (CityRail)
Study of alternative rail noise criteria and the economic and practical implications of meeting each of these throughout the Sydney region rail network. This work led to a paper given at the Australian Acoustical Society 1993 Annual Conference "Criteria for Rail Traffic Noise".

Subiaco Oval, Perth (WA Dept of Planning and Urban Development)
Assessment of impact of crowd and traffic noise on the community.

Mt Pleasant Mine (Coal and Allied)
Assessment of noise from a very large proposed open-cut mine.

Interstate Gas Pipeline (BHP)
Assessment of noise from construction of a 700 km gas pipeline, as well as noise form permanent pumping stations.

1987 to 1992: **RENZO TONIN & ASSOCIATES PTY LTD**

Senior Engineer; Associate Director. Responsible for overseeing all work conducted by the firm, with direct input for major projects. Projects include:

Very Fast Train (VFT Consortium)
Noise assessment and noise control design.

F2 and F5 Freeways (RTA)
Design of noise control measures, and provision of expert testimony in Court.

Tangara Train Noise (Goninan)
Noise measurement and assessment, and design of ameliorative measures.

Sydney Airport Third Runway EIS (FAC)
Provision of comments, evaluation and expert testimony concerning the noise effects of the proposed third runway.

Responsible for noise prediction and assessment of the effects of the noise from various coal mines, including Bulga, Westside and Mitchells flat, including the provision of expert testimony in Court.

Responsible for production of noise impact statements for numerous industrial developments, entertainment venues, etc, and provision of expert testimony as required in Court.

Involved in several projects requiring architectural acoustic design, including hotels (eg Ritz-Carlton, Park Lane, Novotel); radio studios (eg 2EA); concert halls (eg. Hills Entertainment Centre); and numerous commercial developments.

1985 to 1987: ELECTRICITY COMMISSION OF NSW

Scientific Officer. Responsible for acoustic assessment of all of the Commission's development proposals. Specific duties included noise assessments for EIS's, design and specification of noise control measures, and noise measurement and analysis.

1979 to 1985: NATIONAL ACOUSTIC LABORATORIES

Scientific Officer. Involved in studies of community reaction to noise, including a survey of reaction to aircraft noise which has been recognised as an important and definitive study, both within and outside Australia. The results have been used to define the Australian Noise Exposure Forecast system of aircraft noise assessment, and have been adopted in Australian Standard AS 2021 - "Aircraft Noise Intrusion - Building Siting and Construction".

PROFESSIONAL ACTIVITIES IN THE COMMUNITY:

Regularly invited to give lectures at Universities, Engineering Institutions and other public platforms on various noise issues. Recently gave an invited paper at the Annual Queensland Environmental Law Association Conference concerning the future directions of acoustic legislation and guidelines. Closely involved in the community consultation process for Sydney Airport's Noise Management Plan, and the M2 motorway and regularly attends meetings with the public and the press to explain technical aspects of noise management and control.

PUBLICATIONS IN REFEREED JOURNALS:

R. Bullen and F.R. Fricke, 1976
Sound propagation in a street. Journal of Sound and Vibration 46, 33-42.

R. Bullen and F.R. Fricke, 1977
Sound propagation at a street intersection in an urban environment. Journal of Sound and Vibration 54, 123-129.

R. Bullen, 1977
Sound scattering in an urban street. Noise Control Engineering.

R. Bullen, 1977
Attenuation figures for duct linings. Letter to the Editor, Noise Control Engineering 8(1), 3-4.

R. Bullen, 1978
Sound propagation in urban areas. Bulletin of the Australian Acoustical Society 3, 18-21.

R. Bullen and F.R. Fricke, 1979
Traffic noise in urban areas. Australian Road Research 2(4), 11-15.

R. Bullen, 1979
Statistical evaluation of the accuracy of external sound level predictions arising from models. Journal of Sound and Vibration 65, 11-28.

A.J. Hede and R.B. Bullen, 1981
Human perception and reaction to noise. Architectural Science Review 24(3), 58-64.

R. Bullen and F.R. Fricke, 1982
Sound propagation through vegetation. Journal of Sound and Vibration 80, 11-23.

R. Bullen and F.R. Fricke, 1982
Time distribution of impulse noise in an enclosure. Journal of Sound and Vibration 80, 25-30.

R.B. Bullen and A.J. Hede, 1982
Assessment of community noise exposure from rifle shooting. Journal of Sound and Vibration 82, 29-37.

A.J. Hede and R.B. Bullen, 1982
Community reaction to noise from a suburban rifle range. Journal of Sound and Vibration 82, 39-49.

R.B. Bullen and A.J. Hede, 1983
Time-of-day corrections in measures of aircraft noise exposure. Journal of the Acoustical Society of America 73, 1624-1630.

R.B. Bullen, 1983
Comments on "A mathematical model for noise propagation between buildings". Letter to the Editor, Journal of Sound and Vibration 89, 287-290.

R.B. Bullen, 1984
The effects of aircraft noise - current knowledge and future research directions. Bulletin of the Australian Acoustical Society, Dec 1984, 75-80.

R.B. Bullen, 1985
Statistical analysis of threshold-limited data - an example of computer-intensive statistical methods in acoustics. Acoustics Australia, Dec 1985, 97-98.

R. Bullen, A.J. Hede and E. Kyriacos, 1986
Reaction to aircraft noise in residential areas around Australian airports. Journal of Sound and Vibration 108, 199-225.

R.B. Bullen and A.J. Hede, 1986
Comparison of the effectiveness of measures of aircraft noise exposure using social survey data. Journal of Sound and Vibration 108, 227-245.

R.B. Bullen, A.J. Hede and R.F.S. Job, 1991
Community reaction to noise from an artillery range. Noise Control Engineering Journal 37, 115-128.

R.B. Bullen and S.E. Banks, 1993
Criteria for Rail Traffic Noise. The Australian Acoustical Society 1993 Annual Conference.

Also a large number of reports and internal documents for the National Acoustic Laboratories, Electricity Commission, Renzo Tonin and Associates and ERM Mitchell McCotter.

MACKIE ENVIRONMENTAL RESEARCH

COLIN D. MACKIE
Principal

Highly experienced in design and management of large scale projects for groundwater supply, dewatering, contaminated site assessments and water management studies. Conversant in geophysics, data and image processing techniques supported by computer programming background for global data management, computer simulation of aquifers, database and GIS capability. Extensive offshore exploration and design experience for mining and industrial projects in southern and central Africa, the Middle East, and Pacific regions.

Recognised authority on groundwater resources in the Hunter Valley.

Qualifications: Bachelor of Science (Geophysics & Geology)
Master of Science (Groundwater Hydrology)
Post Grad. Taining - computer systems, electronics

EXPERIENCE PROFILE

WATER SUPPLY

Development of geophysical search strategies for location of buried channels in the eastern goldfields of WA and parts of NSW and Queensland. Techniques included filter transforms for aeromagnetic data, gravity survey, Sirotem and other TEM methods. Subsequent exploration drilling, testing and design of borefields to supply numerous mine sites including Marvel Loch, Yilgarn Star, Bardoc, Peak Hill, Gidgee, Bronzewing, Kambalda, Bulong, Goonumbla, Selwyn, Hellyer, Beaconsfield, Elura and others.

Exploration, drilling, aquifer testing and development of a regional scale computer simulation model of the Great Artesian Basin aquifers of northern Queensland as part of the joint development and approval process for Placer Pacific Osborne and BHP Cannington mines. Extensive consultation with DPI and provision of numerical model code as part of development agreements. Subsequent design and supervision of borefield construction and monitoring networks for Osborne mine including annual reviews and model recalibrations.

Project manager and principal hydrologist for numerous conjunctive surface and groundwater supply projects requiring assimilation of regional and local climatic data, river flow data, and development and calibration of drainage models for gauged and ungauged catchments. Quantification of aquifer recharge processes, development, calibration and verification of groundwater models using finite difference and element schemes for advective, dispersive and diffusive flow, density dependent salinity invasion, subsurface migration of contaminants, design of containment systems and establishment of safe yields for regional resource management.

Management of numerous major groundwater development projects throughout Africa and the Middle East. Preferred specialist consultant to DeBeers - Anglo American Corporation responsible for exploration, design and development of groundwater supplies to Kleinzee, Orenjumund, Orapa, Letlhakane, Jwaneng and many diamond mines throughout southern Africa. Other assignments included design, testing and commissioning of dewatering systems for Koeberg nuclear power station and conjunctive groundwater supply and dewatering scheme design and testing for Fungurume copper mine (Zaire). Establishment of Group reporting and quality control procedures for offices located in southern Africa, Botswana, Kenya and Europe.

Design, development and implementation of borefield supplies to major towns and cities in southern, central and northern Africa (up to 30 Ml/day). Specifications, drawings and contract assembly, recruiting and training of local staff.

Responsible for the first major groundwater assessment of the southern and central Kalahari desert of Botswana, including extensive gravity and magnetic survey, spectral and image processing of data, exploration drilling and testing, and development of the first computer numerical model of the area. Drilling, testing, design and commissioning of borefields, and preparation of resource monitoring and environmental management plans. Identification, mapping and testing of the regional resource subsequently resulted in long term development of ranching schemes and major contributions to the national economy.

DEWATERING

Design and development of large scale dewatering of a Hunter Valley floodplain. Responsibilities included initial appraisal of feasibility, conceptual design and testing using computer based techniques to simulate surface and groundwater environments, preparation of EIS documentation in respect of groundwater hydrology issues, additional detailed computer simulations of 5km slurry wall construction, and specification of dewatering bores. Coal & Allied Alluvial Lands Project.

Review of historical mining records, regional groundwater assessments, drilling and testing of aquifers and subsequent development of a regional groundwater simulation model for Beaconsfield Gold Mine (wettest mine in Australia). Calibration and testing of dewatering strategies for the underground workings, nomination of pumping rates and longer term cost implications. Ongoing checks on dewatering (600 L/s) with minor recalibration of computer based simulations after 3 years of pumping. Design and implementation of underground test strategies to dewater beyond existing workings to +700m bgl. Techniques included core analyses (vertical and horizontal permeability) and high flow rate injection tests.

Design of large scale dewatering of numerous mines and construction sites including base metal and coal mines in South Africa, Namibia, Botswana, Zambia, Zimbabwe and Zaire. Activities included feasibility studies, drilling and testing of aquifer systems including porous media, dolomitic, karst terrains and fractured hardrock, materials scheduling, specifications, contract supervision and final commissioning of borefields.

WATER MANAGEMENT

Regional assessment of the Hunter River within the entire Hunter Valley catchment in respect of flows and quality. Consolidation of all relevant daily rainfall data (100 years) at all stations, evaporation data, river flow, salinity and turbidity data on a common data base, design and completion of relational queries with specialised database software routines, preparation of flow and salinity relationships and determination of windows of opportunity for the export of all mine wastewater within the Hunter Valley. The study conjunctively underpinned the widely adopted salinity credits scheme for the NSW Coal Association introduced by EPA.

Water management studies involving dynamic modelling of catchment runoff and integration of dam sizing. Model development is based upon soil moisture accounting with modified root zone equations for sandy aquifer systems. Management simulations have been completed at Warkworth, Mt. Owen, Muswellbrook, Bengalla, Glendell, Hunter Valley Mine, Lemington and proposed Mt. Pleasant and Kayuga coal mine sites in the Hunter Valley, and numerous gold and base metal mine sites nationally.

Assessment of the water resources of the Emirate of Dubai and other areas throughout the Middle East, involving drilling and testing of extensive regional shallow sand aquifer systems and development of training programmes with Government, drilling and testing of aquifer characteristics and water quality with special consideration of saline invasion problems (Gulf waters) through over pumping.

CONTAMINATED SITES

Design and management of contaminated site characterisations (ESA) including feasibility studies, environmental geophysical mapping of plumes and other contaminated ground for major oil companies nationally, including BP, Shell, Caltex, Mobil and others. Remediation of affected soils and ground water using land forming bio-heaps, pump and treat, etc.

Assessment of 5 closed landfill sites for submission of works contracts in Hong Kong for Pacific Waste management. Activities included reviews of all historical operations, assessments of current groundwater flow regimes and measured water quality, simulation (HELP model), prediction of future flow regimes and preparation of groundwater control designs for aftercare (Nga Chi Wan, Sai Chau Wan, Jordan Valley and others).

Reviews and checks of preliminary (18 month) testing programs, instrumentation and strategic remediation planning for hydrocarbons clean up at Mobil Spotswood terminal. Final checks and costing for longer term remediation via total fluids pumping, injection to manipulate the water table, sparging and storage-treatment of contaminated groundwater.

MONITORING & INSTRUMENTATION

Design and installation of groundwater and contaminated site monitoring bores and automated monitoring equipment including selection and design of data loggers, software development for download and presentation at numerous mining and urban planning sites including Badgerys Creek, and other local government landfills, housing estates etc.

Review of more than 3,500 bore hydrographic records to establish an optimal monitoring network for Murray Irrigation. Initial sorting of the massive data base was conducted using spectral analysis and filtering techniques to isolate poor quality data followed by two dimensional spectral analysis to assess optimal sampling intervals. Plotting of data and preparation of difference maps provided a basis for a more cost effective and reduced size of monitoring network.

PLANNING

Management of major groundwater projects including environmental assessments for coal mining beneath floodplains adjacent to major rivers in the Hunter Valley, field data collection, drilling and testing of boreholes for aquifer analysis and design of groundwater abstraction and management systems, water quality sampling and testing, rainfall and river flow data processing, aquifer identification, groundwater flow net generation, water control scheme design, development of computer based numerical models and water quality and salinity assessments for advective-dispersive conditions, linkage of computer models to benefit/cost analyses. Extensive reporting to EIS level for Hunter Valley Mine, Wambo Mining, Hargraves, Western Mining, BHP, Peabody Resources, Drayton, Ulan, Ravensworth, Hunter Valley Mine, Lemington, Bayswater, Bengalla, Warkworth, Dartbrook, Mt Owen, Glendell, and others.

MINING PROCESS

Hydraulic evaluation of sand mine operations including design of drill and test programmes in extensive coastal sands, hydraulic data analysis, development of a regional computer simulation model and testing of various mining strategies aimed at minimising regional impacts on the groundwater system and optimising hydraulic circuits to ensure dredge feed capability - QIT Madagascar.

SOFTWARE

Author of extensive software relating to hydrogeological regimes including numerical simulation of aquifers, statistical and time series analysis, geophysical (magnetic, electromagnetic, gravity, seismic, electrical interactive software), data base development in DOS and Windows (Access, Foxpro and others) with user friendly interactive data entry and report preparation forms design/implementation (including OLE). GIS specific software routines for spatial image correction, convolution filtering, pattern recognition and other specialised techniques.

Publications

RJ Best, JR Booker and CD Mackie, Analysis of contaminant transport. Conference Proceedings, Geotechnical Management of Waste Contamination, Sydney 1993.

CD Mackie, Conceptual design criteria for seepage recharge structures, AWRC Conference - Ground water Systems Under Stress, Series No.1 3, 1986.

CD Mackie, Determination of non linear formation losses in pumping wells, AWRC Conference - Groundwater and Man, Series No. 8, 1983.

SD Foster , CD Mackie, and P Townend, Exploration, evaluation and development of large scale water supplies in the Botswana Kalahari, Proc Inst. Civ Engrs, Vol 72, Part 1, (winner of 1983 overseas premium, Institution of Civil Engineers), 1982.

CD Mackie, Multi-rate testing in fractured formations, AWRC Conference - Ground water in Fractured Rock, Series No. 5, 1982.

Personal Data

Date of Birth	20 July 1950
Nationality	Australian
Language(s)	English
Permanent Residence	Australia

Affiliations:	Fellow Aust. Institute of Mining and Metallurgy
	Member Australian Society of Exploration Geophysicists
	Member US Assoc. Professional Engineers and Scientists
	Member International Assoc. Hydrogeologists

Geoffrey Britton
Heritage & Design Consultant

Professional Affiliations:

Member of Australia ICOMOS (International Council for the Conservation of Monuments and Sites of Significance)

Writer Full Member of Australasian Performing Right Association (APRA)

Member of the National Trust of Australia (NSW)

Member of the Australian Garden History Society

Member of the Australian Music Centre

Awards:

One of three 1995 NSW Creative Village Design Team members in association with the Arts Council of NSW through grants from the Australia Council and the NSW Ministry for the Arts

Australian Heritage Award 1990 : Rookwood Necropolis Plan of Management from the Australian Council of National Trusts

Merit Award for Heritage: AILA National Awards 1990

Selected to participate in National Young Composers School with ABC Sinfonia and Australia Music Centre, 1984

Selected to participate in National Composers Workshop and Chamber work (Seymour Group) performance at University of Sydney,1983

Joint Winner of National Composers Competition through Music Department, University of Sydney,1983 (Peter Sculthorpe was to blame on this occasion)

Artist's Traineeship Grant for Landscape Architecture, Visual Arts Board of the Australia Council, 1978

Professional Experience:

April 1995-Present
Geoffrey Britton
Heritage and Design Consultant

1990-1995
Section Manager
Environmental Design & Cultural Landscape Assessment, Suters Architects Pty Ltd, Sydney

1987-1990
Team Manager
Environmental Design Section
Public Works Department of NSW

1988
Project Director and Manager
Rookwood Necropolis Plan of Management
Public Works Department of NSW

1981-1987
Project and Design Landscape Architect
Government Architect's Branch
Public Works Department of NSW

1980
Inaugural Landscape Architect
Forestry Commission of NSW (now State Forests)

1979
Tutor in Landscape Design (Inaugural Position)
Faculty of Environmental Design
University of Canberra

Research Assistant: Statewide Visual Management System
Forests Commission of Victoria, Melbourne

Environmental Design • Heritage Conservation • Visual Resource Assessment • Installations
372 Norton St Leichhardt NSW 2040 Australia Tel: 02 9564 5227 Fax: 02 9564 2474

Geoffrey Britton
Curriculum Vitae

Born in Canberra in 1956 Geoffrey studied music (piano up to the LMusA program, pipe organ and harpsichord) and painting privately from 1966. He then attended Canberra School of Art to study printmaking (with Ysobel Hoyos) and Canberra School of Music for keyboard studies with Dr Donald Hollier and compositional studies with Don Banks during the 1970s. In Sydney he studied experimental music and music theatre with Moya Henderson during the early 1980s.

After graduating from the University of Canberra in 1978 Geoffrey was invited to remain there as a Design Tutor; as well as being offered a research position in landscape assessment methodology with the Victorian Forests Commission in Melbourne. He has since worked as an environmental design consultant in both the public and private sectors in Sydney and the Hunter Valley. He has also been invited on numerous occasions to participate in undergraduate teaching programs at the Universities of Sydney and New South Wales.

While with the NSW Government Architect's Branch during the mid to late 1980s Geoffrey was given responsibility for several high-profile, large scale open space projects. These included the **Rookwood Necropolis Plan of Management** for the Joint Committee of Necropolis Trustees and the original site planning for the new **Westmead Children's Hospital**. Other smaller projects included:-

* A site planning/reconstruction proposal for Bowman's Cottage, Richmond

* Forecourt Concept Design for the former State Office Block, Phillip Street, Sydney

* Initial Design Concept for a roof level Sculpture Garden at the Museum of Contemporary Art, Sydney

Following this was a period of several years with a large architectural practice where Geoffrey managed a specialist service in environmental design and heritage landscape planning. It included leading multidisciplinary projects such as:-

* **Throsby Creek Landscape Masterplan** in association with Tom Sitta (Terragram), Dr John Turner, Tony Rodd and Dr Anne Marie Clements for the Hunter Catchment Management Trust & Newcastle Council

* **Stockton Peninsula Foreshore Land Use and Development Study** for the Stategic Planning Section, Newcastle City Council

* **Sandgate Cemetery Plan of Management** in association with Siobhan Lavelle, Historical Archaeologist for the Sandgate Cemetery Trust & Department of Land and Water Conservation

* **City Hill, Canberra, ACT, Heritage Conservation Study** in association with Michael Lehany and Meredith Walker for the National Capital Planning Authority

* **Plan of Management for Three Colonial Cemeteries, North Parramatta** in association with Siobhan Lavelle and Garry Clubley for Parramatta City Council

* **Fort Wallace Conservation Plan (Cultural Landscape)** for the Department of Defence

* **St Patrick's Cemetery Conservation Plan** in association with Siobhan Lavelle for Parramatta City Council

* **Harris Park Cultural Landscape Masterplan** in association with Kylie Winkworth and John Whitehouse for Parramatta City Council

Many of these projects involved collaborating with other professionals including architects, town planners, engineers, ecologists, historians, archaeologists, visual artists as well as cultural and interpretive planners.

Following this Geoffrey established his own design practice where a diverse range of work has been maintained. Particular interests include environmental design - especially the design of urban space; heritage assessments and conservation management; visual resource assessment; and the design of installations.

Selected list of completed projects since April 1995

- *Werribee Park* Landscape Management Plan, Victoria in association with Jessie Serle, Michael Lehany, Meredith Walker and Dr James Broadbent for Melbourne Parks and Waterways (1995-1996)
- *Anglewood*, Burradoo Landscape Assessment(1995) for Scott Carver Pty Ltd and Department of Public Works & Services
- Creative Village Project, Cessnock with Roger Johnson, Architect and Kris Smith, Visual Artist for the Arts Council of NSW (1995)
- Listing Proposal for Cumberland Hospital, Parramatta with Colleen Morris for the National Trust of Australia (NSW) (1996)
- University of Newcastle Chancellery Annexe Project (Installation concepts and site design) for the University of Newcastle (1995)
- Tallaganda Shire Rural Heritage Study (Cultural Landscape Assessment) for Clive Lucas, Stapleton & Partners (1996)
- Listing Assessment Proposals for 30 significant cultural landscapes for the National Trust of Australia (NSW)(Two separate commissions through Heritage Assistance Grants) (1996-1997)
- Newcastle City-wide Heritage Study (Cultural landscape component) for Newcastle City Council (1996-1997)
- EIS Visual Landscape Assessment and Advice to Coal & Allied Operations Pty Ltd for two proposed major Mining Projects (1995-1997) in association with ERM - Mitchell McCotter
- Parramatta Heritage Pilot Studies to compare & test AHC and SHIP assessment criteria in association with Siobhan Lavelle for Jyoti Somerville on behalf of the NSW Heritage Office & the Australian Heritage Commission (1997)
- **Cardiff Locomotive Workshops Heritage Assessment (Cultural Landscape)** (1995) for the Department of Public Works and Services (State Property)
- **Advice and Concept Design for Bourke Street curtilage of the former St Peter's Anglican Church** (1867), Darlinghurst (now the SCEGGS Great Hall) for SCEGGS in conjunction with Clive Lucas, Stapleton & Partners Pty Ltd (1997)
- Preparation and production of a **media Briefing document** for the Historic Houses Trust of NSW (1996)
- **Landscape Conservation Assessment of the former RC Orphanage Site**, Parramatta in association with Colleen Morris for the Dept of Public Works & Services (1997)
- **Conceptual Landscape Masterplan for the Fort Scratchley Site**, Newcastle as part of a Business Plan for the Department of Administrative Services (1997)
- **Conservation Assessment (Cultural Landscape) including a Heritage Impact Assessment for the *Redleaf* Site**, Double Bay with Design 5 Architects for Woollahra Municipal Council (1997)
- **Heritage Impact Assessment (Cultural Landscape component) and Land & Environment Court Expert Witness for the former *Tiana* Estate**, Cronulla in conjunction with Architectural Projects for Sutherland Shire Council (1998)
- **Conservation Plan for the St Patrick's Cathedral & Site**, Parramatta (1997) with Siobhan Lavelle and Terry Kass for the Catholic Diocese of Parramatta
- **Heritage Impact Assessment (Cultural Landscape component) for the *Windy Drop-down* site**, North Curl Curl in conjunction with Architectural Projects Pty Ltd for Warringah Council (1998)
- **Heritage Impact Assessment (Cultural Landscape) of the former grounds of *Aeolia*** (1859), Randwick for Clive Lucas, Stapleton & Partners (1998)

Selected list of current projects

* **Conservation Management Plan (Cultural Landscape component) for *Babworth House*,** Darling Point in conjunction with Design 5 Architects, Allen Jack + Cottier and Julie Bindon & Associates for the Sisters of Charity Area Health Service (St Vincent's Hospital) (1998)

* **Cultural Landscape Conservation Analysis & Strategy** for the Penrith Lakes Development Corporation with Colleen Morris and in conjunction with Kylie Winkworth, Siobhan Lavelle and Associate Professor Carol Liston (1998)

* **Survey and Assessment of selected Western Sydney Colonial Landscapes and their Curtilages (Pre 1860) Stage 1** in association with Colleen Morris for the National Trust of Australia (NSW) and NSW Heritage Office (1997-1998)

* **Site planning and design for *Marseille*,** an RAIA-listed F Glynn Gilling house (1941), Vaucluse for Architectural Projects Pty Ltd (1997-1998)

* **Master Planning and Design Advice for the St Paul's College site including the New Wing,** University of Sydney in association with Clive Lucas, Stapleton and Partners (ongoing)

* **Site Design and Advice** for a Centennial Park residence in conjunction with Mark Ian Jones Architecture (1997-1998)

* **Site Planning and Design Advice for the grounds of the former St Mary's Convent,** Sans Souci for Architectural Projects Pty Ltd (1998)

* **Site Design Advice** (ongoing) for SCEGGS Darlinghurst with Clive Lucas, Stapleton & Partners

* **Conceptual Planning and Design Advice** to Dr Kam Tara of Urban Research & Planning Pty Ltd for the Morisset Main Street Study for Lake Macquarie Council (1998)

* **Visual Resource Assessment** for a proposed Interchange at Tarcutta, in conjunction with the Snowy Mountains Engineering Corporation (SMEC) for the NSW Roads & Traffic Authority (1998)

* **Cultural Landscape Analysis & Policy** for the combined Government Precinct at North Parramatta with Colleen Morris and in conjunction with Carol Liston for the NSW Department of Public Works and Services (1998)

* **Advice to Design 5 Architects and Allen Jack + Cottier for the *Redleaf* site DA for Woollahra Municipal Council**

NAME:	TIMOTHY NICHOLAS BROOKER
ACADEMIC QUALIFICATIONS:	Bachelor of Engineering Science University of Exeter, UK, 1981 Doctor of Philosophy (Civil Engineering) Plymouth Polytechnic, UK, 1986
PROFESSIONAL AFFILIATIONS AND QUALIFICATIONS:	Institution of Engineers, Australia, M.I.E. Aust, C.P.Eng
CAREER & SPECIALISED COMPETENCE:	Over twelve years experience in road and traffic engineering including road design, road maintenance planning, pavement condition assessments, materials testing, road safety investigations and economic assessments.

SYNOPSIS

Tim has over fifteen years experience in project management, technical assessments and research investigations for transport and engineering projects. His experience includes planning and environmental assessment reports for major roads and rail projects, feasibility studies for public transport systems and economic appraisals.

He has also undertaken traffic engineering and road safety investigations for local government, pavement engineering and road design reports, acting as an expert witness in the L&E Court, car parking studies and the preparation of section 94 contributions plans for roads and car parking facilities.

PROFESSIONAL EXPERIENCE:

1992 to 1996	**ERM MITCHELL McCOTTER PTY LTD**
1991 to 1992	**CROOKS, MITCHELL, PEACOCK AND STEWART PTY LTD**
1989 to 1990	**GUTTERIDGE, HASKINS AND DAVEY PTY LTD**
1988 to 1989	**LYLE MARSHALL AND ASSOCIATES PTY LTD**
1982 to 1987	**PLYMOUTH POLYTECHNIC DEPARTMENT OF CIVIL ENGINEERING (UK)**

KEY PROJECTS

- St. Georges Basin Bypass Stage 2 Traffic Study
- Pacific Highway Upgrading, Karuah to Buladelah R.E.F.
- Muswellbrook Rail Strategy Study
- Coffs Harbour CBD Masterplan
- Sydney Airport Taxi Rank Relocation Feasibility Study
- Manly Section 94 Transport Levy
- Cessnock Alternative Heavy Vehicle Route Study
- Engineering Assessment for Rosgrove Site DA, 288 Dwellings
- CityRail Western Line Carriage Stability Facility Economic Evaluation
- Lawson Bridge Road Safety Improvements Study
- Warringah/Lower North Shore Transport Improvement Study
- North Nowra Bomaderry Link Road Assessment of Options
- Rezoning Report for Proposed Five Dock Shopping Centre
- Newvale No. 2 Colliery Haulage Road REF
- Harris Park Y-Link Rail Line Statement of Environmental Effects
- Subiaco Oval Social Impact Study
- Berry Bypass EIS Traffic and Economics Assessment
- EIS for Kooragang Coal Terminal Stage III, Transport Assessment

NAME:	DAVID JOHN ROBERTSON
ACADEMIC QUALIFICATIONS:	Bachelor of Science (Honours), Ecology, University of Melbourne,1980. Doctor of Philosophy, Ecology, University of Melbourne, 1986.
PROFESSIONAL AFFILIATIONS	Ecological Society of Australia Wildlife Society Australian Society for Limnology Frog and Tadpole Society River Basin Management Society
CAREER & SPECIALISED COMPETENCE:	Biodiversity issues, flora and fauna field surveys, freshwater ecology, biological monitoring and environmental impact assessment.

PROFESSIONAL EXPERIENCE

1997 to Present — **ERM MITCHELL McCOTTER PTY. LTD**
Senior Ecologist

- Senior Ecologist
- Expert Witness
- Lecturer
- Policy Development

1995-1996	**AUSTRALIAN MUSEUM - Senior Ecologist/Project Director**
1987-1995	**SCHOOL OF SCIENCE AND TECHNOLOGY, CHARLES STURT UNIVERSITY Lecturer In Ecology And Aquatic Biology**
1985-1987	**SCHOOL OF ENVIRONMENTAL PLANNING, UNIVERSITY OF MELBOURNE - Research Fellow,**
1985	**VICTORIAN NATIONAL PARKS SERVICE - Technical Officer, Scientific**

Relevant Experience

Category	**Examples**
Statement of evidence and expert testimony	Mining Wardens Inquiry: Impact of peat harvesting on flora and fauna in Wingecarribee, Impact of proposed subdivision in Wahroonga on Red Crowned Toadlet, Darwinia biflora, Tetratheca glandulosa and Sandstone Ridgetop Vegetation
Environmental Impact Assessment	Lecture series: Australian Catholic University.
Eight part test	Lysimachia vulgaris var davurica (Yellow Loosestrife) for the proposed peat harvesting operations at Wingecarribee Swamp. Emerald Peat Pty Ltd, Impact of a proposed extension of the Timbara Gold Mine on the frogs Mixophyes iteratus and Philoria spp. Ross Mining NL, proposed 132 kV transmission line corridor between Moree and Inverell. Transgrid.
Species/Fauna Impact Statements	Proposed extension to Ravensworth West Mine. Peabody Pty Ltd,. Proposed subdivision at Greencape, southern New South Wales. Greencape Resorts Pty Ltd, Proposed Warragamba Dam Auxilliary Spillway

NAME:	ALISON JANE NIGHTINGALE
ACADEMIC QUALIFICATIONS:	Bachelor of Arts (Honours) University of Sydney, 1993
PROFESSIONAL AFFILIATIONS AND QUALIFICATIONS:	Australian Archaeological Association
CAREER & SPECIALISED COMPETENCE:	Skills in Aboriginal and European cultural heritage assessment, including research, field investigations, significance assessment, archaeological excavation and heritage studies

PROFESSIONAL EXPERIENCE:

1995 to Present **ERM MITCHELL McCOTTER PTY. LTD.**

- Senior Archaeologist
- providing technical advice on heritage issues
- independent archaeology and heritage studies
- multidisciplinary environmental and planning studies
- impact assessment and management measures
- archaeological excavation

1994 to 1995 UNIVERSITY OF SYDNEY, DEPARTMENT OF PREHISTORIC AND HISTORICAL ARCHAEOLOGY **(Archaeological Computing Laboratory)**

Relevant Experience

Category	Examples
Aboriginal Cultural Heritage Studies:	Sydney International Equestrian Centre at Horsley Park, Olympic Mountain Bike Facility at Fairfield, Singleton Heights Residential Development Study, Black Hill Residential Lands Study, East Kurrajong Land Clearing and Use Assessment
Historic Heritage Studies:	Mittagong Land Capability Study, Byron Bay Local Environmental Study
Aboriginal and/or Historic Archaeological Investigations for Environmental and Planning Projects:	Warragamba Dam Environmental Impact Study, Karuah Sewage Treatment Plant EIS, Shoalhaven Regional Effluent Management Scheme EIS, Inverell to Moree Transmission Line EIS, Mount Pleasant Coal Mine EIS, Ravensworth West coal mine EIS, Kooragang Coal Terminal Expansion, Far North Coast Quarries Environmental Impact Assessment; Ecotourism Development at Jervis Bay, Bombala Timber Facility EIS, Ponds Subiaco Bushland Reserves Plan of Management, Killalea State Recreation Area Plan of Management, Wyong coal Environmental Management Plan and Codes of Practice.

NAME:	BOB McCOTTER
POSITION	Deputy Chairman, ERM Mitchell McCotter Pty Limited
ACADEMIC QUALIFICATIONS:	Bachelor of Engineering (Hons), (Civil & Structural) Sydney University, 1970. Diploma of Building Science, Sydney University, 1985.
PROFESSIONAL AFFILIATIONS/ ACTIVITIES	Fellow, Institution of Engineers, Australia Fellow, Australian Institute of Company Directors Member, Australian Water and Wastewater Association Guest Lecturer in environmental engineering and planning at the Universities of Newcastle, Wollongong, NSW and University of Technology Sydney.
CAREER & SPECIALISED COMPETENCE:	Twenty eight years experience, most of which has focused on the environmental assessment of major infrastructure projects. These included roads and bridges, dams, water supply and sewerage, electricity generation and distribution, chemical manufacturing, ports and more than fifty coal mines.

PROFESSIONAL EXPERIENCE:

Project examples include the following:

- *Ravensworth Ash Disposal Study (Macquarie Generation)*

This study considered the optimal use of former mining voids to dispose of fly ash from Bayswater and Lidell Power Stations. This study included water management, logistics and the commercial value of conserving void space.

- *Emergency Fire Protection Reservoirs, Munmorah and Vales Point Power Stations (Electricity Commission)*

Detailed designs were prepared of emergency fire reservoirs to safeguard two power stations on the central coast of New South Wales. At the time the reservoirs were the largest fully lined turkey nest storages in Australia.

- *Mt Piper Power Station Coal Access Road EIS (N Craven)*

This EIS considered a new road access between Angus Place Colliery and Mt Piper Power Station. Issues included air quality, noise, transport and water management.

- *Wallerawang Power Station Road Rehabilitation (Electricity Commission of NSW)*

Detailed design was completed for the reconstruction of all internal access roads and parking areas.

- *Lucas Heights Gas Generating Plant EIS (NSW Waste Service)*

The Waste Service wished to extract landfill gas from Sydney's largest waste disposal depot. This study considered the environmental implications of using the landfill gas to generate electricity which was directed to the state grid.

- *Environmental Impact Statements for Various Electricity Transmission Lines (Transgrid and County Councils)*

Several Environmental Impact Statements were prepared for electricity transmissions lines including Inverell to Moree, the MacArthur region and Bowral.

ABRIDGED C.V.

R.M. GORDON

Roderick Munro Gordon
Manager - Environmental Services
Rio Tinto Coal NSW
P.O. Box 315
SINGLETON, N.S.W. 2330
AUSTRALIA

Phone: (61 2) 65700371
Fax: (61 2) 65700377

Rory Gordon holds a Bachelor of Natural Resources degree and a Diploma of Business Studies from the University of New England, Armidale N.S.W., Australia

After graduation, he joined the Soil Conservation Service of N.S.W. which is the State government agency which manages soil conservation and degraded land improvement programmes. He was initially involved in the design and implementation of soil conservation earthworks programmes, and in later years, undertook soils and hydrologic research.

In mid-1979, he joined Coal & Allied Operations Pty, Limited as Environmental Officer at Hunter Valley Mine, where he became the first mine site environmental specialist in the Hunter Valley coal industry. At that mine he was responsible for rehabilitation design and implementation, as well as planning and implementation of the mine site pollution control programmes.

In his current position, he has responsibility for Rio Tinto Coal (NSW) environmental management programmes at the Company's mining operations and associated infrastructure. Broadly, this involves development, implementation and monitoring operational compliance programmes, implementing and maintaining the Company's environmental management systems, monitoring legislation as it affects the Company's operations, Government liaison and managing environmental investigations for the preparation of Environmental Impact Statements for new projects and expansions.

As Manager Environmental Service, Rory Gordon manages the Rio Tinto Coal NSW Environmental Services group. The function of this group includes:

- Rehabilitation planning, design, implementation and monitoring
- Water management planning, design, implementation and monitoring
- Preparation of environmental management plans
- Hydrocarbon management
- Waste management

- Environmental monitoring including air quality, water quality, noise including ambient and from blasting and vibration from blasting
- Environmental training
- Commitments under the RTC Greenhouse Gas Abatement programme
- Aboriginal heritage
- Community and statutory authority consultation
- Environmental approvals and licencing
- Environmental Reporting
- Landcare management of company property
- Environental complaint management through the Rio Tinto 24 hour Environmental Hot Line
- Preparation of Environmental Impact Statements

Appendix C

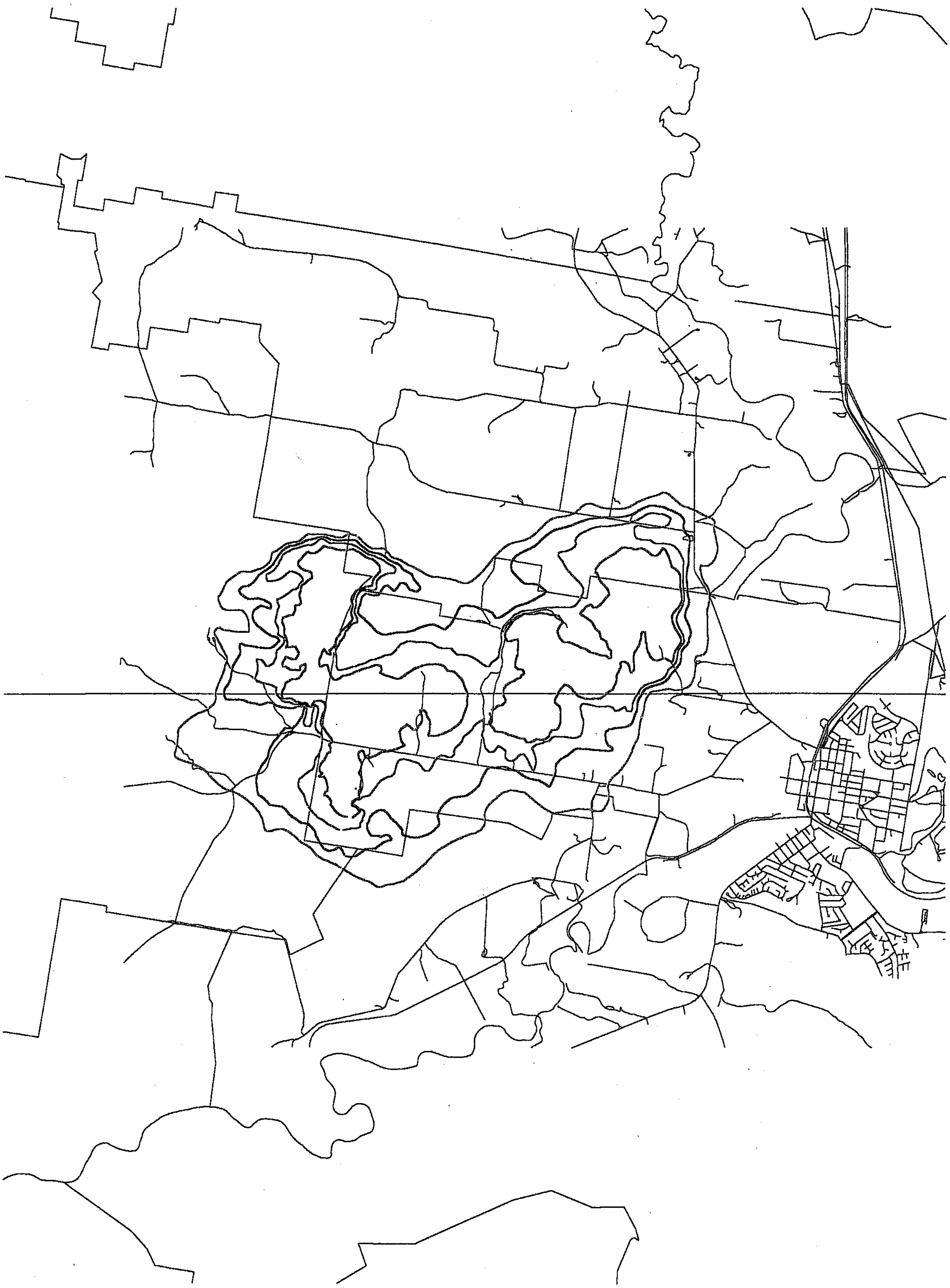
NOISE INFORMATION

C.1 NOISE CONTOURS UNDER STILL ISOTHERMAL CONDITIONS

The contours on the following pages show predicted noise levels from Mount Pleasant Mine under still isothermal conditions - that is, no wind and no temperature gradient. These were calculated using the ENM noise prediction model.

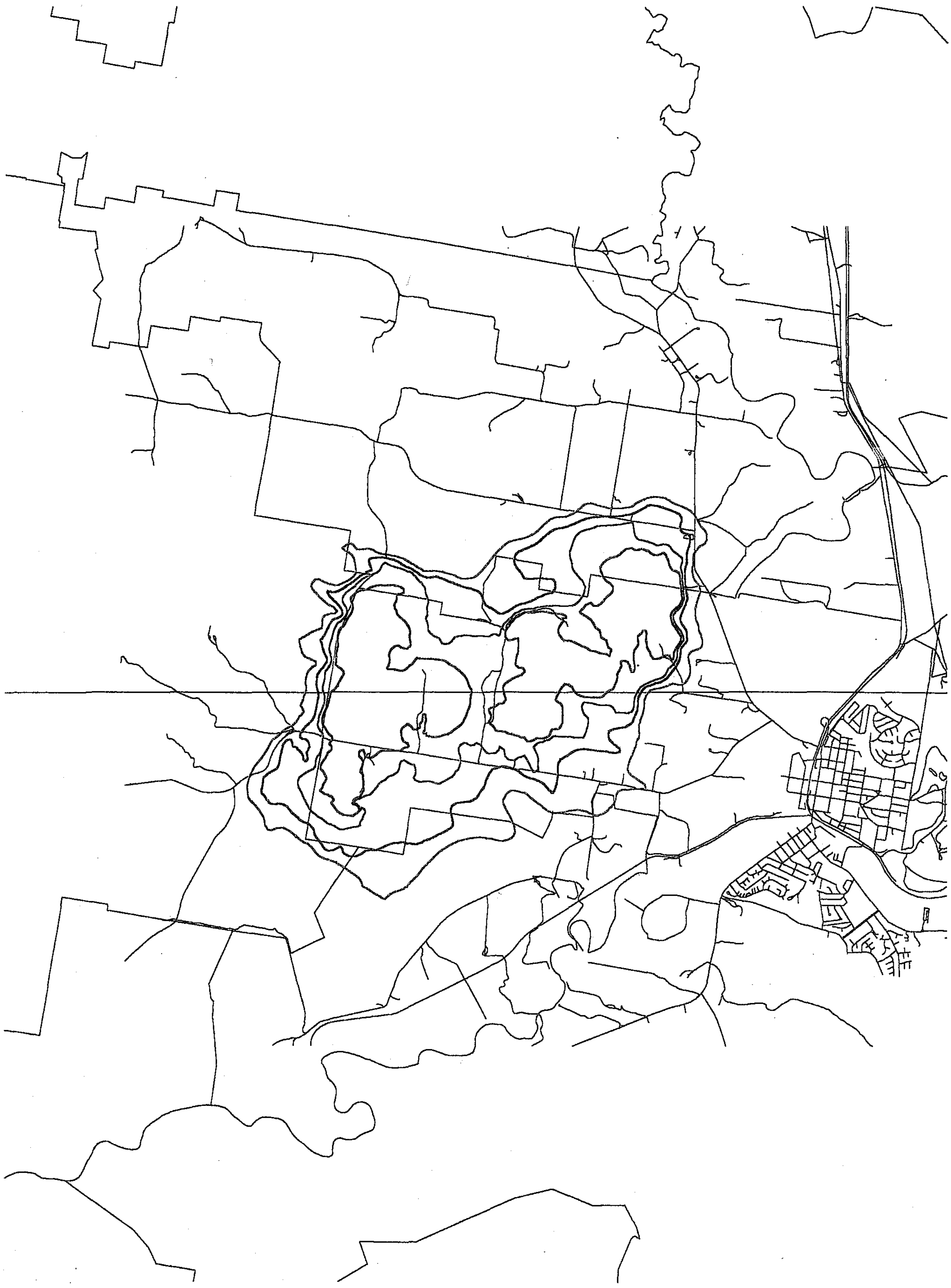
Noise contours are shown for 20 different mining stages. These represent daytime and night-time operations in years 2, 3, 5, 10, 15 and 20 of the project. For years 5, 10, 15 and 20, two alternative equipment configurations were modelled, representing periods when equipment would be located largely in either the north or south pit.

Contours presented in the EIS correspond with the 40 dB(A) contour for daytime and the 35 dB(A) contour for night-time. For years 5 to 20, the EIS showed the outer envelope of the two contours using alternative equipment locations.



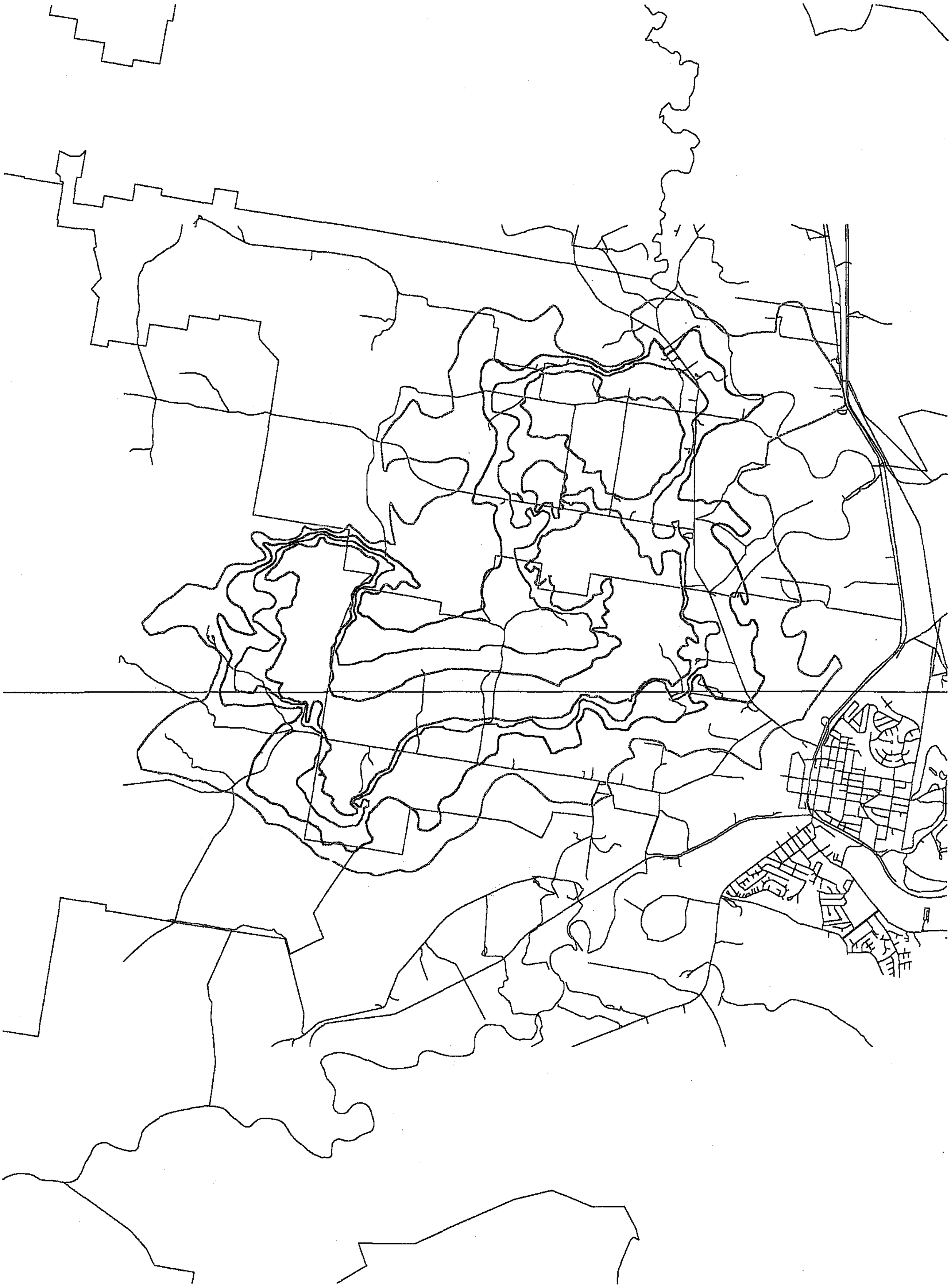
30 dB(A)
35 dB(A)
40 dB(A)
45 dB(A)

YEAR 2 DAY



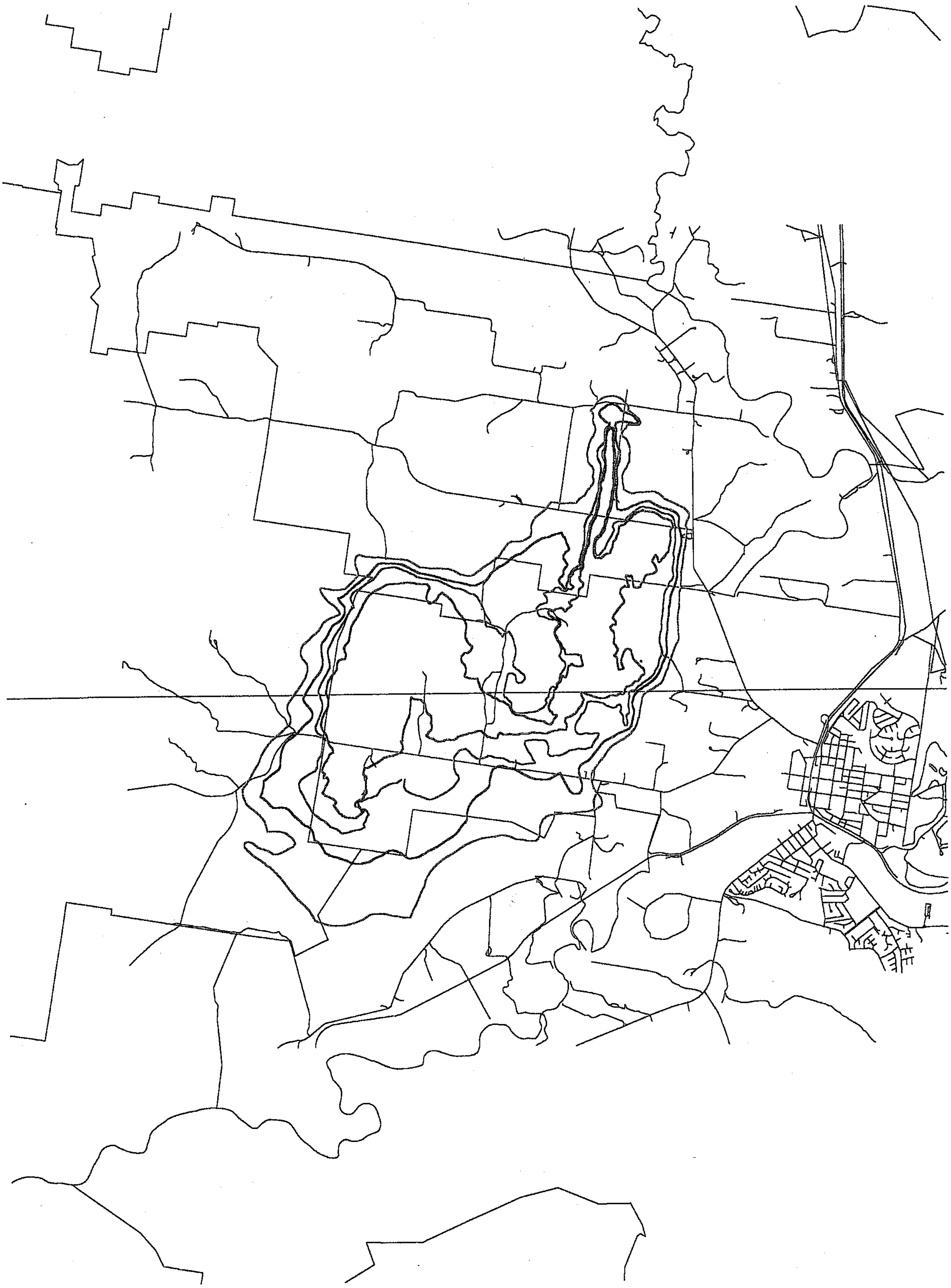
30 dB(A)
35 dB(A)
40 dB(A)
45 dB(A)

YEAR 2 NIGHT



30 dB(A)
35 dB(A)
40 dB(A)
45 dB(A)

YEAR 3 DAY

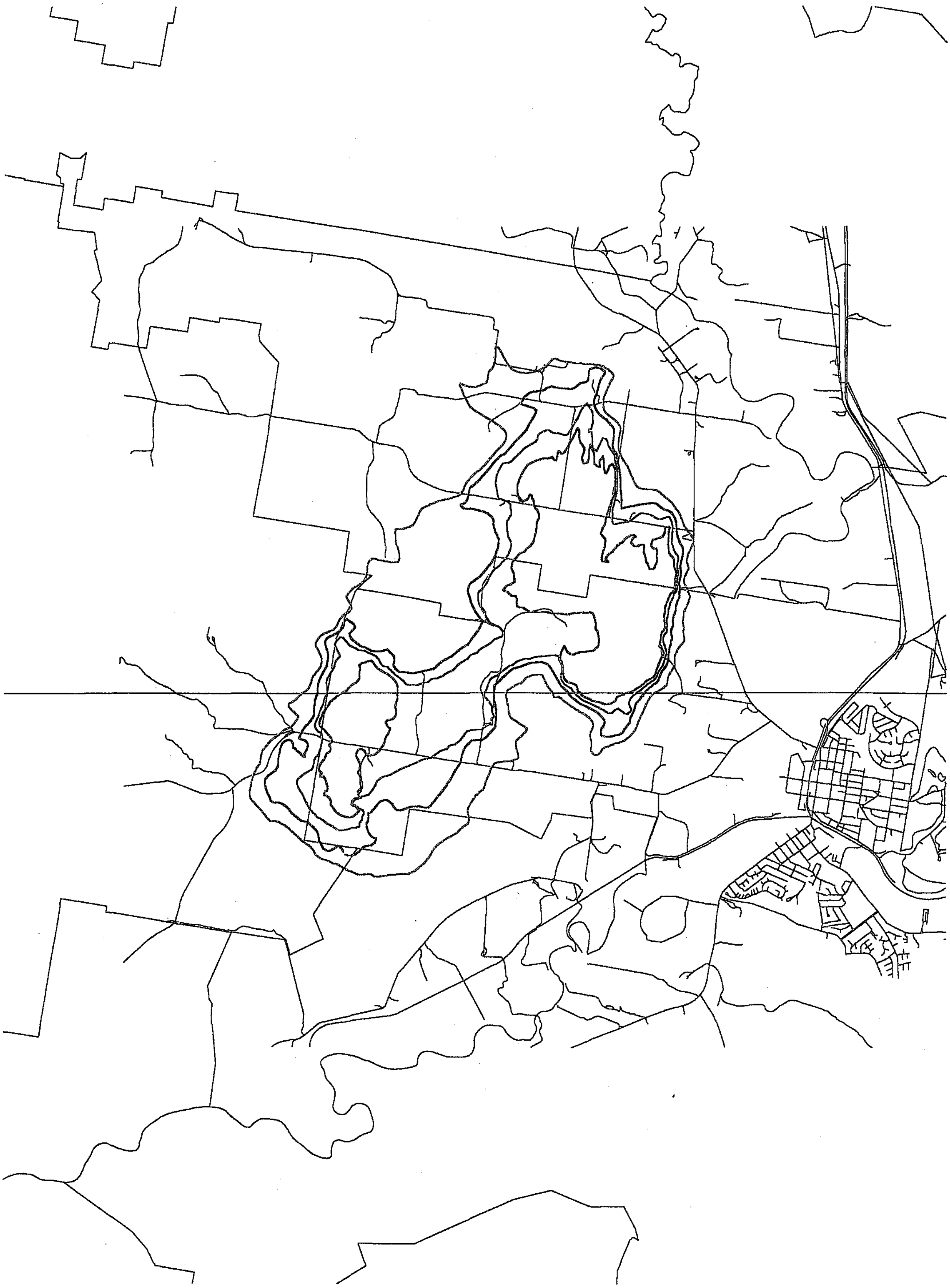


30 dB(A)
40 dB(A)
35 dB(A)
45 dB(A)

YEAR 3 NIGHT

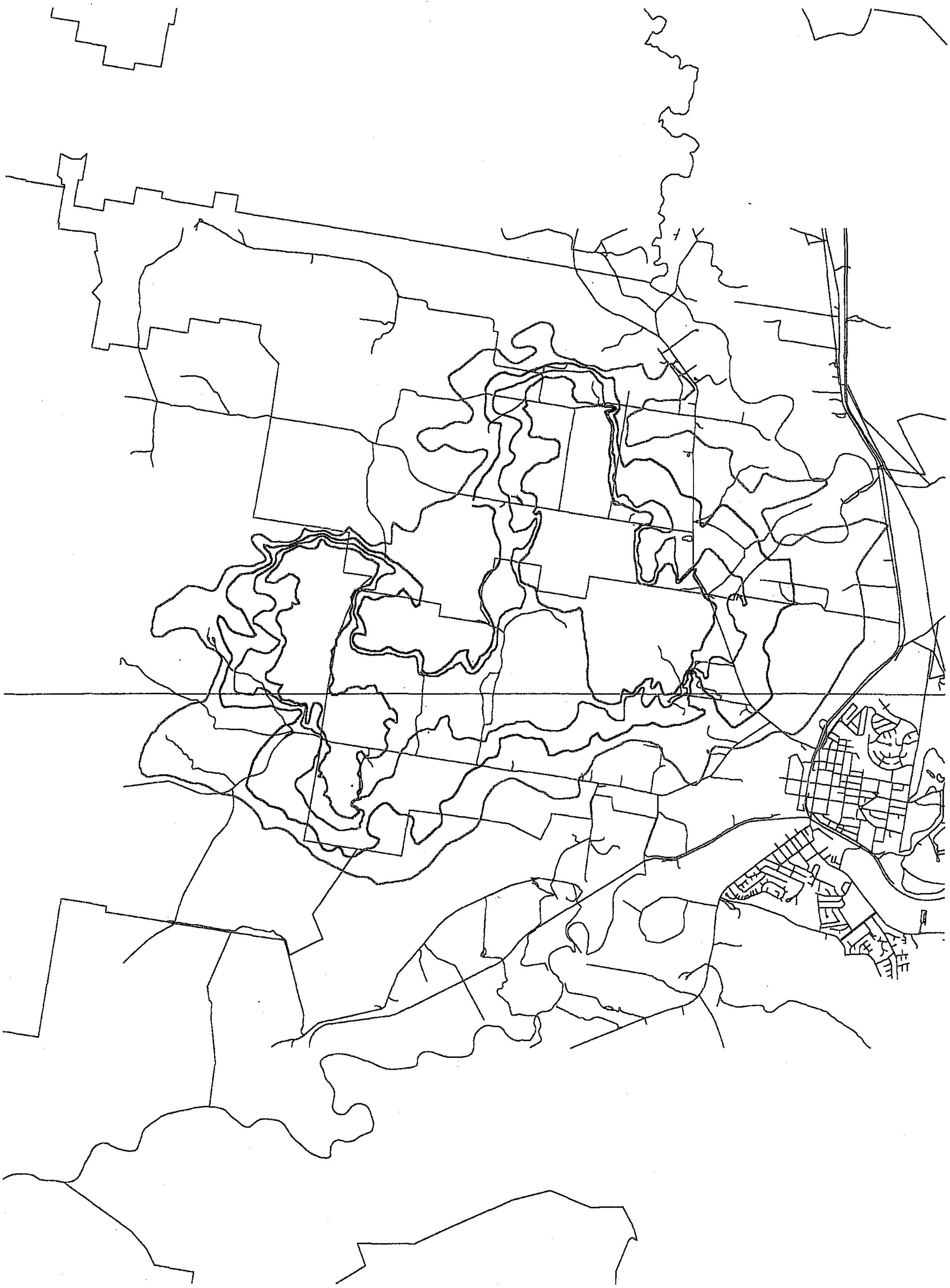
30 dB(A)
35 dB(A)
40 dB(A)
45 dB(A)

YEAR 5-1 DAY



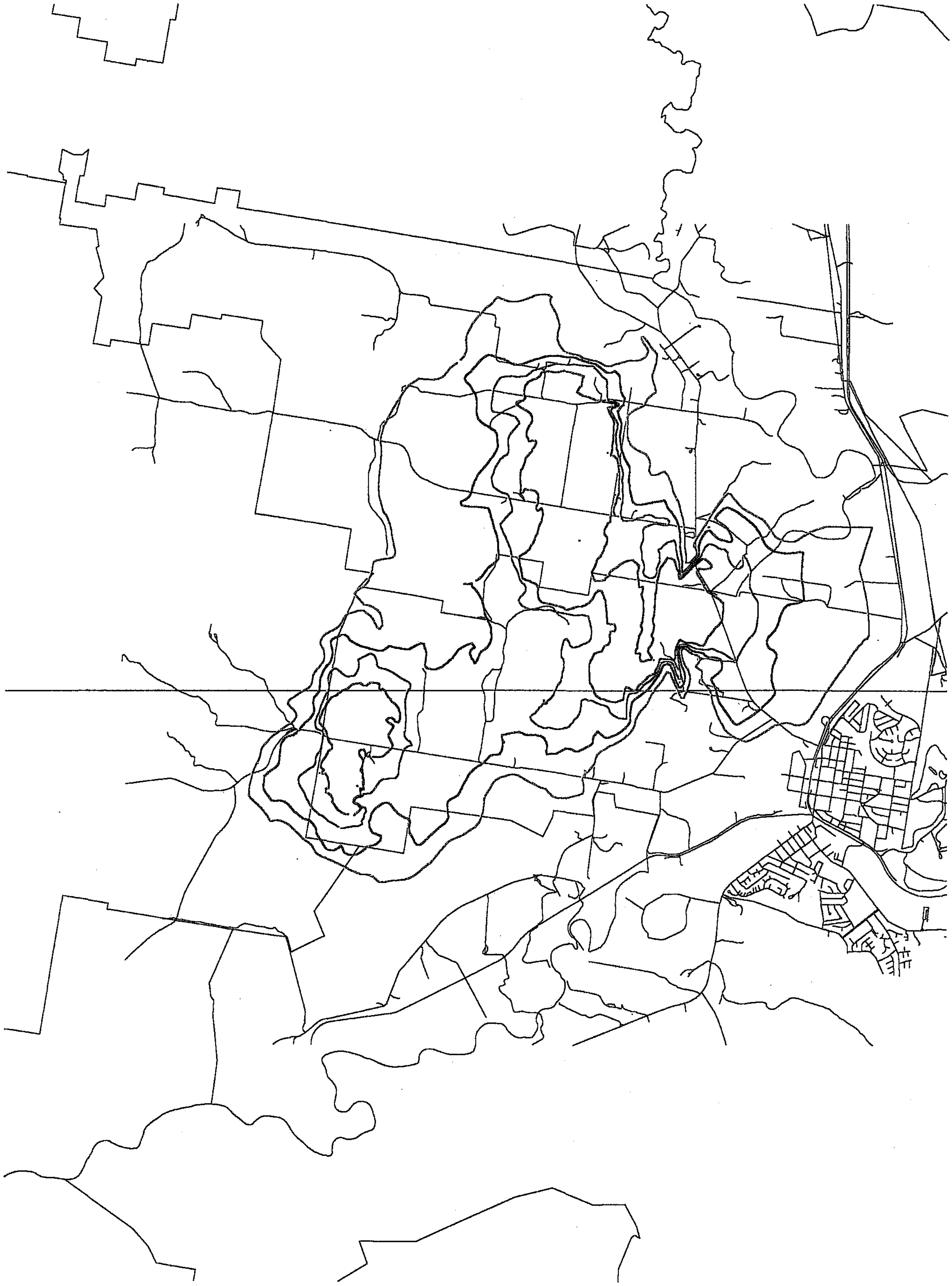
30 dB(A)
35 dB(A)
40 dB(A)
45 dB(A)

YEAR 5-1 NIGHT



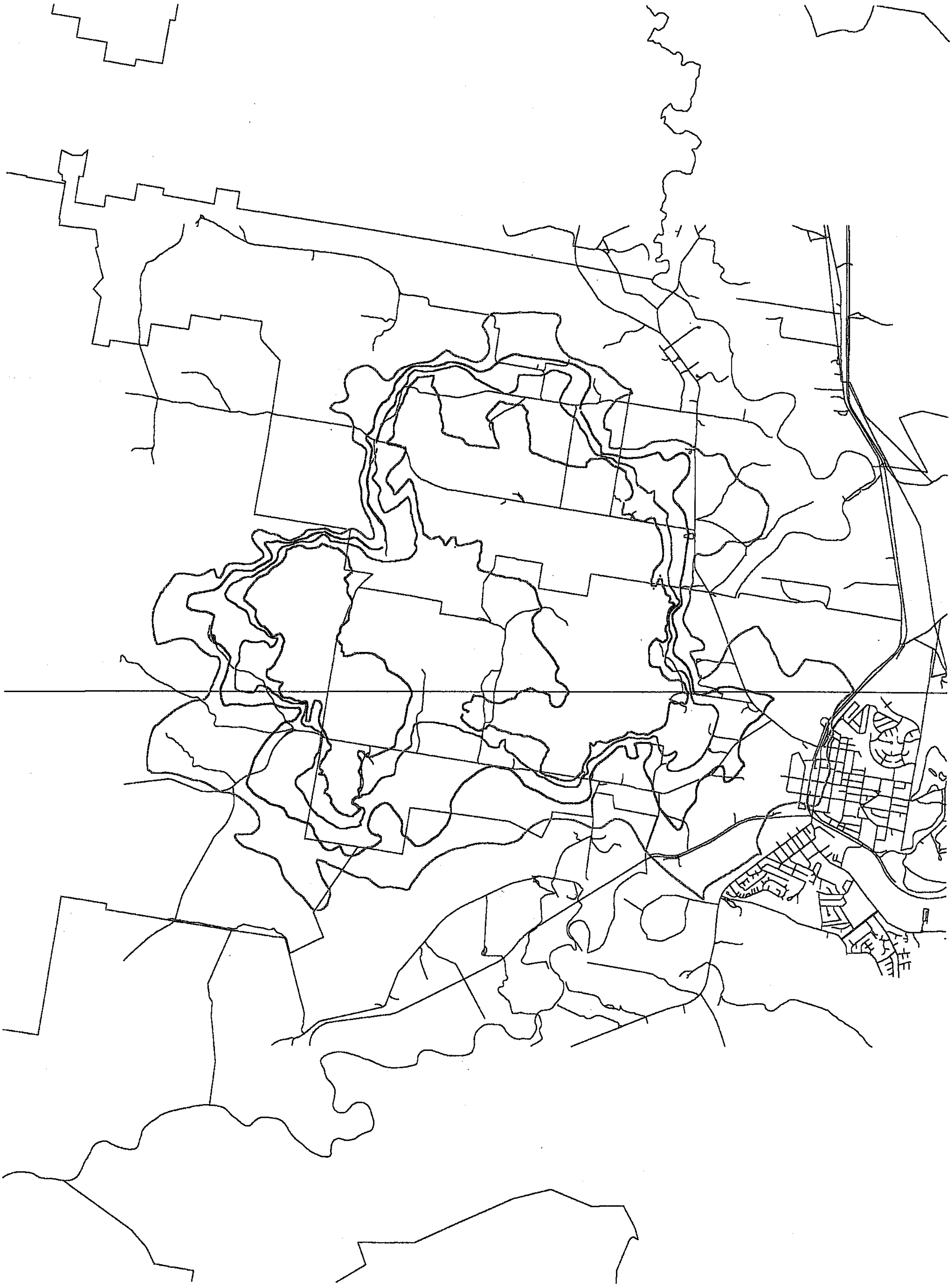
30 dB(A)
35 dB(A)
40 dB(A)
45 dB(A)

YEAR 5-2 DAY



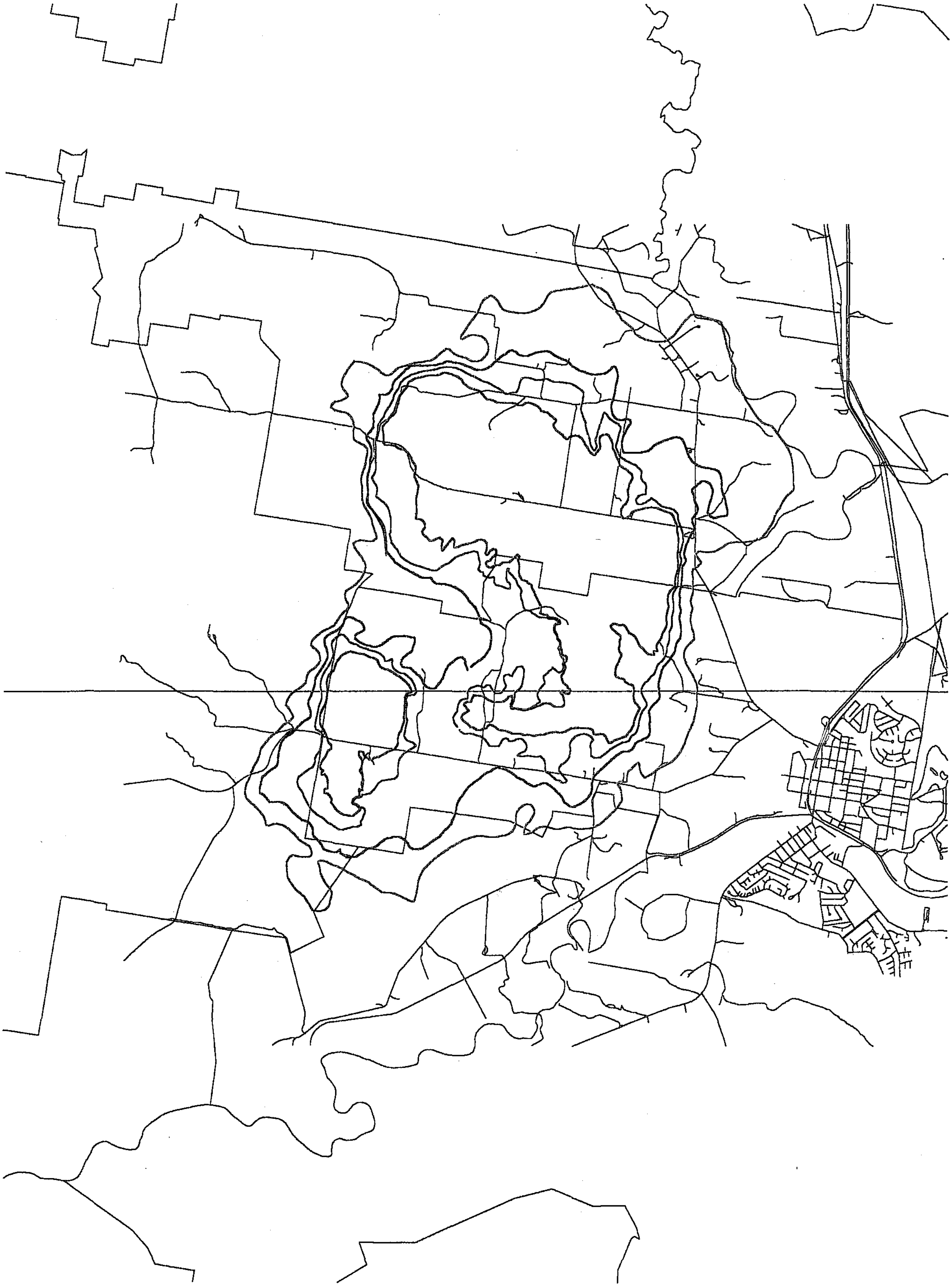
30 dB(A)
35 dB(A)
40 dB(A)
45 dB(A)

YEAR 5-2 NIGHT



30 dB(A)
35 dB(A)
40 dB(A)
45 dB(A)

YEAR 10-1 DAY

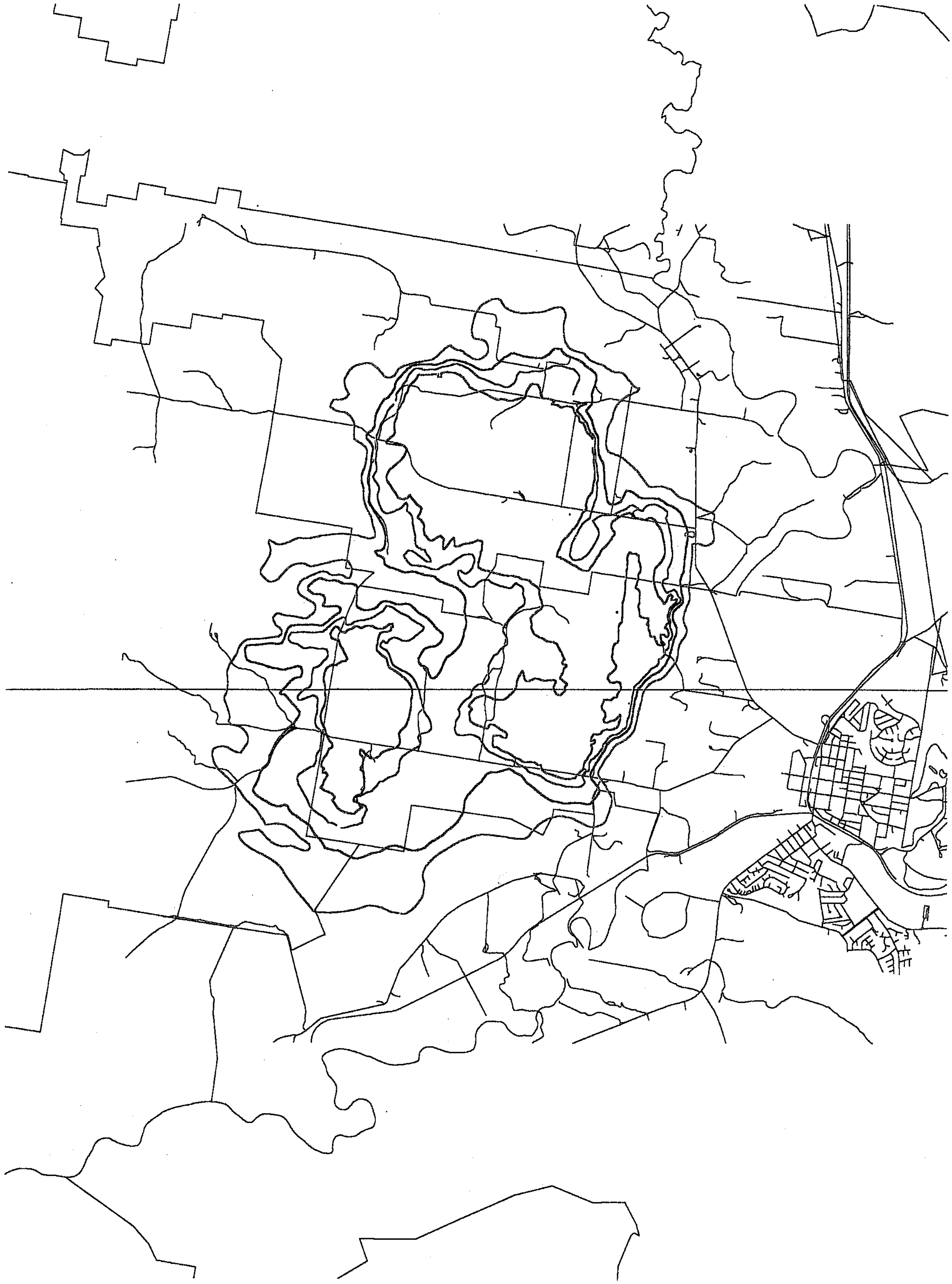


30 dB(A)
35 dB(A)
40 dB(A)
45 dB(A)

YEAR 10-1 NIGHT

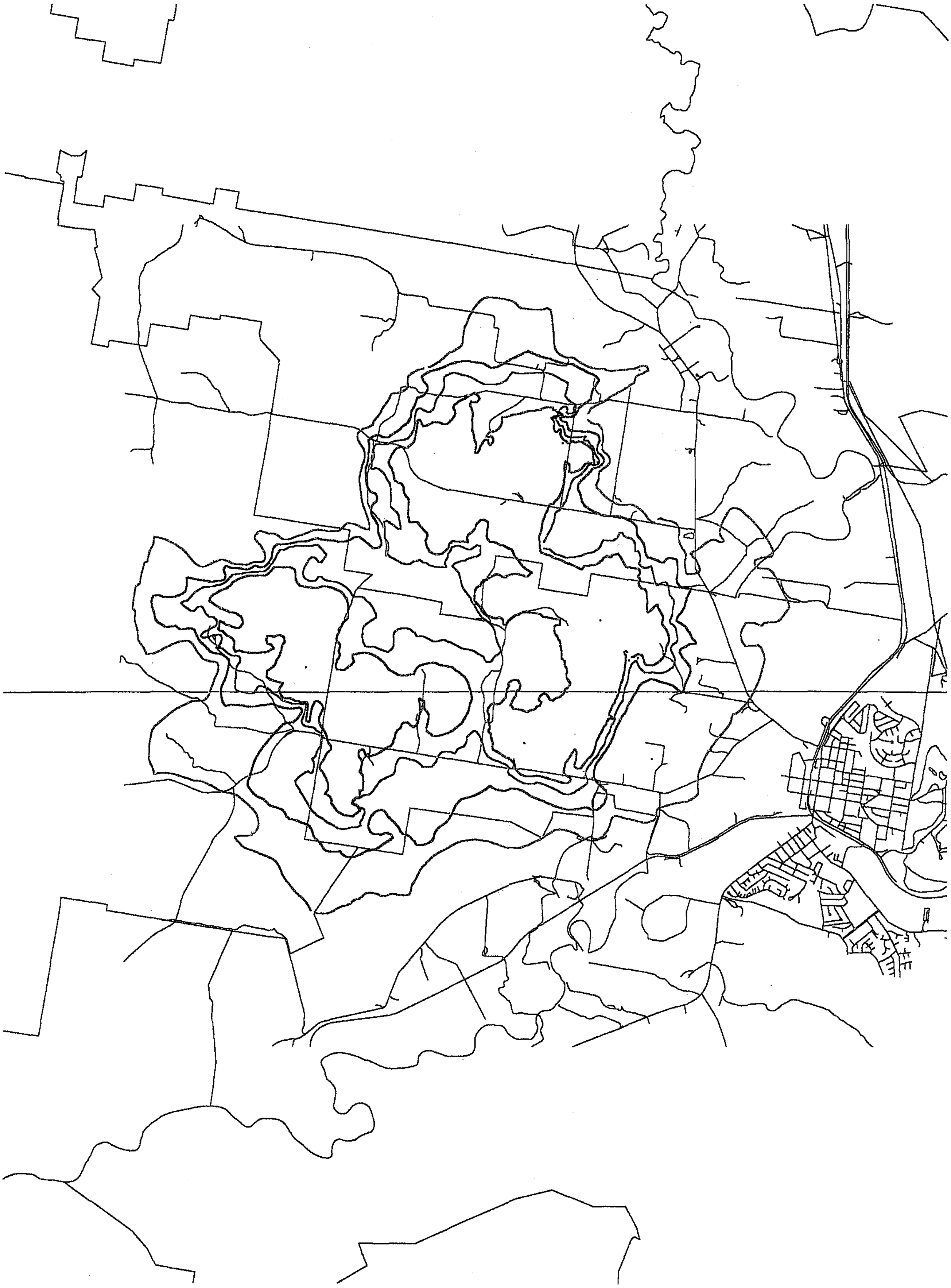
30 dB(A)
40 dB(A)
35 dB(A)
45 dB(A)

YEAR 10-2 DAY



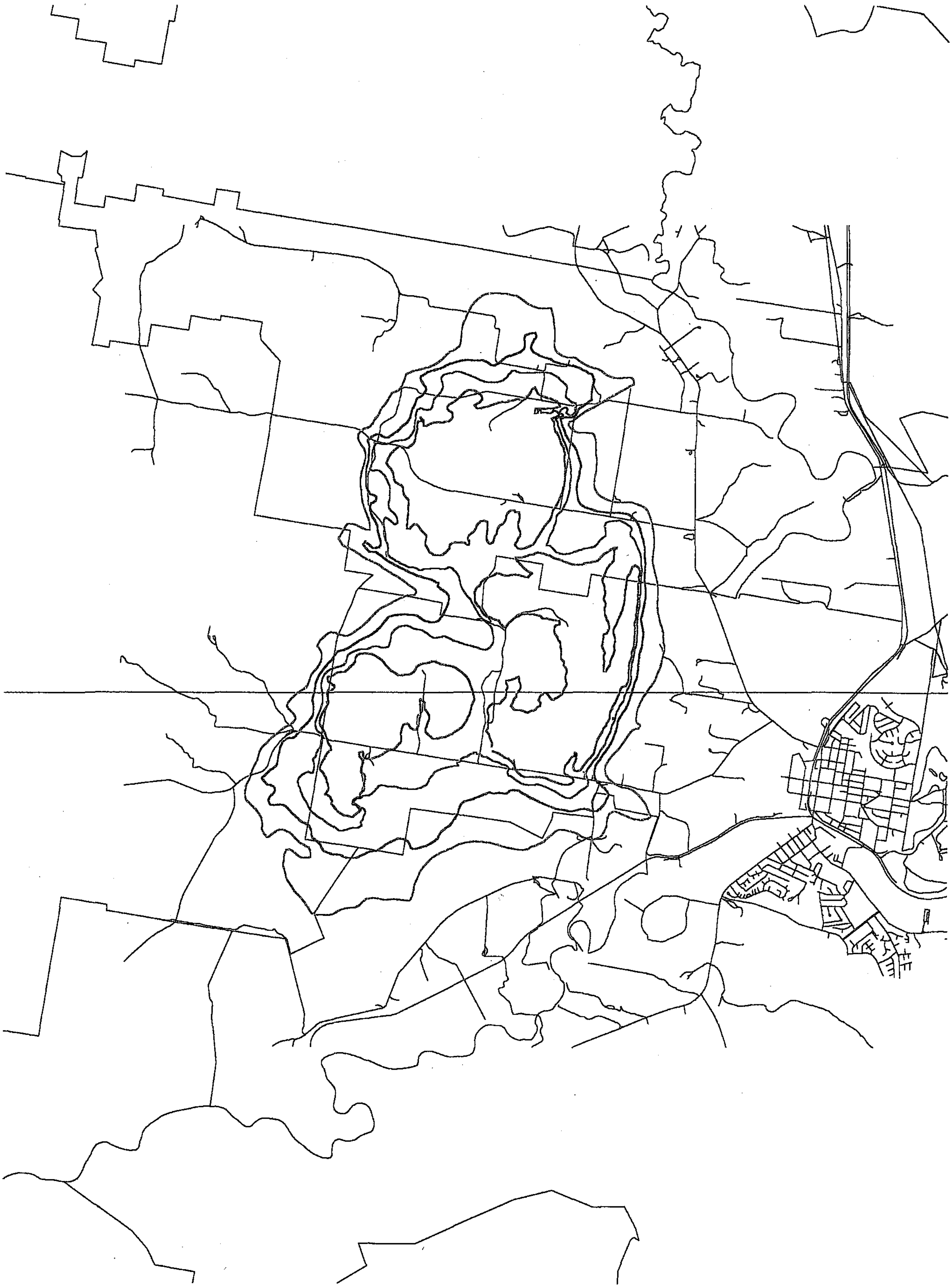
30 dB(A)
35 dB(A)
40 dB(A)
45 dB(A)

YEAR 10-2 NIGHT



30 dB(A)
35 dB(A)
40 dB(A)
45 dB(A)

YEAR 15-1 DAY

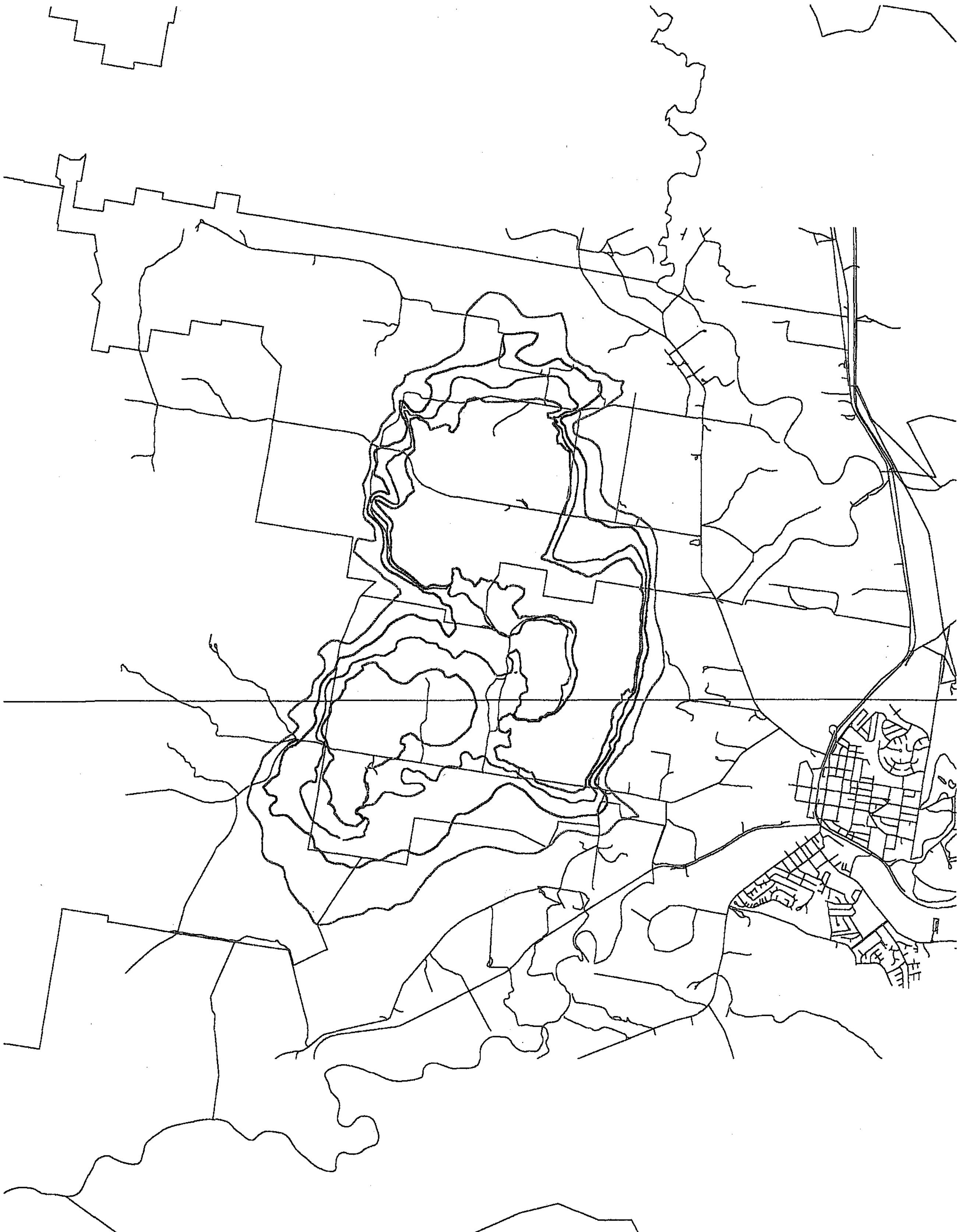


30 dB(A)
35 dB(A)
40 dB(A)
45 dB(A)

YEAR 15-1 NIGHT

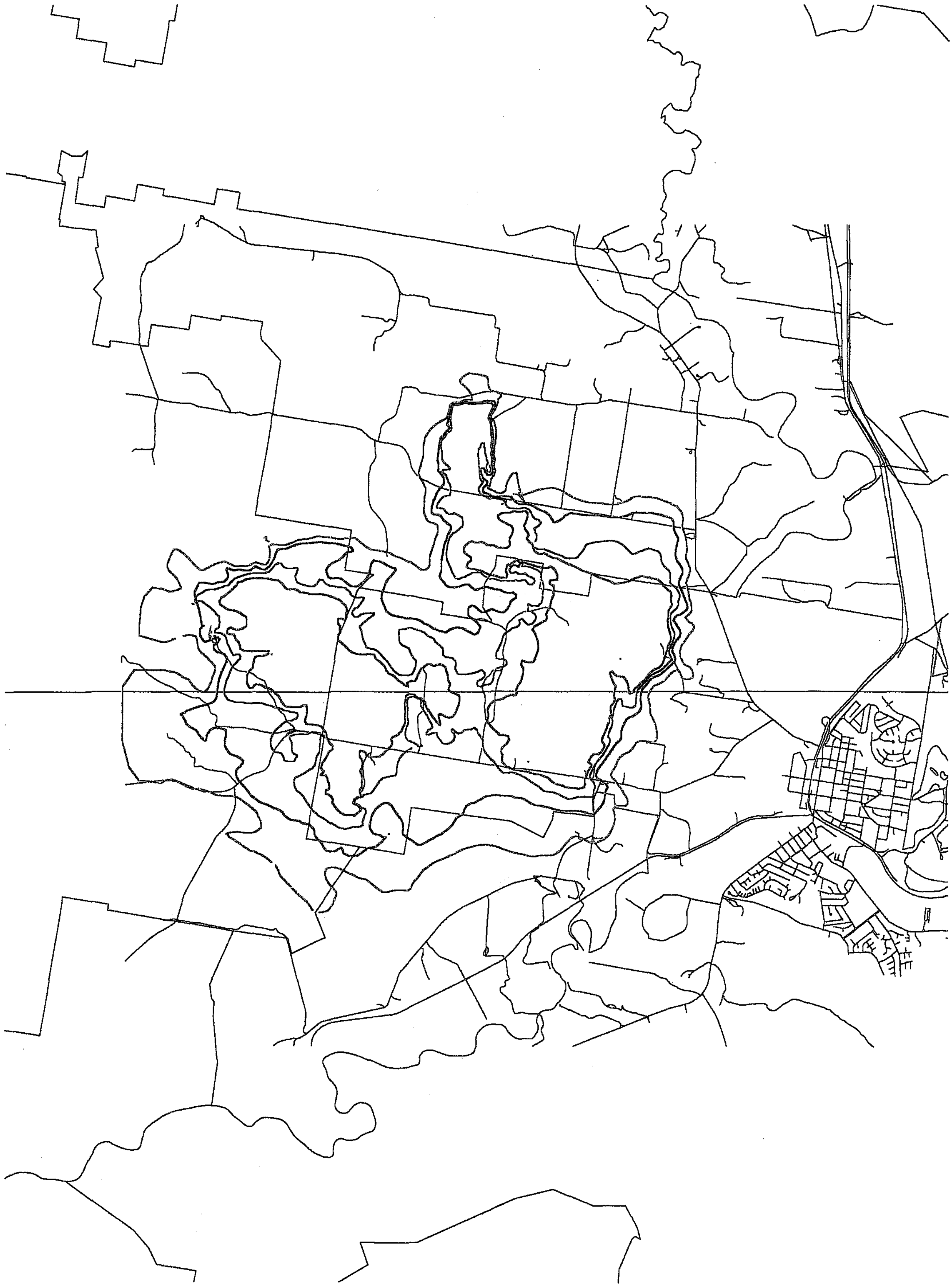
30 dB(A)
35 dB(A)
40 dB(A)
45 dB(A)

YEAR 15-2 DAY



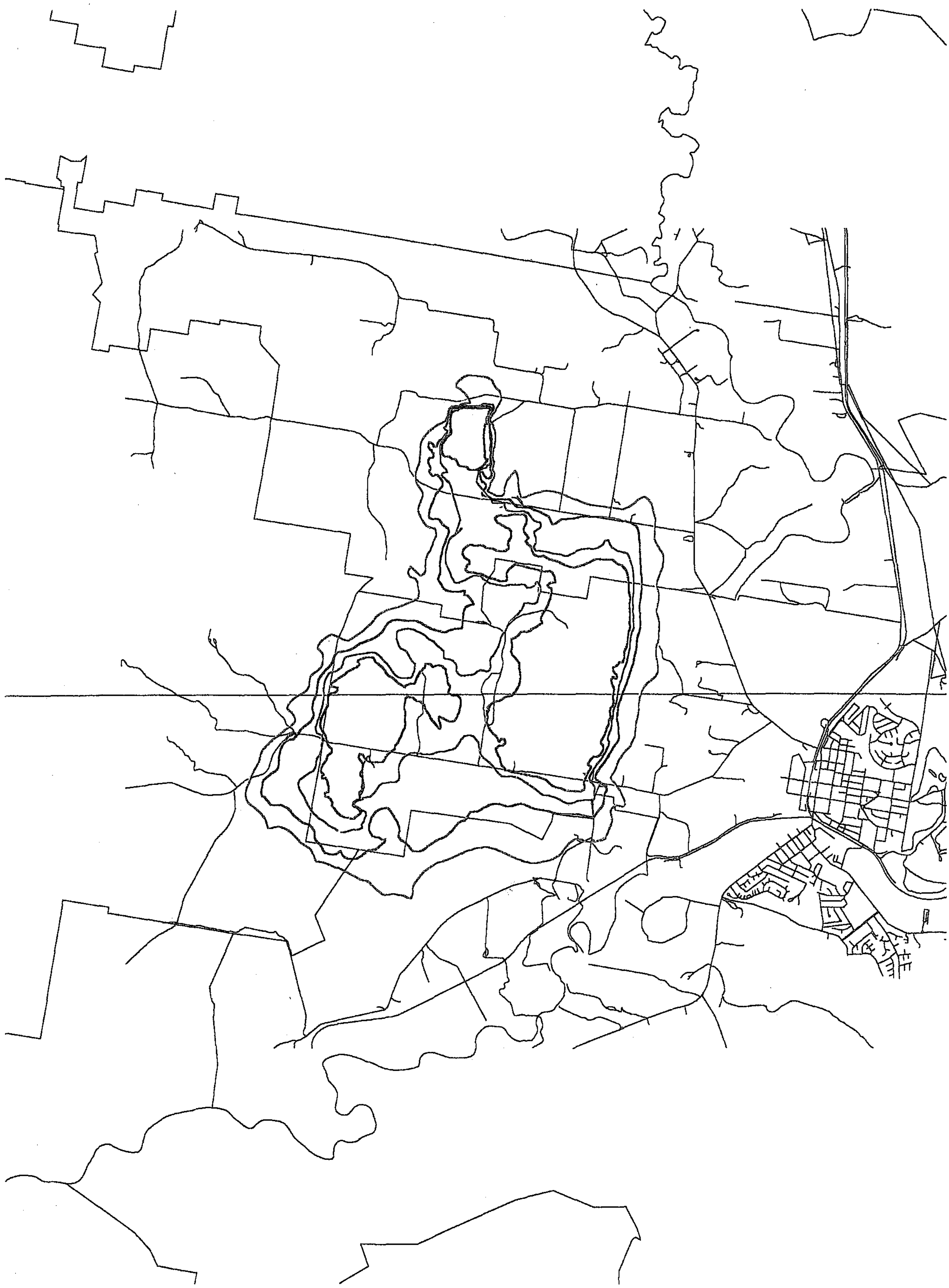
30 dB(A)
35 dB(A)
40 dB(A)
45 dB(A)

YEAR 15-2 NIGHT



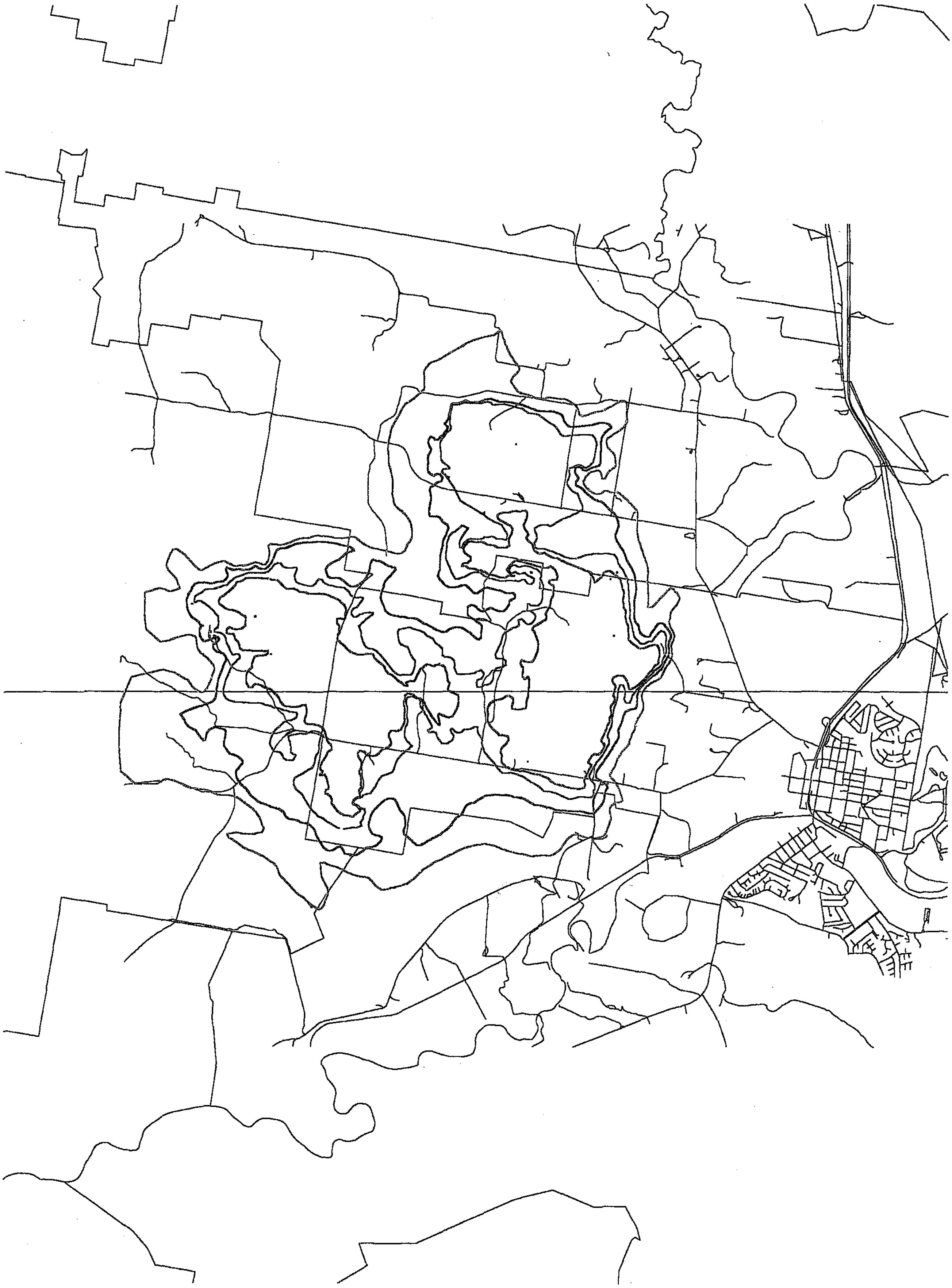
30 dB(A)
35 dB(A)
40 dB(A)
45 dB(A)

YEAR 20-1 DAY



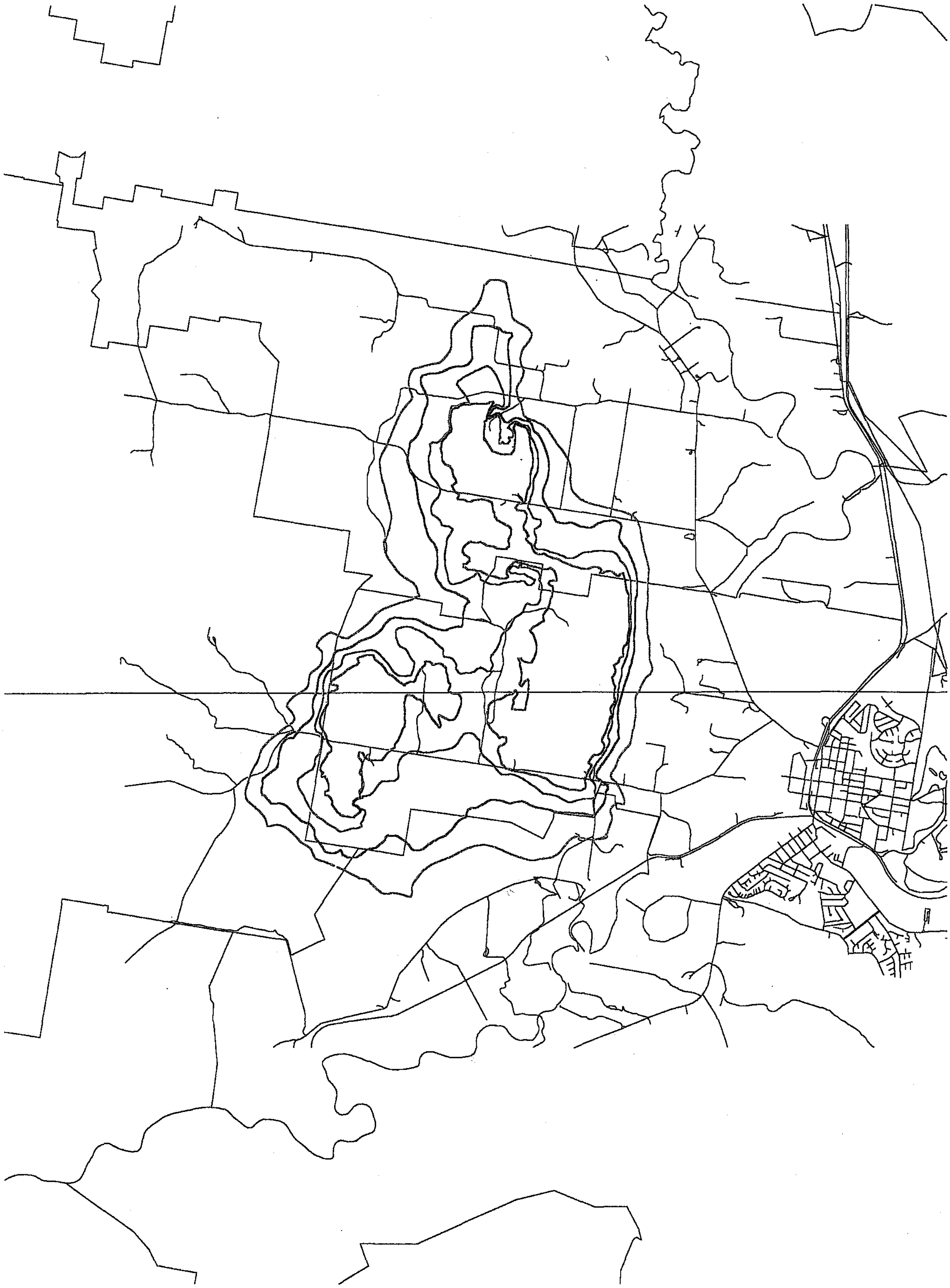
30 dB(A)
35 dB(A)
40 dB(A)
45 dB(A)

YEAR 20-1 NIGHT



30 dB(A)
35 dB(A)
40 dB(A)
45 dB(A)

YEAR 20-2 DAY



30 dB(A)
35 dB(A)
40 dB(A)
45 dB(A)

YEAR 20-2 NIGHT


DORSET ROAD
CASTLEROCK ROAD
WYBONG ROAD
KAYUGA ROAD
MUSWELLBROOK

RESIDENCES

C.2 NOISE CONTOURS UNDER ADVERSE METEOROLOGICAL CONDITIONS

The contours on the following pages show noise levels from Mount Pleasant Mine which are predicted to be exceeded for ten per cent of daytime and night-time periods over a year. This was chosen to represent the higher noise levels which may be experienced under adverse meteorological conditions.

Calculations were performed in the following way. Prevailing meteorological conditions were divided into ninety-six categories, representing eight wind directions, two wind speeds and five atmospheric stability classes. (Stability class can be related to likely temperature gradient using standard procedures.) The proportion of time each of these conditions existed was determined from historical data for both night-time and daytime periods.

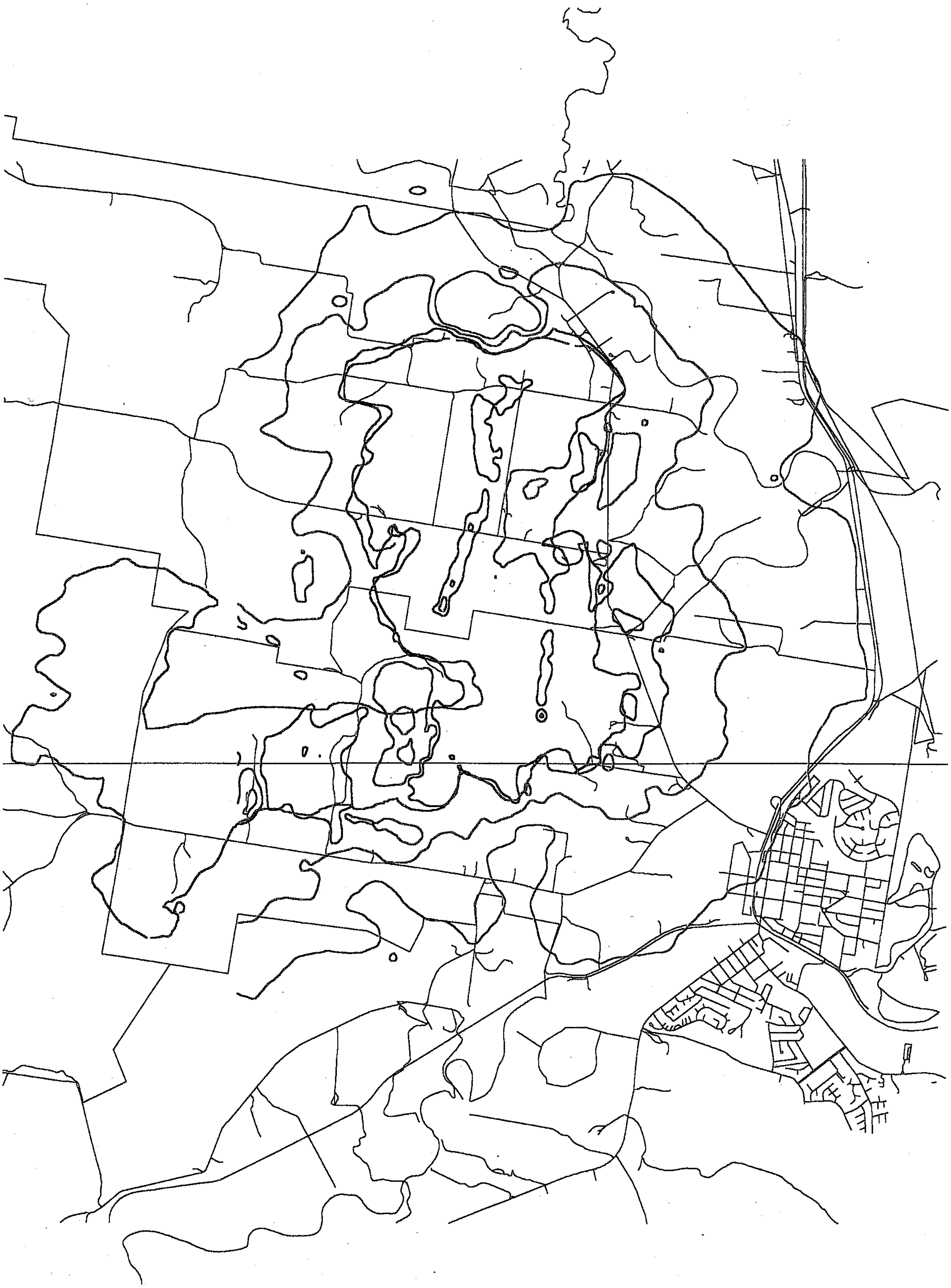
Next, noise levels were calculated under each of these conditions at approximately 11,400 points, spaced 100 metres apart, on a grid covering most of the potentially-affected residences around the site. Calculations used the ENM model in single-point mode. This represents over one million single-point noise level calculations for each mine layout.

The next step in calculations was to combine the noise levels at each grid point, using the proportion of time spent in each meteorological condition, to give the noise level which is exceeded for ten per cent of the time at that point. Finally, the "Surfer" surface-generation program was used to create contours from the ten percent exceedance noise levels.

Twenty different mine layouts were studied under still, isothermal conditions, representing different years, equipment configurations and times of day (see Section C.1). However, due to the large amount of data processing involved in calculations under adverse conditions, eight of these layouts were taken, representing the worst case for noise impact at various locations around the site. These were:

- Year 3, day;
- Year 3, night;
- Year 5, configuration 2 (largely north pit), night;
- Year 10, configuration 1 (largely south pit), day;
- Year 10, both configurations, night;
- Year 15, configuration 1 (largely south pit), night; and
- Year 20, configuration 1 (largely south pit), night.

Noise contours for each of these mine layouts, under adverse weather conditions, are shown in the following diagrams.



40 dBA(SI) 35 dBA

45 dBA

40 dBA

YEAR 3 DAY

35 dBA(SI)
35 dBA
45 dBA
40 dBA

YEAR 3 NIGHT

YEAR 5-2 NIGHT

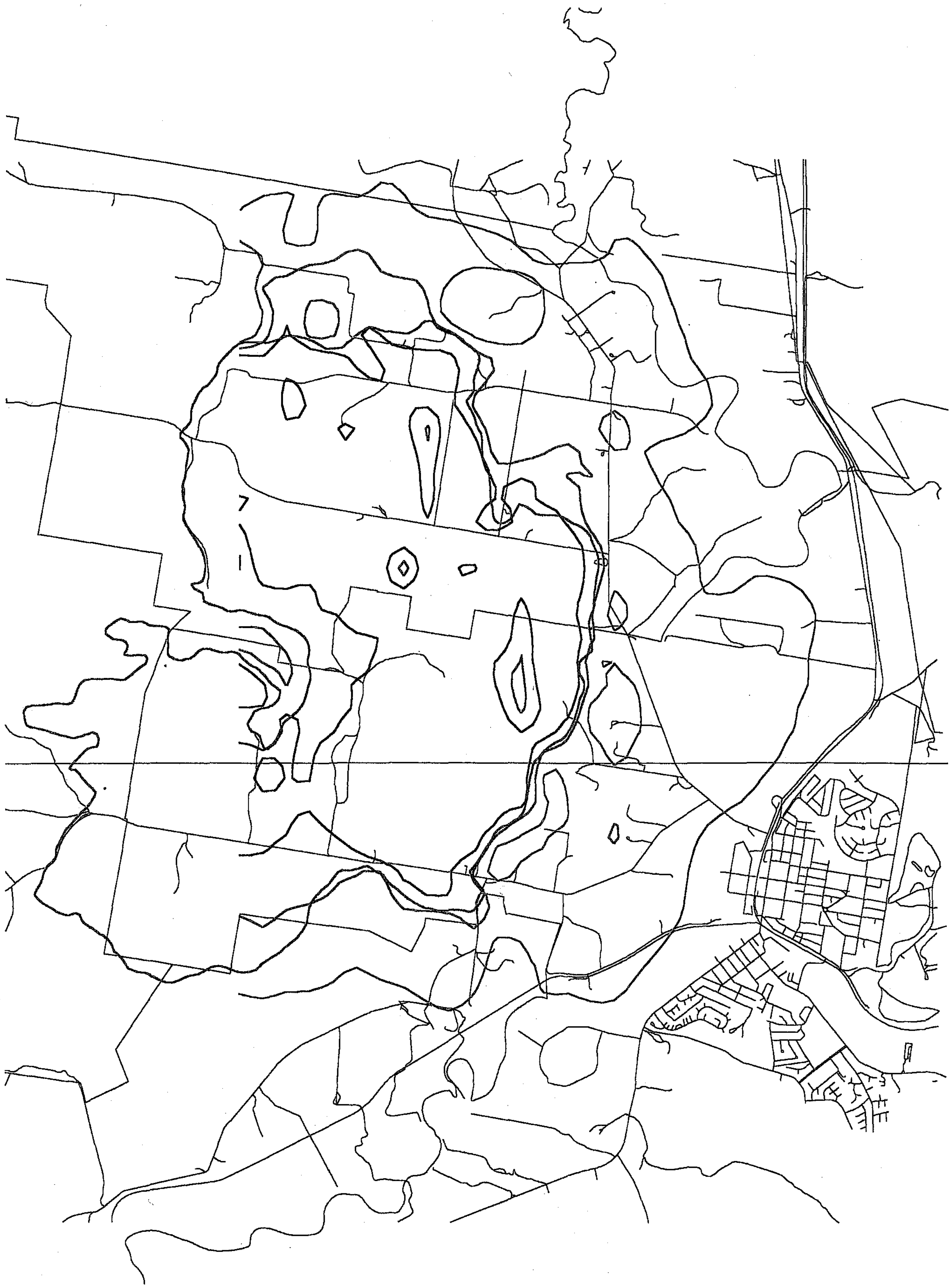
—— 40 dBA(SI)　　—— 35 dBA

—— 45 dBA

—— 40 dBA

YEAR 10-1 DAY

YEAR 10-1 NIGHT



——— 35 dBA(SI) ——— 35 dBA

——— 45 dBA

——— 40 dBA

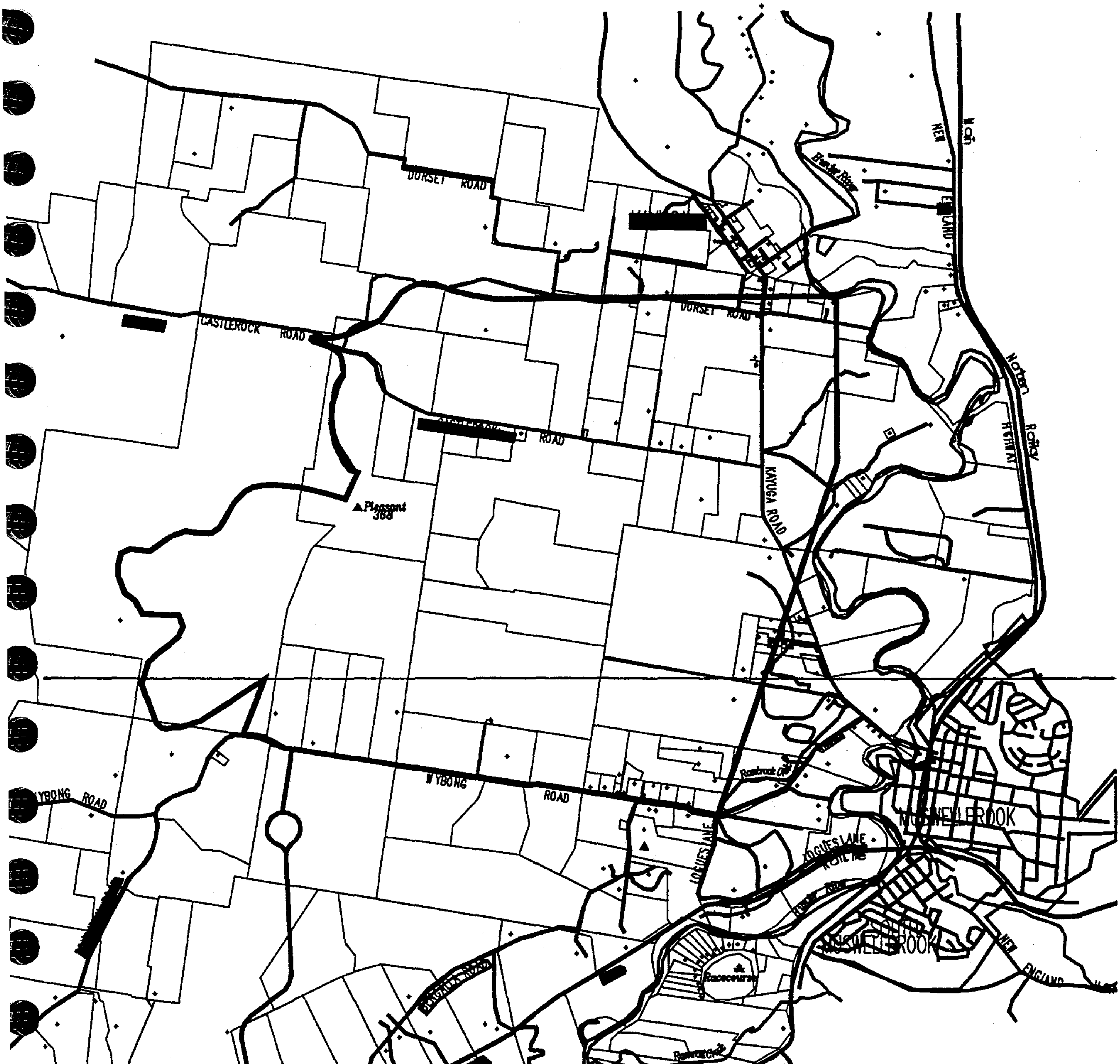
YEAR 10-2 NIGHT

35 dBA(SI)
35 dBA
45 dBA
40 dBA

YEAR 15-1 NIGHT

35 dBA(SI)
35 dBA
45 dBA
40 dBA

YEAR 20-1 NIGHT


DORSET ROAD
CASTLEROCK ROAD
DORSET ROAD
KAYUGA ROAD
Pleasant
368
WYBONG ROAD
WYBONG ROAD
JOGUES LANE
MUSWELLBROOK
SOUTH MUSWELLBROOK
Racecourse
NEW ENGLAND
Norton
Railway
HIGHWAY

RESIDENCES

C.3 MODELLED EQUIPMENT LOCATIONS

The mining equipment assumed to be operating at each stage of mine development was shown in tabular form in the EIS. The following figures show locations of all equipment for each of the twenty mine configurations studied. In each case, a number of items of equipment may be located at each source point, and these are listed in the tables following each figure.

YEAR 2 EQUIPMENT

GROUP	COMPOSITION
1	2 REAR DUMP TRUCK, 1 DOZER
2	1 REAR DUMP TRUCK
3	1 REAR DUMP TRUCK, 1 DOZER, 1 LIGHTING PLANT
4	1 WATER TRUCK
5	1 REAR DUMP TRUCK
6	1 REAR DUMP TRUCK, 1 FRONT END LOADER
7	1 REAR DUMP TRUCK, 1 DOZER, 1 ROPE SHOVEL
8	1 LIGHTING PLANT, 1 DRILL
9	1 SCRAPER
10	1 GRADER
11	1 REAR DUMP TRUCK
12	1 REAR DUMP TRUCK
13	1 REAR DUMP TRUCK, 1 FRONT END LOADER
14	1 LIGHTING PLANT
15	1 REAR DUMP TRUCK
16	1 REAR DUMP TRUCK, 1 FRONT END LOADER
17	1 DOZER, 1 DRILL
18	1 REAR DUMP TRUCK, 1 EXCAVATOR
19	1 DRILL
20	1 REAR DUMP TRUCK, 1 WATER TRUCK
21	1 REAR DUMP TRUCK
89	LOADOUT BIN
90	LOADOUT CONVEYOR
91	STACKER/RECLAIMER
92	COAL PREPARATION PLANT
93	3 90 CLASS LOCOMOTIVES
94	1 REAR DUMP TRUCK
95	1 WATER TRUCK
96	1 DOZER, 3 SCRAPER, 1 COMPACTOR, 1 SMALL WATER TRUCK
97	1 REAR DUMP TRUCK
98	1 REAR DUMP TRUCK, 1 DOZER

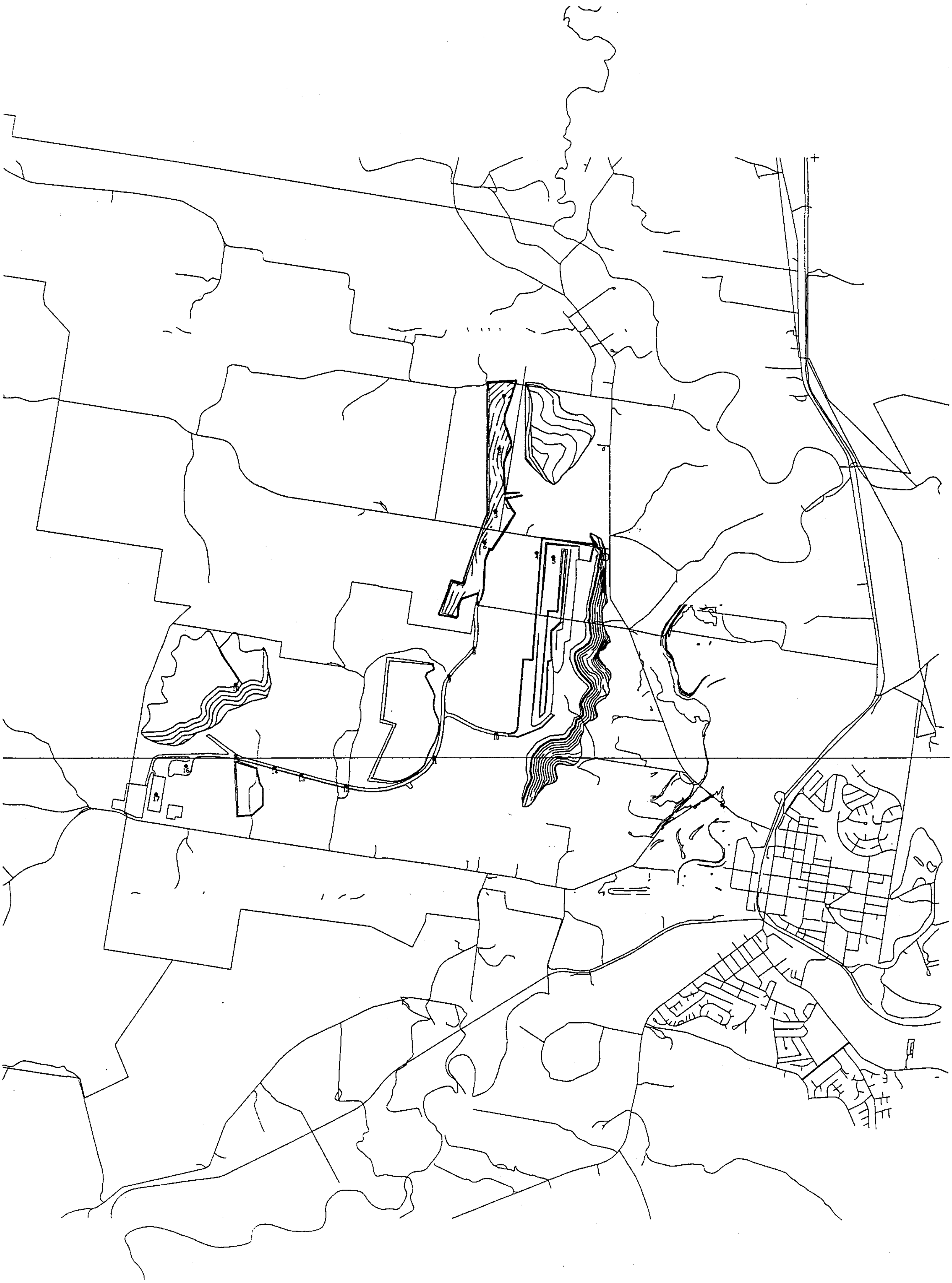
YEAR 2 DAY

YEAR 2 NIGHT

YEAR 3 EQUIPMENT

GROUP	COMPOSITION
1	1 DOZER, 1 LIGHTING PLANT, 1 LIGHT VEHICLE
2	2 REAR DUMP TRUCK, 1 LIGHTING PLANT
3	1 WATER TRUCK
4	1 REAR DUMP TRUCK
5	1 DOZER, 1 DRAGLINE
6	1 DRILL
7	1 FUEL TRUCK, 1 LIGHT VEHICLE
8	2 REAR DUMP TRUCK, 1 ROPE SHOVEL
9	1 REAR DUMP TRUCK, 1 FRONT END LOADER
10	1 LIGHTING PLANT
11	1 LIGHTING PLANT
12	1 DRILL
13	1 DOZER, 1 DRILL
14	1 REAR DUMP TRUCK, 1 DOZER, 2 LIGHTING PLANT
15	1 SCRAPER
16	1 REAR DUMP TRUCK
17	1 WATER TRUCK
18	1 LIGHT VEHICLE
19	1 REAR DUMP TRUCK
20	1 REAR DUMP TRUCK, 1 FRONT END LOADER
21	1 DOZER, 1 FUEL TRUCK
22	1 LIGHTING PLANT, 1 GRADER
23	1 DRILL
24	1 LIGHT VEHICLE, 1 SCRAPER
25	2 REAR DUMP TRUCK, 1 EXCAVATOR, 1 FUEL TRUCK
26	1 LIGHTING PLANT
27	1 DRILL
28	1 FRONT END LOADER
29	1 LIGHTING PLANT
30	1 REAR DUMP TRUCK, 1 GRADER
31	1 REAR DUMP TRUCK, 1 LIGHT VEHICLE, 1 CABLE REELER
32	1 WATER TRUCK
33	2 REAR DUMP TRUCK
34	2 DOZER
35	1 DRILL
89	LOADOUT BIN
90	LOADOUT CONVEYOR
91	STACKER/RECLAIMER
92	COAL PREPARATION PLANT
93	3 90 CLASS LOCOMOTIVES
94	1 REAR DUMP TRUCK
95	1 WATER TRUCK
96	1 DOZER, 3 SCRAPER, 1 COMPACTOR, 1 SMALL WATER TRUCK
97	1 REAR DUMP TRUCK
98	1 REAR DUMP TRUCK, 1 DOZER

YEAR 3 DAY

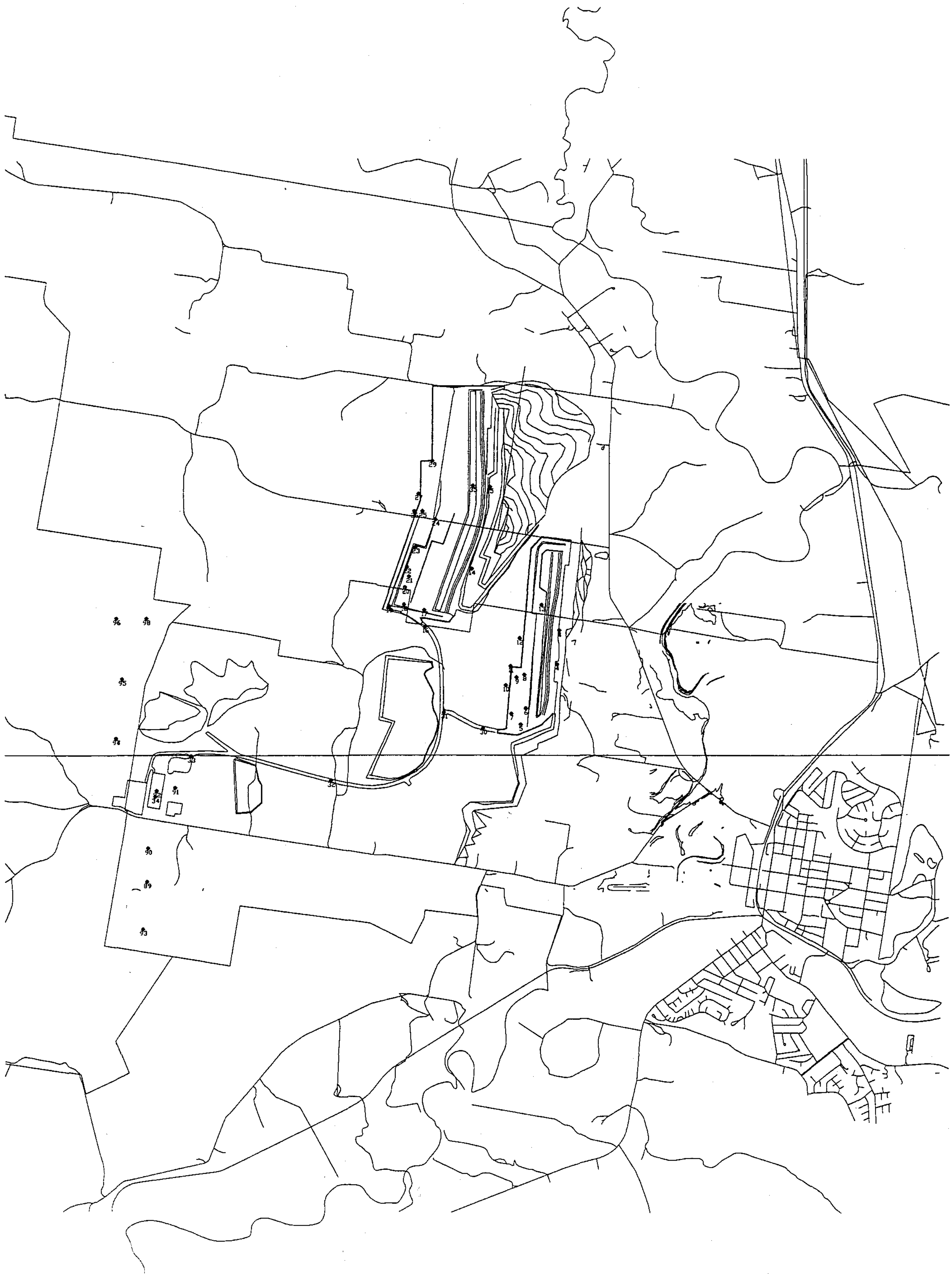


YEAR 3 NIGHT

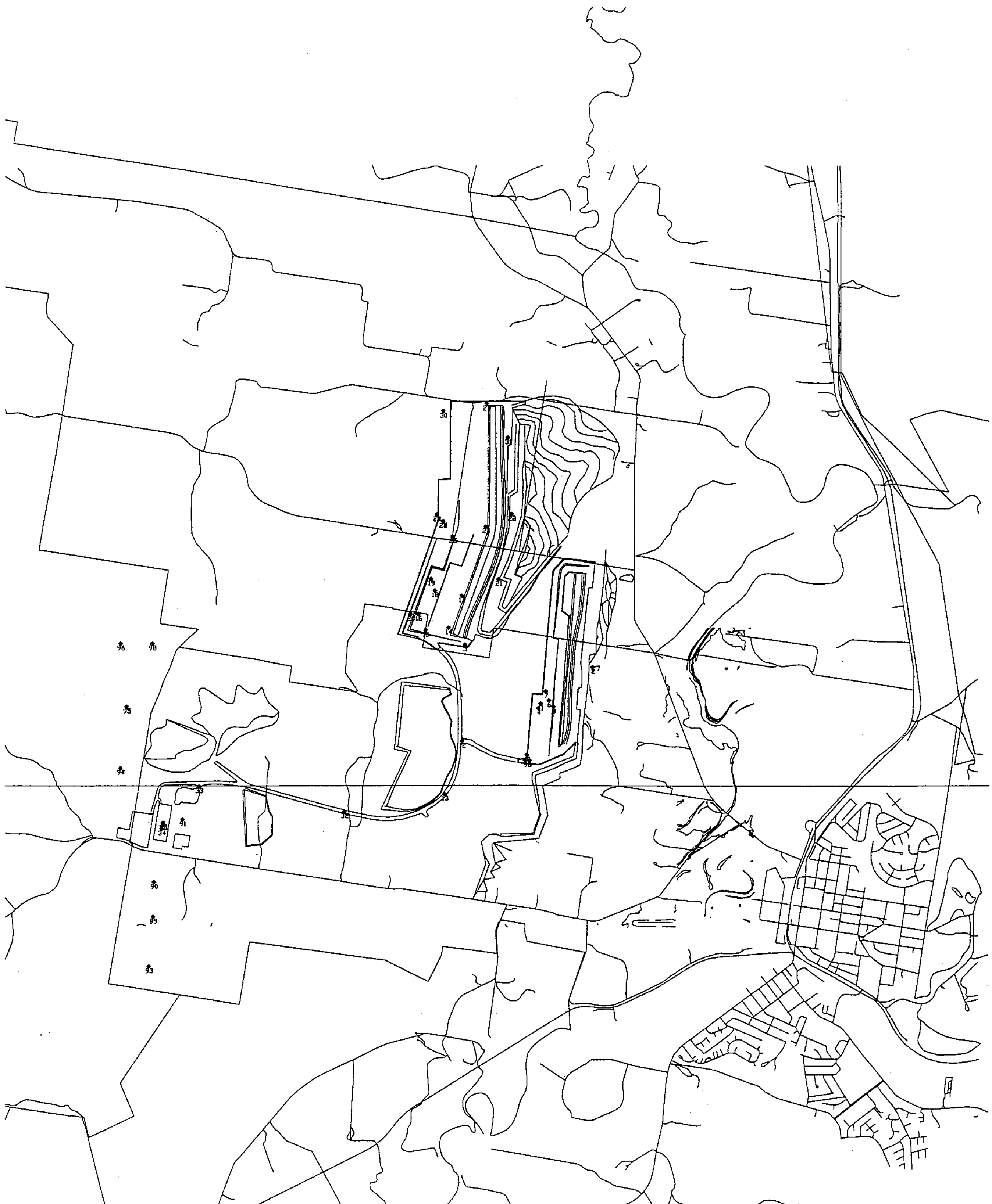
YEAR 5 EQUIPMENT

GROUP	COMPOSITION
1	1 DOZER, 1 LIGHTING PLANT, 1 LIGHT VEHICLE
2	2 REAR DUMP TRUCK, 1 LIGHTING PLANT
3	1 WATER TRUCK
4	1 REAR DUMP TRUCK
5	1 DOZER, 1 DRAGLINE
6	1 DRILL
7	1 FUEL TRUCK, 1 LIGHT VEHICLE
8	2 REAR DUMP TRUCK, 1 ROPE SHOVEL
9	1 REAR DUMP TRUCK, 1 FRONT END LOADER
10	1 LIGHTING PLANT
11	1 LIGHTING PLANT
12	1 DRILL
13	1 DOZER, 1 DRILL
14	1 REAR DUMP TRUCK, 1 DOZER, 2 LIGHTING PLANT
15	1 SCRAPER
16	1 REAR DUMP TRUCK
17	1 WATER TRUCK
18	1 LIGHT VEHICLE
19	1 REAR DUMP TRUCK
20	1 REAR DUMP TRUCK, 1 FRONT END LOADER
21	1 DOZER, 1 FUEL TRUCK
22	1 LIGHTING PLANT, 1 GRADER
23	1 DRILL
24	1 LIGHT VEHICLE, 1 SCRAPER
25	2 REAR DUMP TRUCK, 1 EXCAVATOR, 1 FUEL TRUCK
26	1 LIGHTING PLANT
27	1 DRILL
28	1 FRONT END LOADER
29	1 LIGHTING PLANT
30	1 REAR DUMP TRUCK, 1 GRADER
31	1 REAR DUMP TRUCK, 1 LIGHT VEHICLE, 1 CABLE REELER
32	1 WATER TRUCK
33	2 REAR DUMP TRUCK
34	2 DOZER
35	1 DRILL
89	LOADOUT BIN
90	LOADOUT CONVEYOR
91	STACKER/RECLAIMER
92	COAL PREPARATION PLANT
93	3 90 CLASS LOCOMOTIVES
94	1 REAR DUMP TRUCK
95	1 WATER TRUCK
96	1 DOZER, 3 SCRAPER, 1 COMPACTOR, 1 SMALL WATER TRUCK
97	1 REAR DUMP TRUCK
98	1 REAR DUMP TRUCK, 1 DOZER

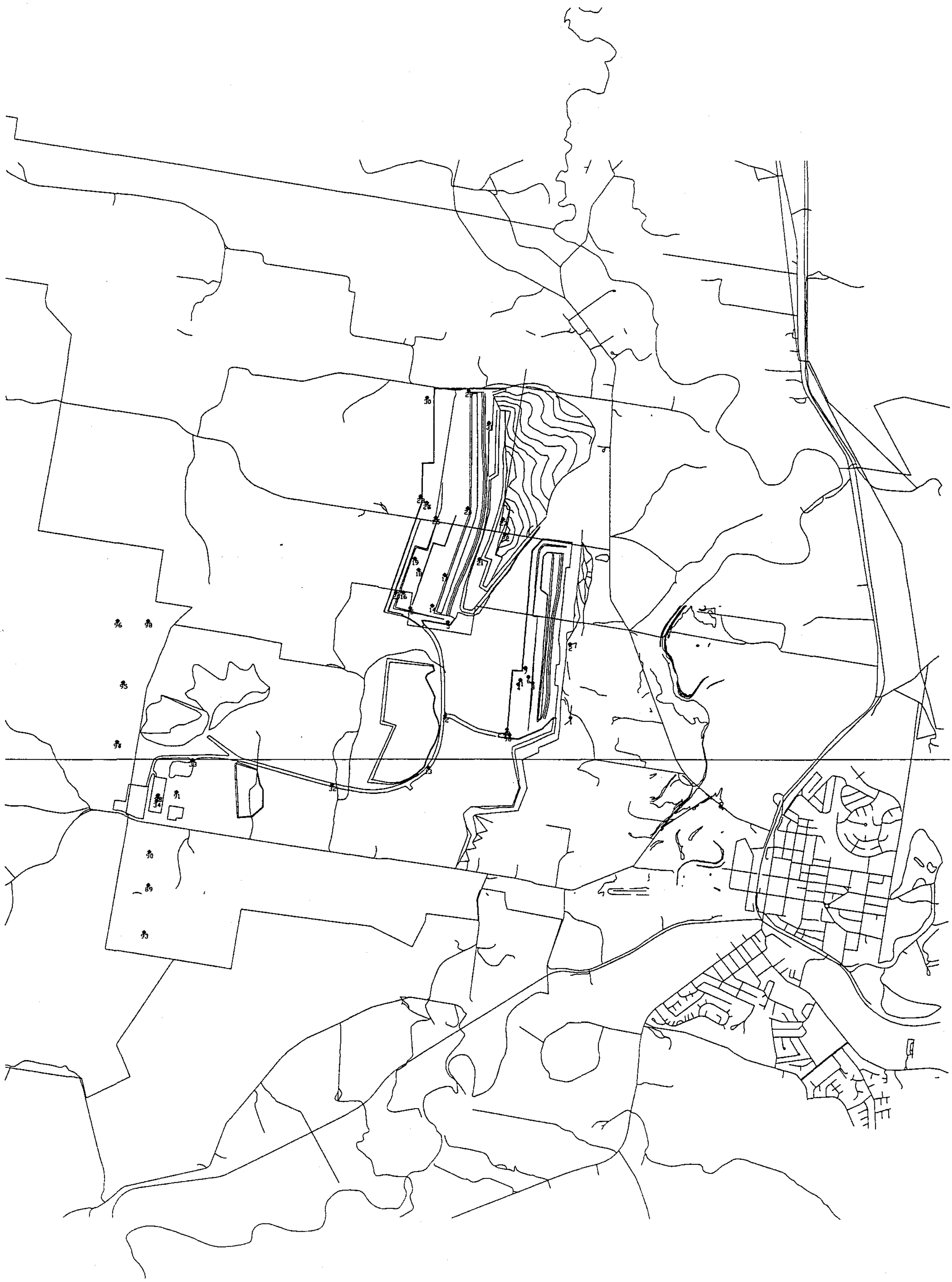
YEAR 5-1 DAY



YEAR 5-1 NIGHT



YEAR 5-2 NIGHT

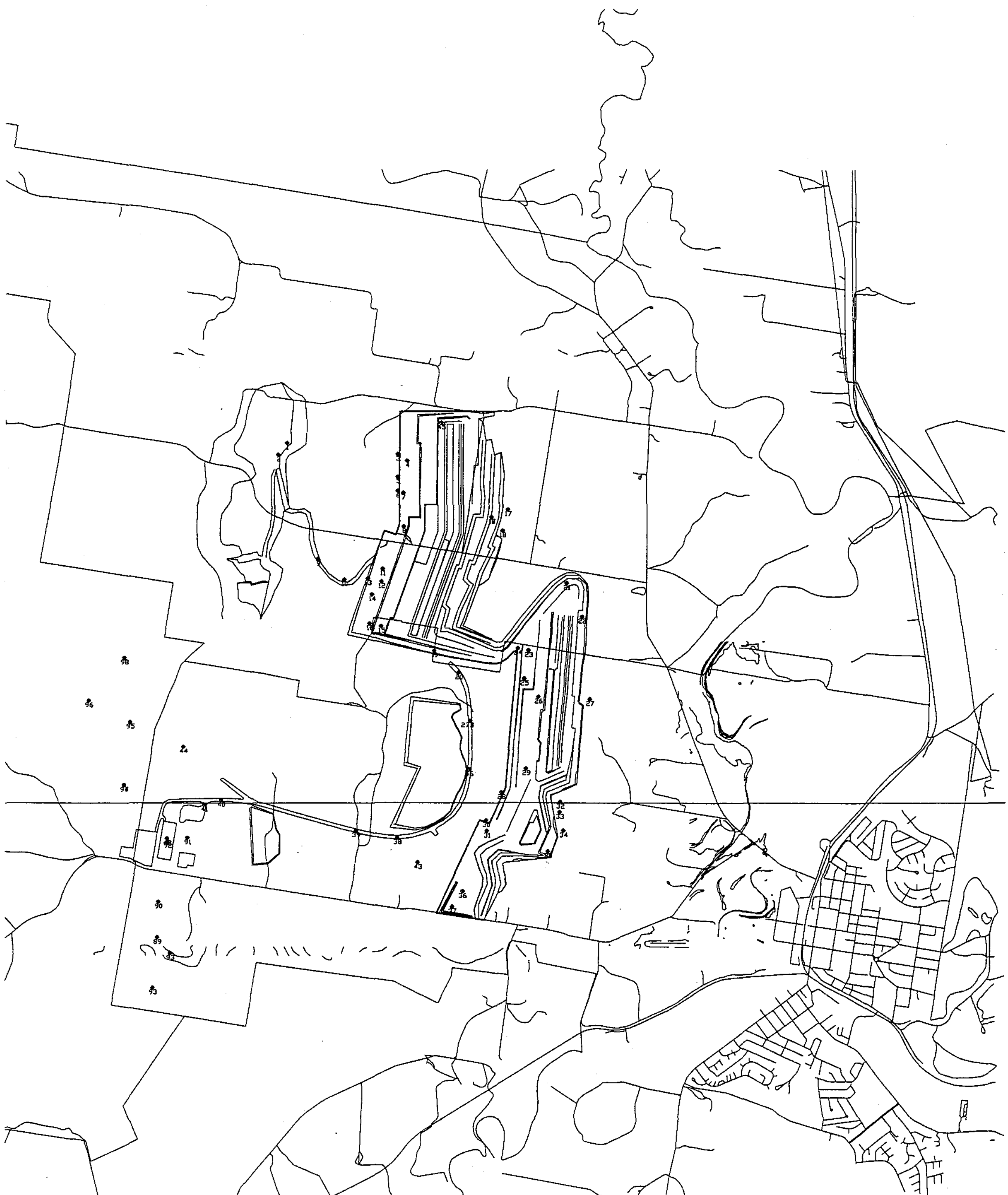


YEAR 5-2 DAY

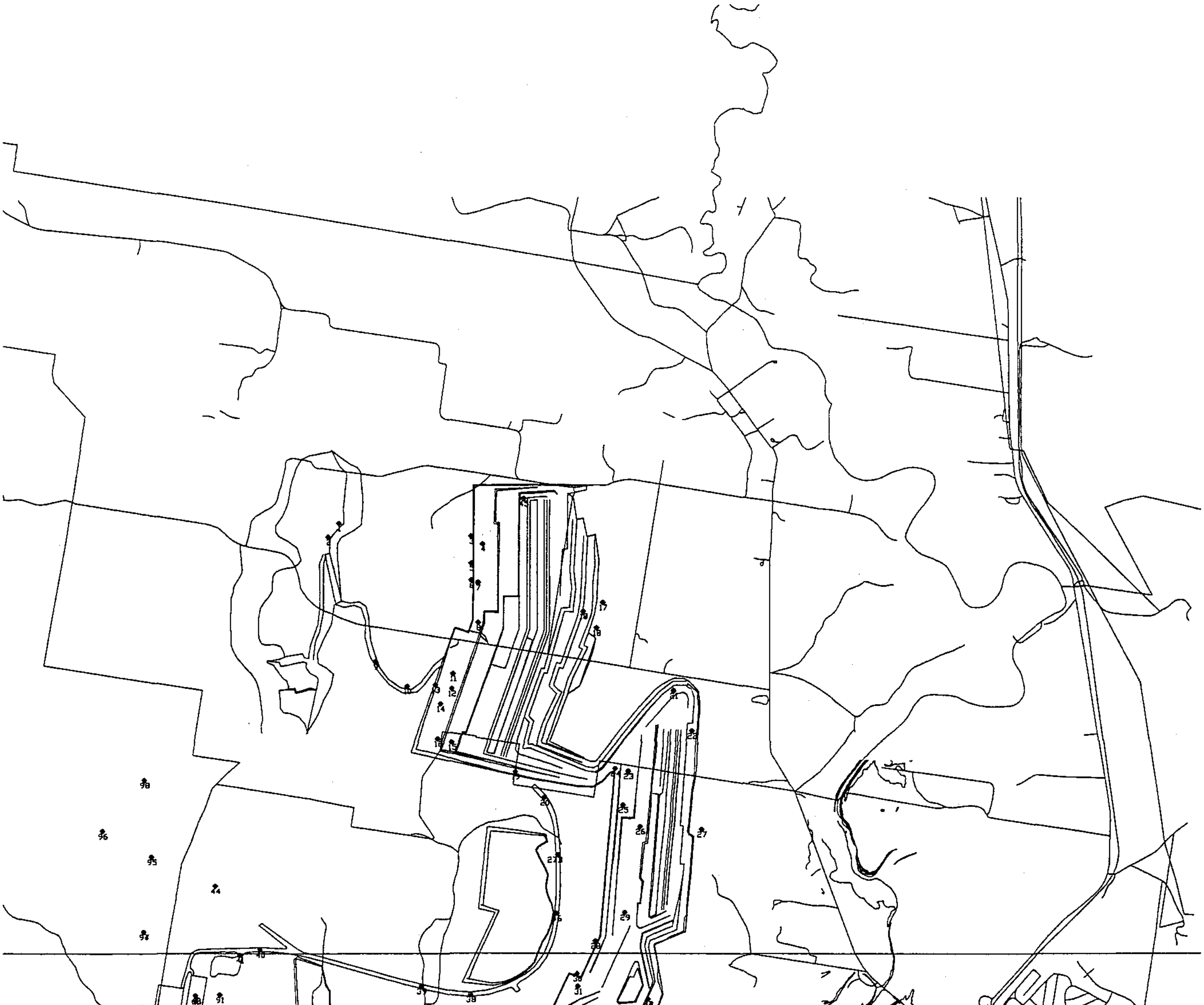
YEAR 10 EQUIPMENT

GROUP	COMPOSITION
1	2 REAR DUMP TRUCK, 1 DOZER, 1 LIGHTING PLANT
2	1 WATER TRUCK, 1 LIGHT VEHICLE
3	1 DRILL
4	1 FUEL TRUCK
5	1 LIGHTING PLANT
6	1 LIGHTING PLANT
7	1 REAR DUMP TRUCK, 1 WATER TRUCK, 1 ROPE SHOVEL
8	1 GRADER
9	1 REAR DUMP TRUCK
10	1 FUEL TRUCK
11	1 DRILL
12	1 DOZER
13	1 LIGHTING PLANT
14	1 REAR DUMP TRUCK, 1 FRONT END LOADER, 1 DRILL
15	1 REAR DUMP TRUCK, 1 FRONT END LOADER
16	1 LIGHTING PLANT
17	1 DOZER, 1 LIGHTING PLANT
18	2 REAR DUMP TRUCK
19	1 REAR DUMP TRUCK
20	1 GRADER
21	1 REAR DUMP TRUCK
22	2 REAR DUMP TRUCK, 1 DOZER, 1 LIGHTING PLANT
23	1 REAR DUMP TRUCK, 1 EXCAVATOR
24	1 LIGHTING PLANT
25	1 DRILL
26	1 LIGHT VEHICLE, 1 DRILL
27	1 SCRAPER
27B	1 REAR DUMP TRUCK
28	1 DRILL
29	1 DOZER, 1 WATER TRUCK, 1 DRAGLINE
30	1 LIGHTING PLANT
31	1 REAR DUMP TRUCK, 1 ROPE SHOVEL, 1 GRADER
32	1 REAR DUMP TRUCK, 1 LIGHTING PLANT
33	1 REAR DUMP TRUCK, 1 DOZER
34	1 FUEL TRUCK
35	1 REAR DUMP TRUCK
36	1 REAR DUMP TRUCK, 1 DOZER, 1 FRONT END LOADER, 1 LIGHTING PLANT
37	1 LIGHTING PLANT, 1 DRILL
38	1 REAR DUMP TRUCK
39	1 FUEL TRUCK
40	1 REAR DUMP TRUCK
41	1 REAR DUMP TRUCK
42	2 DOZER
46	1 LIGHT VEHICLE

89	LOADOUT BIN
90	LOADOUT CONVEYOR
91	STACKER/RECLAIMER
92	COAL PREPARATION PLANT
93	3 90 CLASS LOCOMOTIVES
94	1 REAR DUMP TRUCK
95	1 WATER TRUCK
96	1 DOZER, 3 SCRAPER, 1 COMPACTOR, 1 SMALL WATER TRUCK
97	1 REAR DUMP TRUCK
98	1 REAR DUMP TRUCK, 1 DOZER



YEAR 10-1 DAY



YEAR 10-1 NIGHT

YEAR 10-2 DAY

YEAR 10-2 NIGHT

YEAR 15 EQUIPMENT

GROUP	COMPOSITION
1	1 REAR DUMP TRUCK, 1 LIGHTING PLANT
2	2 REAR DUMP TRUCK
3	1 REAR DUMP TRUCK
4	1 REAR DUMP TRUCK, 1 DOZER, 1 FRONT END LOADER
5	1 DOZER
6	1 DOZER, 1 DRAGLINE
7	1 LIGHT VEHICLE, 1 CABLE REELER
8	1 DRILL
9	1 LIGHTING PLANT
10	1 DRILL
11	1 REAR DUMP TRUCK, 1 EXCAVATOR, 1 GRADER
12	1 LIGHTING PLANT
13	1 DRILL
14	1 GRADER
15	2 REAR DUMP TRUCK, 1 ROPE SHOVEL
16	1 LIGHTING PLANT
17	1 REAR DUMP TRUCK, 1 DRILL
18	1 REAR DUMP TRUCK
19	1 REAR DUMP TRUCK
20	1 REAR DUMP TRUCK
21	1 REAR DUMP TRUCK
22	1 REAR DUMP TRUCK, 1 WATER TRUCK, 1 LIGHT VEHICLE
23	2 REAR DUMP TRUCK, 1 FUEL TRUCK
24	2 DOZER
25	1 WATER TRUCK, 1 GRADER
26	3 REAR DUMP TRUCK, 1 DOZER, 1 WATER TRUCK, 2 LIGHTING PLANT, 1 LIGHT VEHICLE
27	1 REAR DUMP TRUCK, 1 FRONT END LOADER, 1 LIGHT VEHICLE, 1 DRILL
28	1 LIGHTING PLANT
29	1 REAR DUMP TRUCK, 1 ROPE SHOVEL
30	1 LIGHTING PLANT
31	1 REAR DUMP TRUCK
32	1 REAR DUMP TRUCK
33	1 DRILL
34	1 REAR DUMP TRUCK, 1 FRONT END LOADER
35	1 LIGHTING PLANT, 1 DRILL
36	2 REAR DUMP TRUCK, 1 DOZER, 1 FUEL TRUCK
37	1 LIGHTING PLANT
38	1 SCRAPER
39	1 REAR DUMP TRUCK
40	1 DRILL
89	LOADOUT BIN
90	LOADOUT CONVEYOR
91	STACKER/RECLAIMER

92	COAL PREPARATION PLANT
93	3 90 CLASS LOCOMOTIVES
94	1 REAR DUMP TRUCK
95	1 WATER TRUCK
96	1 DOZER, 3 SCRAPER, 1 COMPACTOR, 1 SMALL WATER TRUCK
97	1 REAR DUMP TRUCK
98	1 REAR DUMP TRUCK, 1 DOZER

YEAR 15-1 DAY

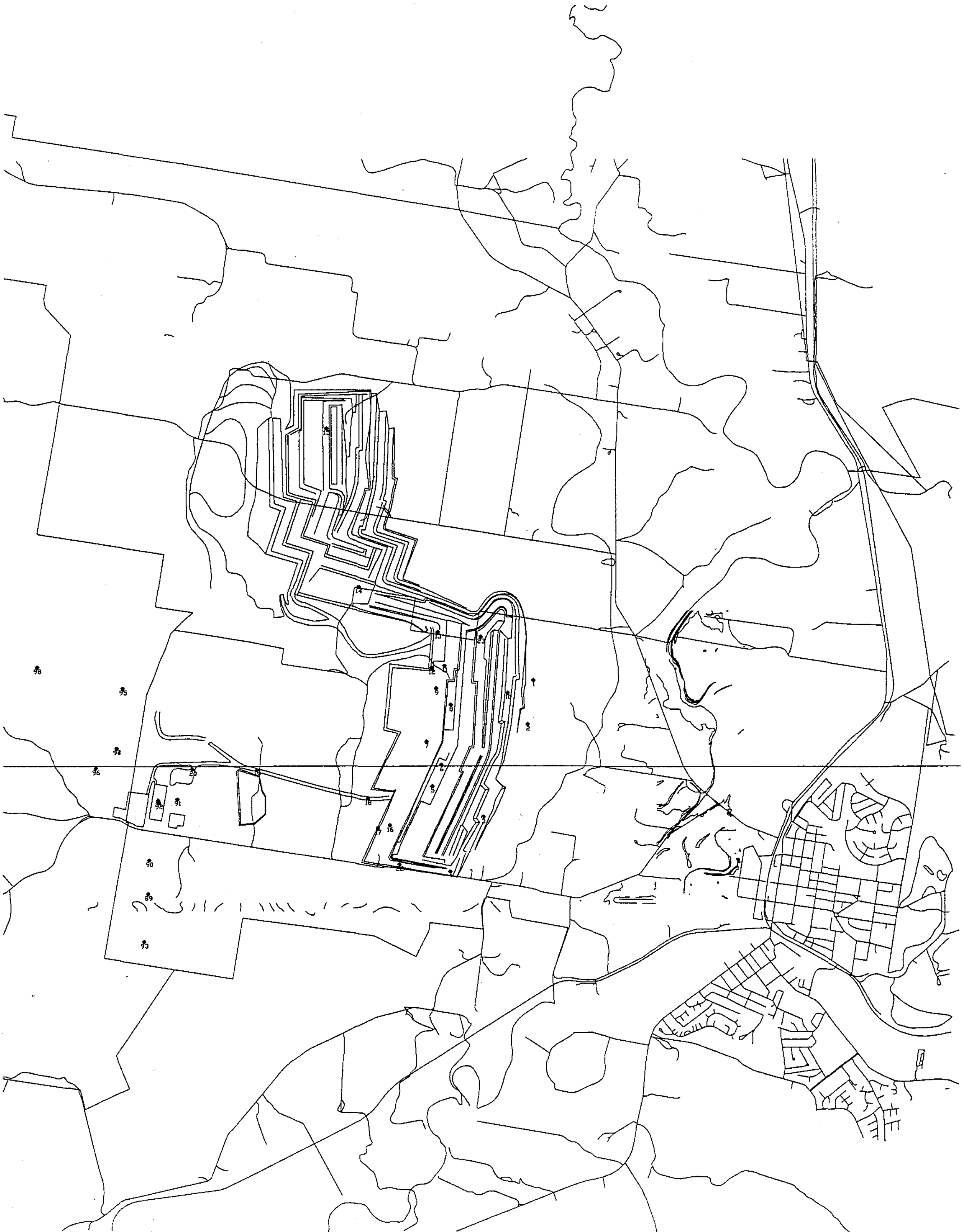
YEAR 15-1 NIGHT

YEAR 15-2 DAY

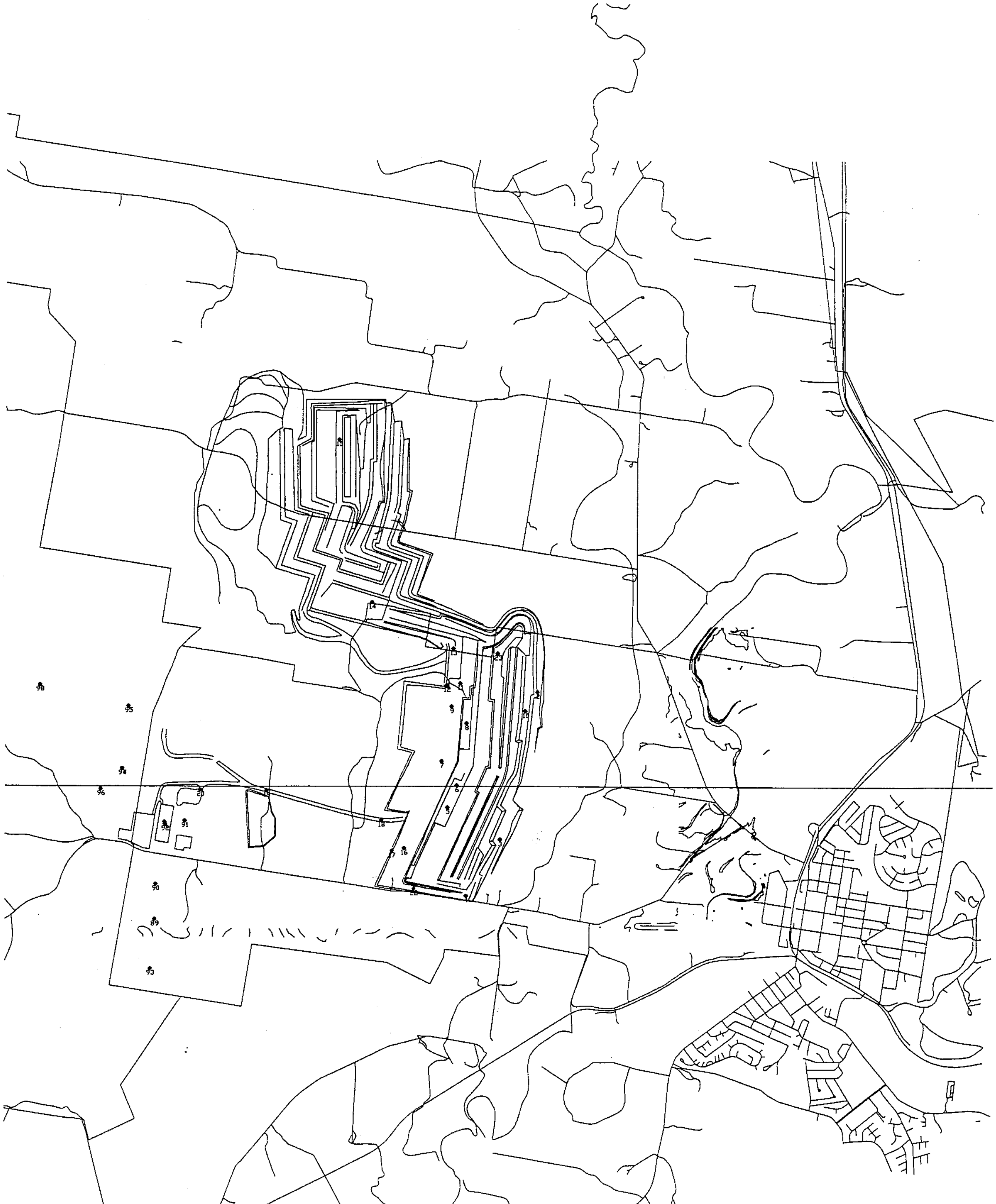
YEAR 15-2 NIGHT

YEAR 20 EQUIPMENT

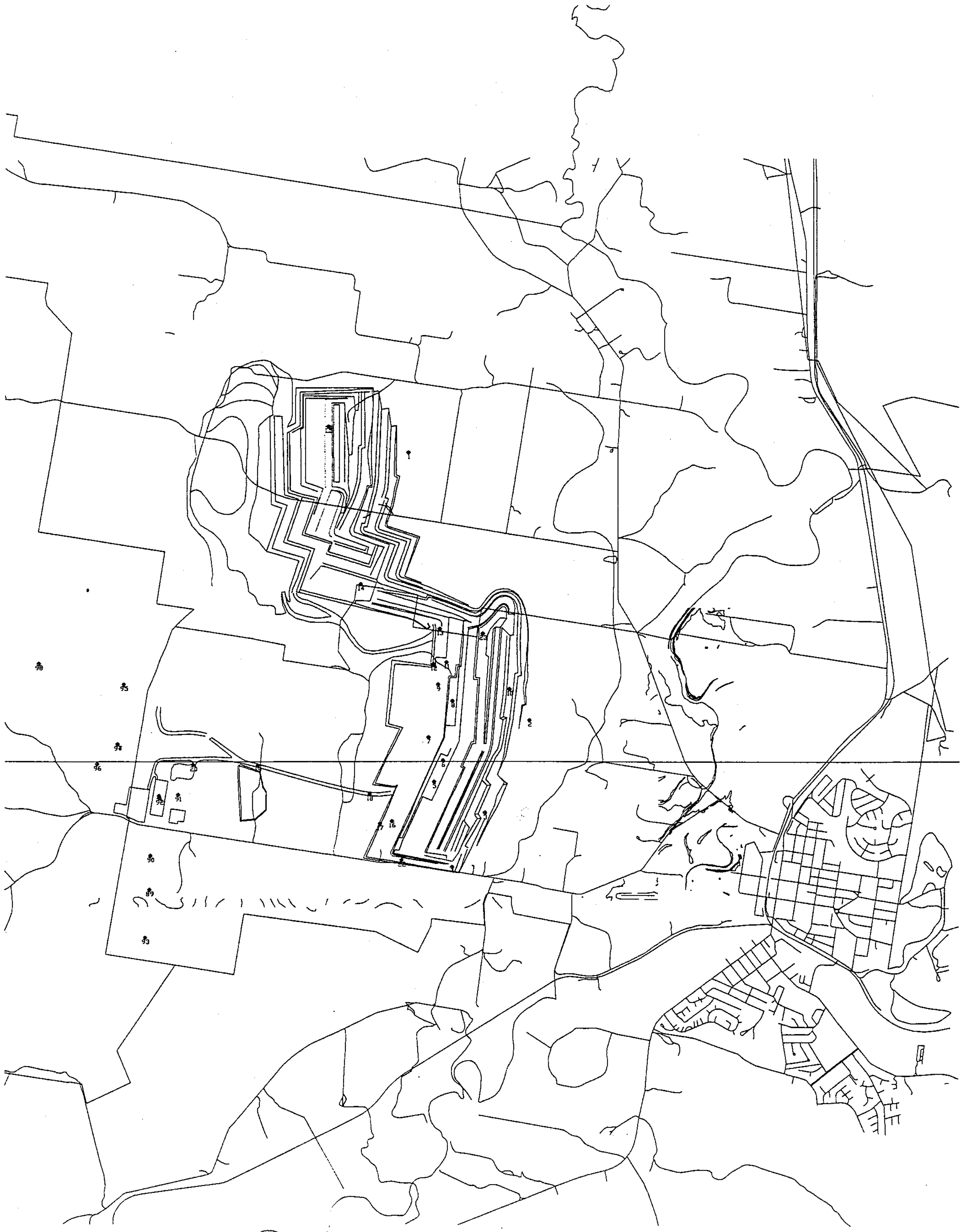
GROUP	COMPOSITION
1	2 REAR DUMP TRUCK, 1 DOZER, 1 FUEL TRUCK
2	1 SCRAPER
3	2 REAR DUMP TRUCK, 1 DOZER, 1 LIGHTING PLANT
4	1 REAR DUMP TRUCK
5	2 REAR DUMP TRUCK, 1 WATER TRUCK, 1 FRONT END LOADER, 1 LIGHTING PLANT
6	2 REAR DUMP TRUCK, 1 DOZER, 1 FRONT END LOADER, 1 LIGHTING PLANT, 1 DRILL
7	1 REAR DUMP TRUCK
8	1 REAR DUMP TRUCK, 1 EXCAVATOR
9	1 LIGHTING PLANT
10	2 REAR DUMP TRUCK, 1 LIGHTING PLANT
11	2 REAR DUMP TRUCK, 1 FRONT END LOADER, 1 ROPE SHOVEL, 1 DRILL, 1 FUEL TRUCK
12	1 LIGHTING PLANT
13	1 LIGHTING PLANT, 1 DRILL, 1 GRADER
14	2 REAR DUMP TRUCK, 1 DOZER, 1 LIGHTING PLANT, 1 FUEL TRUCK, 1 GRADER
15	1 DOZER, 1 DRILL, 1 DRAGLINE, 1 CABLE REELER
16	1 REAR DUMP TRUCK, 1 ROPE SHOVEL
17	1 LIGHTING PLANT
18	1 REAR DUMP TRUCK
19	1 REAR DUMP TRUCK, 1 WATER TRUCK
20	1 REAR DUMP TRUCK
21	2 DOZER
22	1 REAR DUMP TRUCK
23	1 DRILL
89	LOADOUT BIN
90	LOADOUT CONVEYOR
91	STACKER/RECLAIMER
92	COAL PREPARATION PLANT
93	3 90 CLASS LOCOMOTIVES
94	1 REAR DUMP TRUCK
95	1 WATER TRUCK
96	1 DOZER, 3 SCRAPER, 1 COMPACTOR, 1 SMALL WATER TRUCK
97	1 REAR DUMP TRUCK
98	1 REAR DUMP TRUCK, 1 DOZER



YEAR 20-1 DAY



YEAR 20-1 NIGHT



YEAR 20-2 DAY

YEAR 20-2 NIGHT

C.4 PREDICTED NOISE LEVELS AT AFFECTED RESIDENCES

The EPA requested specific noise level predictions, under adverse weather conditions, for residences lying within the proposed noise criteria contours - that is, 35 dB(A) at night or 40 dB(A) during the daytime under SI conditions.

These noise levels were calculated from the data used in preparing the "adverse conditions" noise level contours shown in Section C.2. They represent the noise level which is predicted to be exceeded for ten per cent of the relevant time period, under the operating conditions specified. As in Section C.2, noise levels are provided for the eight operating scenarios which may represent the worst-case noise level at some point around the mine.

Table C.4.1 shows calculated ten per cent exceedance noise levels at the 81 residences within the relevant contour. Of these, 20 residences are owned by the proponent and 15 are owned by other mines in the area, leaving 46 residences which are privately owned.

Table C.4.1 NOISE LEVELS EXCEEDED TEN PER CENT OF TIME AT RESIDENCES

Residence Code	Calculated L_{10} Noise Level, dB(A)							
	Year 3 Day	Year 3 Night	Year 5 Config. 2 Night	Year 10 Config. 1 Day	Year 10 Config. 1 Night	Year 10 Config. 2 Night	Year 15 Config. 1 Night	Year 20 Config. 1 Night
8a	42.9	30.6	43.4	43.8	44.0	43.4	42.8	33.4
8b	48.9	32.0	49.2	45.6	46.1	44.8	47.1	31.4
8c	40.7	26.2	41.2	36.1	36.9	39.1	35.4	27.6
13	45.7	29.3	43.2	38.6	39.2	37.6	39.0	29.3
14	40.7	27.0	40.2	37.9	38.9	37.4	34.8	28.8
16	40.0	30.9	40.1	41.7	42.9	41.4	43.0	35.1
22	41.1	32.2	42.9	44.9	48.3	44.9	49.6	39.6
25	44.3	32.6	44.9	38.1	39.3	37.3	37.2	29.4
27	43.0	33.8	37.4	40.5	40.6	34.9	33.3	31.1
29a	43.7	38.1	41.2	41.7	41.6	37.9	35.5	34.1
29b	43.5	37.3	37.7	41.4	41.4	37.2	35.2	32.7
31	43.6	48.1	43.9	51.1	51.2	50.8	42.4	41.7
32	43.6	48.7	44.1	50.1	50.2	50.3	44.9	44.5
33	47.0	42.7	49.5	50.7	50.9	43.3	41.3	43.3

Table C.4.1 NOISE LEVELS EXCEEDED TEN PER CENT OF TIME AT RESIDENCES

Residence	Calculated L_{10} Noise Level, dB(A)							
Code	Year 3 Day	Year 3 Night	Year 5 Config. 2 Night	Year 10 Config. 1 Day	Year 10 Config. 1 Night	Year 10 Config. 2 Night	Year 15 Config. 1 Night	Year 20 Config. 1 Night
34	47.5	51.0	51.6	50.9	50.9	45.0	40.0	41.2
35	48.8	35.8	51.1	49.9	49.8	49.5	41.6	41.4
43	44.4	37.0	45.5	49.1	49.1	48.3	51.0	46.1
44	47.8	36.7	48.9	49.9	49.9	50.4	44.2	46.6
48	46.7	51.4	47.3	51.3	51.2	51.2	43.0	45.9
50	43.4	35.6	43.9	39.3	39.1	36.9	35.3	36.1
57	48.8	38.0	49.6	38.6	38.2	37.6	35.9	33.2
58	51.3	37.6	51.4	37.1	35.9	34.6	35.2	31.5
59	51.6	40.0	51.7	36.9	36.3	35.7	36.2	31.2
63	34.6	44.9	35.1	48.2	47.2	48.2	48.7	39.9
66a	43.0	37.5	29.2	46.6	39.4	37.1	39.3	34.4
66b	40.8	36.1	40.0	40.9	41.1	38.0	36.9	37.9
67	45.4	39.4	33.9	47.5	41.9	38.4	39.3	35.9
69	45.0	34.8	45.1	38.9	37.4	37.1	34.8	34.0
75	38.9	35.4	38.1	42.8	42.1	40.0	39.1	40.7
76	37.8	35.1	37.3	41.3	40.8	38.8	37.8	40.1
77	35.0	35.3	32.8	39.8	39.1	34.7	37.3	33.4
83	34.2	38.6	34.0	33.7	35.8	33.3	38.3	35.9
84	35.8	38.9	35.6	36.3	38.0	36.7	40.1	39.8
85	36.7	39.4	36.5	37.8	39.6	39.3	43.8	43.9
86	36.9	40.2	36.7	39.5	43.2	42.2	46.0	48.0
87	37.7	42.1	37.4	44.1	48.8	45.6	49.3	51.0
88	38.6	42.4	38.4	44.7	50.9	45.3	50.1	50.1
89	38.6	43.1	38.4	47.3	48.8	48.3	50.4	50.8
91	41.6	50.0	41.6	44.7	45.6	50.8	50.5	49.9
94[1]	-	-	-	-	-	-	-	-
95[1]	-	-	-	-	-	-	-	-
99	44.1	40.2	41.1	44.4	41.0	41.1	40.2	41.2
113	36.7	38.0	36.5	39.2	40.9	39.8	42.7	42.9
115a	34.7	38.0	34.3	37.5	38.2	38.0	41.4	40.2

Table C.4.1 NOISE LEVELS EXCEEDED TEN PER CENT OF TIME AT RESIDENCES

Residence Code	Calculated L_{10} Noise Level, dB(A)							
	Year 3 Day	Year 3 Night	Year 5 Config. 2 Night	Year 10 Config. 1 Day	Year 10 Config. 1 Night	Year 10 Config. 2 Night	Year 15 Config. 1 Night	Year 20 Config. 1 Night
115b	35.0	38.5	34.8	36.8	37.7	36.8	41.5	40.3
121	51.1	50.9	51.1	50.0	50.1	50.7	50.0	49.7
124	35.8	38.7	35.6	35.1	36.5	35.0	40.8	38.9
126	45.7	31.1	36.7	40.3	40.4	35.6	33.2	30.0
130	46.8	36.4	46.9	37.3	36.4	35.8	35.0	33.0
131	46.6	36.6	46.6	38.4	36.9	36.5	35.1	33.3
132	47.4	38.1	44.7	37.1	32.9	32.9	36.7	33.5
134	46.4	34.9	41.3	37.1	34.0	33.4	35.4	33.3
135	45.9	36.1	45.4	38.9	36.0	35.4	35.2	33.0
136	49.2	36.3	38.3	35.0	33.5	32.7	36.0	33.7
137	48.3	35.3	42.0	35.1	33.6	32.7	35.0	33.8
138a	43.3	37.1	38.2	45.0	42.0	37.6	37.4	34.8
139	43.1	35.9	42.1	41.0	40.7	37.3	36.0	36.6
141	44.6	36.7	44.5	40.4	38.3	36.5	35.6	34.7
142	45.7	33.7	41.2	39.0	34.4	33.8	34.5	33.0
143	45.3	35.6	43.3	40.3	35.7	34.9	34.7	33.2
144	45.1	35.8	43.7	39.9	35.6	34.9	34.9	32.9
145	45.3	36.2	44.4	40.3	36.1	35.3	35.0	33.0
146	44.8	36.3	44.1	40.4	37.0	35.5	35.1	33.6
148	44.8	36.0	43.9	40.3	36.3	35.0	34.9	33.1
149	45.5	36.7	44.8	40.5	37.1	36.3	35.4	33.6
150	44.8	36.6	44.1	40.4	38.0	36.4	35.5	34.3
151	44.9	36.6	44.3	40.4	37.7	36.1	35.4	34.1
152	44.9	36.6	44.3	40.5	37.5	35.8	35.4	34.0
153	44.5	36.8	43.8	40.1	38.9	37.8	35.6	35.2
154	44.9	36.8	44.2	40.3	38.5	37.4	35.6	34.6
155	44.7	36.8	44.1	40.2	38.6	37.5	35.6	34.8
156	44.6	36.7	43.9	40.2	38.8	37.4	35.6	34.9
157	44.2	36.7	43.6	40.2	39.1	37.1	35.7	35.3
158	43.8	36.6	43.2	40.2	39.7	37.2	35.8	35.8

Table C.4.1 NOISE LEVELS EXCEEDED TEN PER CENT OF TIME AT RESIDENCES

Residence Code	Calculated L_{10} Noise Level, dB(A)							
	Year 3 Day	Year 3 Night	Year 5 Config. 2 Night	Year 10 Config. 1 Day	Year 10 Config. 1 Night	Year 10 Config. 2 Night	Year 15 Config. 1 Night	Year 20 Config. 1 Night
159	43.6	35.0	42.8	40.8	40.1	36.7	35.9	35.9
160	43.9	35.4	43.1	40.7	39.7	36.6	35.8	35.6
161	42.3	35.0	41.6	40.7	41.0	37.7	36.1	37.5
162	42.9	35.4	42.1	40.7	40.8	37.5	36.1	36.9
163	42.6	35.3	41.8	40.7	40.9	37.7	36.1	37.2
198	47.5	31.5	38.2	40.3	40.4	36.3	35.3	31.6
201	46.2	31.4	37.6	39.8	39.9	36.0	34.6	31.6

Notes: *1..These residences are located within the proposed coal preparation plant area*

C5 DETAILS OF BLAST NOISE CALCULATIONS

The EPA requested further details of blast noise calculations contained in the EIS. As stated in the EIS, overpressure and vibration levels were calculated from predictive equations derived from measurements conducted at a number of mines in the Hunter Valley. One predictive equation, shown graphically in the EIS, was derived from measurements at three mines - Mount Thorley, Hunter Valley and Muswellbrook No 2. Inclusion of the Muswellbrook No 2 data resulted in lower predicted airblast levels at relatively close distances to the mine and hence an alternative analysis was also carried out using only data from the other two mines. Other standard predictive equations gave results similar to these two.

The predictive equations use the "scaled distance" from the blast as described in the EIS. An alternative analysis using multiple regression on distance and charge weight as independent variables showed no significant increase in prediction accuracy.

The analysis used blast requirements as predicted from the mine plan for each year of operation and each mine working block. Two likely blast locations were selected for each year in each of the eight working blocks. These represented the positions of the dragline (if any) and shovel (if any) within that block. Maximum instantaneous charge (MIC) for each blast was calculated from the required level of overburden removal for that location. Blast locations and MIC values were based on the proposed mine plan.

The above data allowed overpressure and peak particle vibration velocity to be predicted at any location around the mine. Initial calculations indicated that the most-affected residential location outside the identified area of noise impact would be to the south-west of Kayuga, and data presented below are for that location. In addition, predicted levels of airblast overpressure are closer to the relevant criterion than the corresponding values of ground vibration and hence only data for overpressure are presented.

Tables C.5.1 and *C.5.2* show:

- the predicted distance from each blast location to the above residence;
- the maximum predicted MIC for any blast in the relevant year at the blast location; and
- the predicted maximum overpressure level due to such a blast, using the three-mines predictive equation for each year of operation, working block and blast location within the block.

Figure C.5.1 summarises these results in terms of the maximum predicted blast overpressure for any year, at the selected residence. The figure also shows the results of alternative calculations using the two-mines predictive equation.

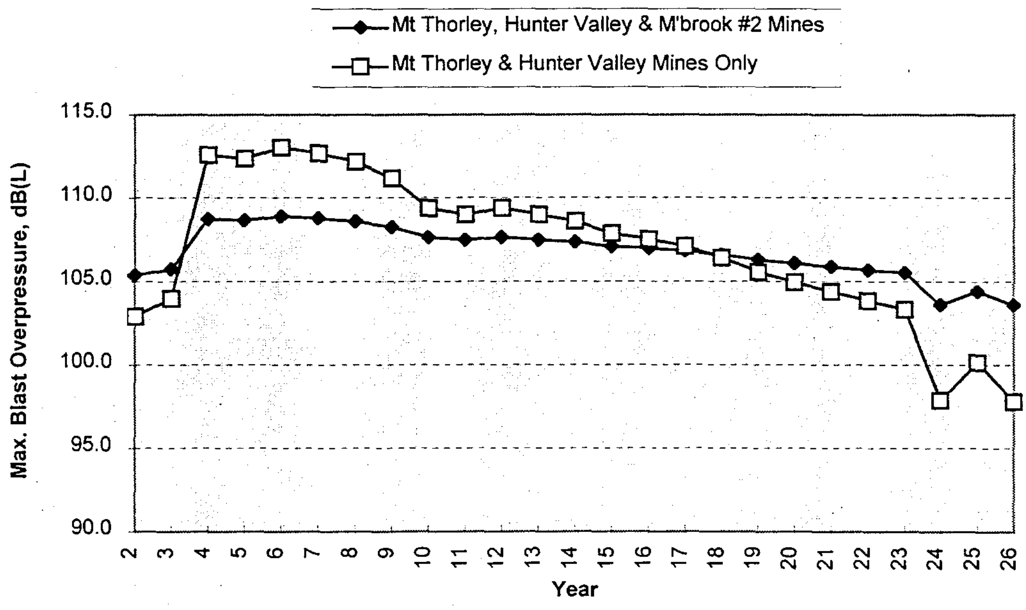


Figure C.5.1 CALCULATED MAXIMUM BLAST OVERPRESSURE IN ANY YEAR, AT MOST-AFFECTED RESIDENCE

Figure C.5.1 indicates that predicted blast overpressure levels are below the criterion of 115 dB(L) at all times using either of the two derived predictive equations. In addition, higher blasting levels are not predicted to be reached until year 4 of the project, allowing time for site measurements to confirm the accuracy of the predictive equations and for site-specific blasting techniques to be developed to limit noise generation. At other potentially-affected residences maximum blast levels are reached at a much later stage.

As noted in the EIS, the above predictions are based on mean values of measured blast overpressure rather than 95th percentile values. This means that good blasting techniques and practices will need to be employed to ensure that the higher levels of blast noise sometimes generated at other mines are avoided.

Table C.5.1 CALCULATION OF OVERPRESSURE LEVELS FROM BLASTING - THREE-MINES EQUATION, YEARS 2 - 14

Block	Location		2	3	4	5	6	7	8	9	10	11	12	13	14
1	Drag-Line	Distance, m					1560	1695	1763	1899	2242	2311	2242	2311	2379
		MIC, kg					1985	2352	2352	2352	2579	2579	2579	2579	2579
		O/pressure, dB(L)					108.9	108.8	108.6	108.3	107.6	107.5	107.6	107.5	107.4
	Shovel	Distance, m			1190	1426	1968	1968	2242	2379	2448	2586	2725		3071
		MIC, kg			797	1300	545	545	1274	2143	2375	1479	1113		1116
		O/pressure, dB(L)			108.7	108.7	105.9	105.9	106.6	107.1	107.1	106.1	105.5		104.9
2	Drag-Line	Distance, m					1930	1980	2031	2136	2474	2359	2474	2533	2592
		MIC, kg					2352	2352	2352	2352	2579	2352	2579	2579	2579
		O/pressure, dB(L)					108.2	108.1	108.0	107.7	107.2	107.3	107.2	107.1	107.0
	Shovel	Distance, m			1758	1834	2246	2302	2359	2533	2713	2774	2959		3021
		MIC, kg			879	1931	654	862	888	574	846	1029	1842		2189
		O/pressure, dB(L)			107.1	108.1	105.5	105.8	105.8	104.8	105.0	105.2	105.8		106.0
3	Drag-Line	Distance, m					2465	2532	2607	2686	2905	2953	2905	2953	3000
		MIC, kg					2352	2352	2352	2352	2579	2579	2579	2579	2579
		O/pressure, dB(L)					107.1	106.9	106.8	106.7	106.4	106.4	106.4	106.4	106.3
	Shovel	Distance, m	2351	2357	2291	2433	2728	2815	2859	2953	3099	3201	3304		3467
		MIC, kg	681	873	810	2304	1484	1808	1812	1669	734	1032	1059		1127
		O/pressure, dB(L)	105.4	105.7	105.8	107.1	105.9	106.0	106.0	105.7	104.2	104.6	104.5		104.4
4	Drag-Line	Distance, m					3098	3178	3207	3269	3444	3483	3444	3483	3563
		MIC, kg					1542	2151	2352	2352	2579	2579	2579	2579	2579
		O/pressure, dB(L)					105.4	105.8	105.8	105.8	105.7	105.6	105.7	105.6	105.5

Table C.5.1 CALCULATION OF OVERPRESSURE LEVELS FROM BLASTING - THREE-MINES EQUATION, YEARS 2 - 14

Block	Location		2	3	4	5	6	7	8	9	10	11	12	13	14
	Shovel	Distance, m	2693	2742	3075	3075	3269	3336	3444	3604	3604	3688	3962	4010	4364
		MIC, kg	696	646	1080	1080	1871	1439	1548	2641	2641	2581	2433	2617	1382
		O/pressure, dB(L)	104.8	104.6	104.8	104.8	105.4	104.9	104.9	105.5	105.5	105.3	104.9	105.0	103.6
5	Drag-Line	Distance, m							3644	3646	3648	3652	3657	3652	3661
		MIC, kg							359	632	796	880	907	260	892
		O/pressure, dB(L)							102.4	103.2	103.6	103.7	103.8	101.9	103.8
	Shovel	Distance, m			3776	3644	3644	3652	3652	3668		3675	3675	3694	3704
		MIC, kg			699	761	761	764	764	619		915	260	1442	660
		O/pressure, dB(L)			103.2	103.5	103.5	103.5	103.5	103.2		103.8	101.8	104.4	103.2
6	Drag-Line	Distance, m					4124	4143	4159	4178	4196	4348	4348	4348	4348
		MIC, kg					114	131	197	198	190	787	861	20	118
		O/pressure, dB(L)					100.0	100.2	100.8	100.8	100.7	102.8	102.9	97.1	99.9
	Shovel	Distance, m	4479	4563	4581	4124	4178	4239		4350			4357		4366
		MIC, kg	1264	1101	1079	748	590	635		529			657		550
		O/pressure, dB(L)	103.4	103.1	103.0	102.9	102.5	102.6		102.2			102.5		102.2
7	Drag-Line	Distance, m								5076		5023		5023	5039
		MIC, kg								605		719		204	134
		O/pressure, dB(L)								101.7		102.0		100.0	99.4
	Shovel	Distance, m		5201					5029	5039	5039	5036	5036		5046
		MIC, kg		697					543	635	635	553	553		585
		O/pressure, dB(L)		101.8					101.5	101.8	101.8	101.5	101.5		101.6

Table C.5.1 CALCULATION OF OVERPRESSURE LEVELS FROM BLASTING - THREE-MINES EQUATION, YEARS 2 - 14

Block	Location		2	3	4	5	6	7	8	9	10	11	12	13	14
8	Drag-Line	Distance, m													
		MIC, kg													
		O/pressure, dB(L)													
	Shovel	Distance, m								5890		5779	5782	5786	
		MIC, kg								561		630	803	969	
		O/pressure, dB(L)								100.9		101.1	101.5	101.8	

Table C.5.2 CALCULATION OF OVERPRESSURE LEVELS FROM BLASTING - THREE-MINES EQUATION, YEARS 15 - 26

Block	Location		15	16	17	18	19	20	21	22	23	24	25	26
1	Drag-Line	Distance, m	2517	2586	2725	2863	3002	3140	3279	3417	3555			
		MIC, kg	2579	2579	2744	2720	2579	2579	2579	2579	2579			
		O/pressure, dB(L)	107.1	107.0	106.8	106.6	106.3	106.1	105.9	105.7	105.5			
	Shovel	Distance, m	3209	3348	3417	3763	3625							
		MIC, kg	1419	2007	2457	1905	1213							
		O/pressure, dB(L)	105.1	105.4	105.6	104.8	104.3							
2	Drag-Line	Distance, m	2652	2774	2897	2959	3084	3211	3339	3597	3662			
		MIC, kg	2579	2697	2668	2700	2579	2579	2579	2733	2579			
		O/pressure, dB(L)	106.9	106.7	106.5	106.4	106.2	106.0	105.8	105.6	105.4			
	Shovel	Distance, m	3339	3467	3727	3859	3662							
		MIC, kg	1463	1487	2350	1528	1329							
		O/pressure, dB(L)	104.9	104.8	105.2	104.3	104.4							
3	Drag-Line	Distance, m	3099	3149	3252	3359	3467	3577	3690					
		MIC, kg	2579	2579	2579	2579	2579	2579	2579					
		O/pressure, dB(L)	106.1	106.1	105.9	105.8	105.6	105.5	105.3					
	Shovel	Distance, m	3748	3863		4160	4160							
		MIC, kg	2503	2669		1788	1788							
		O/pressure, dB(L)	105.2	105.2		104.2	104.2							

Table C.5.2 CALCULATION OF OVERPRESSURE LEVELS FROM BLASTING - THREE-MINES EQUATION, YEARS 15 - 26

Block	Location		15	16	17	18	19	20	21	22	23	24	25	26
4	Drag-Line	Distance, m	3604	3645	3732	3203								
		MIC, kg	2579	2579	2579	893								
		O/pressure, dB(L)	105.5	105.4	105.3	104.4								
	Shovel	Distance, m												
		MIC, kg												
		O/pressure, dB(L)												
5	Drag-Line	Distance, m	3668	3675	3675	3684	3684	3694	3704	3716	3728	3756	3799	3815
		MIC, kg	882	882	882	852	888	909	905	903	901	882	864	866
		O/pressure, dB(L)	103.7	103.7	103.7	103.7	103.7	103.7	103.7	103.7	103.7	103.6	103.5	103.5157
	Shovel	Distance, m	3716	3728	3728	3741	3756	3786	3848	3831	3866	3885	3885	3925
		MIC, kg	623	380	245	591	763	961	1392	719	1580	804	1636	991
		O/pressure, dB(L)	103.1	102.4	101.7	103.0	103.4	103.7	104.2	103.2	104.4	103.3	104.4	103.5913
6	Drag-Line	Distance, m	4350	4348	4354	4357	4362	4366	4373	4380	4387	4405	4428	4452
		MIC, kg	320	124	765	1006	1103	1045	935	874	743	412	380	599
		O/pressure, dB(L)	101.4	99.9	102.7	103.1	103.3	103.2	103.0	102.9	102.6	101.7	101.6	102.2387
	Shovel	Distance, m		4373	4380		4397	4416	4428	4452	4465	4479	4494	4527
		MIC, kg		633	764		1213	785	886	1494	835	867	1224	961
		O/pressure, dB(L)		102.4	102.7		103.4	102.7	102.9	103.6	102.7	102.8	103.3	102.8871
7	Drag-Line	Distance, m	5041	5039	5037	5036	5041	5046	5053	5061	5068	5086	5106	5131
		MIC, kg	249	235	369	568	669	732	783	827	824	697	590	418
		O/pressure, dB(L)	100.3	100.2	100.9	101.6	101.8	102.0	102.1	102.1	102.1	101.9	101.6	101.0334

Table C.5.2 CALCULATION OF OVERPRESSURE LEVELS FROM BLASTING - THREE-MINES EQUATION, YEARS 15 - 26

Block	Location		15	16	17	18	19	20	21	22	23	24	25	26
	Shovel	Distance, m			5053		5077	5118	5131	5131	5157	5171	5171	
		MIC, kg			574		785	551	555	240	536	679	227	
		O/pressure, dB(L)			101.6		102.0	101.5	101.5	100.2	101.4	101.7	100.1	
8	Drag-Line	Distance, m	5890	5972	5890	5779	5782	5786	5790	5796	5801	5824	5847	5874
		MIC, kg	145	25	236	283	327	384	425	429	411	394	399	415
		O/pressure, dB(L)	98.8	96.0	99.5	99.9	100.1	100.3	100.5	100.5	100.4	100.4	100.4	100.3997
	Shovel	Distance, m	5796	5796		5801	5809	5824	5847	5861	5905	5890	5939	5939
		MIC, kg	1261	1261		533	569	1147	1379	1318	712	1100	907	1072
		O/pressure, dB(L)	102.2	102.2		100.8	100.9	102.0	102.3	102.2	101.2	101.9	101.5	101.8051

Appendix D

HERITAGE

D1 NPWS SUBMISSION

MT PLEASANT EIS ABORIGINAL HERITAGE ASSESSMENT- GENERAL COMMENTS

The three reports on surveys for the Mt Pleasant area have been reviewed and copies are attached.

The reviews have identified the following issues which need to be addressed before it is possible to assess the significance of the archaeological evidence across the Mt Pleasant lease area.

- the EIS suggests (10.26) that the management recommendations have incorporated the views of both the Wonnarua Tribal Council and Wanaruah LALC. However, the letter from the Wonnarua Tribal Council have stated that they will not support a consent to destroy for any sites in the lease area. This would appear to be contradictory and needs to be resolved.
- the information from the three reports has not been integrated to provide an overall assessment of the sites and areas of archaeological potential for the whole lease area.
- the assessment of the sites as being of low significance is not supported and the reasons for this are highlighted in the reviews.
- a conservation/protection strategy has not been defined for the lease area on the basis of clearly defined criteria.

The reviews set out the issues that need to be addressed either through more detailed reporting or the interpretation of the data. On the current level of information it is not possible to support the conclusions of the EIS that "the Mount Pleasant Authorisation does not contain a substantial archaeological resource".

(66)

1.Introduction
Describes nature of impact, scope of work and objectives.

The section on Aboriginal consultation states that representatives of the Wanaruah LALC and Wonnarua Tribal Council were included in the survey and that the recommendations in the report incorporate the views of these groups. The letter from the WTC does not suggest that their recommendations have incorporated.

2. Environmental Context
Very general description of soils, vegetation and past impacts. These impacts are not described in sufficient detail. It is not possible to identify areas which have not been impacted on, and the effects of any such impacts on sites or archaeological potential, in those areas where impacts have occurred. This information needs to be mapped.

Erosion is mentioned, but not quantified in any way to provide a basis for assessing effective conditions for site detection. This information needs to be tabulated and mapped.

Three landform units are identified and mapped. It would have been useful to provide an area calculation for each to establish their relative areas. This information would have been helpful in analysing trends across the different landform units and catchments.

3. Archaeological Context
The model of site distribution is a very simplistic one and other archaeological investigations in the Hunter Valley has shown that artefacts numbers alone do provide an adequate indication of assemblage variation across the landscape. This is touched on in the section describing the results of the Bengalla survey where it was suggested that different types of artefacts or assemblages were associated with different landform units.

A summary description of the chronology of occupation in the Hunter Valley is presented. An omission is the Late Pleistocene open site at Glennies creek, north of Singleton which indicates older occupation than the suggested 5,000 years. The omission of this evidence means that older assemblages are not considered.

The point is made that dating of open sites is problematic, however, previous work has proposed a model of technological change which may be useful for dating. Also other cultural features such as hearths have been dated in a number of locations and they also provide a useful means of dating open sites.

There is no indication how the general information (sections 3.2) relates to the present study area, especially in terms of the chronology (for example: are there deposits which could contain older assemblages (than 5,000 years).

The background review does not synthesise the information available from the region to develop predictive models pertinent to the present study area, beyond the prediction that open artefact scatters will occur.

4. Field Investigation

It is suggested that sample survey units were inspected. It is unclear where these units are located (not mapped) and how much of each landform unit these samples represented. It is stated that a number of transects were inspected. It is unclear how these two different survey methods relate to each other. It is unclear how these two survey methods lead to an 80% coverage of the study area.

The survey coverage data needs to be presented in such a way that it is possible to see how coverage estimates have been arrived at. The different levels of exposure (and visibility) are best mapped.

The results indicate that artefacts were located in 90 locations across the study area. A "site" category "possible scarred tree" is included. This category is not helpful for determining the range of Aboriginal activities represented. It is the responsibility of the consultant to determine whether a tree is a "scarred tree" of Aboriginal origin or not.

Table 4.1. presents a number of characteristics of the sites recorded. Detailed site description s are not included in the report. Such descriptions need to be included in survey reports. The characteristics listed are useful, however, it is unclear what the percentage figures in columns 6 and 7 relate to or what they mean. It is not possible to assess whether the greater number of artefacts at some sites for example site 44 is purely a function of exposure or is in fact an indication of more intensive artefact reduction or occupation frequency. More detailed site recordings would have assisted in getting a better picture of the amount and nature of the exposure at each of the find locations. Data on the area of exposure, area of visibility (by giving length and breath measurements as well as area) also needs to be included in the tabulated data.

The results of the survey are presented in terms of the number of find locations across the landscape and the density of artefacts in each landform unit. These data are not interpreted and because there is no discussion of exposure on the landsurfaces within each of the landform units it is not possible to assess how representative these data are.

The analysis includes a tabulation of the types of raw materials represented and how certain artefact types recorded were represented in the landform units. These data need to be interpreted.

A glossary of terms is included in the report. Some of the definitions are confusing: For example: "Hammerstone" the text does not define this object; "knapping floor" remains unclear because a knapping event has not been defined; "backed blade" this text includes terms that are not defined (microlith, scraper, Bondi point), therefore the object is not defined.

Some terms are not included in the glossary: eg: pebble tool.

In Tables 4.6 to 4.8 there is a category referred to as P=other piece . This is not defined or explained.

The section titled "reduction sequence indicators" does not discuss reduction sequences. It includes a listing of the artefacts identified as having been retouched or used. The analysis suggest that most of these artefacts were located in the "gullies", however, from Table 4.11 it is evident that the highest proportion of such artefacts were in fact located in ridgetop contexts. The percentage of artefacts with cortex and the size ranges of the artefacts are presented for each raw material.

Table 4.12 presents the proportion of artefacts with cortex for each raw material. It is not clear that the percentage figures are for the retouched used artefacts. The proportion of artefacts with cortex per raw material is very different from that indicated in table 4.12 (eg silcrete = 2.5%; mudstone=11%) and gives a very different indication of which raw materials were associated with cortex. Similarly with table 4.13. It is especially confusing because there is a change to the assemblage included in Table 4.14., (the total number of artefacts recorded). It is unclear why this attribute is being described and no interpretation of the results is presented.

There is a discussion section (4.8), which presents a summary of the results presented in previous sections, however, there is no analysis of the assemblages recovered.

There is no analysis of the results within the context of regional models.

It is proposed that the "pattern of occupation" (p.4.28) is different in the study area to that identified in the survey area looked at by Rich. However, because the exposure and visibility data is not presented in any detail and not incorporated into the analysis of the results, this conclusion is not supported.

5. Significance Assessment

This section needs to set out the criteria or attributes on the basis of which an assessment can be undertaken. The lack of comparative analysis within the regional context is a problem for developing such a set of criteria. Table 5.1 presents the "significance rating " for each site but it is not possible to see how these ratings were arrived at (ie by what measure). For example:

- how is *"research potential"* identified: it is not clear what "state of preservation" and "nature" mean (p.5.3). The basis for defining research potential needs to be clearly explicated.
- *"rarity":* on the basis of what criteria is this defined (what is rare and why/how does this reflect models of occupation patterns). In the table only one rating is given, but in the paragraph above, it is stated that local, regional and State levels will be evaluated. This does not appear to have been done.
- *"representativeness":* how is this assessed. There are a number of aspects to this concept which have not been discussed in the report. What attributes are being used to arrive at the rating for each site and how do these reflect regional models. On what basis are sites classed as NOT being representative.
- *density and size:* why are these two criteria grouped together, and what attributes are used to arrive at the assessment of "NO".

Comparative statements are made (p5.7) that the sites in the study area are "typical" of sites in the region. However, as there has been regional comparative data set out against which to compare the data for the study area this conclusion is not supported. "Typical" is not defined.

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In the end the main criterion for assessing significance appears to be artefact density. Because the data on exposure extent and type for each site is not available it is not possible to determine to what degree artefact density is indicative. The report does not present an argument or validation that artefact density is an adequate indicator of site significance.

6. Impacts and Safeguards
In this section those sites not effected by impacts are listed.

The results of the present study are not integrated with the results from the first survey area (Rich). No conservation strategy for the total lease area is discussed or conservation options proposed for the Mt Pleasant area as a whole. While some areas are identified as being excluded from impact it is not clear that these areas may contain the most significant suite of sites representative of this general area.

The areas of archaeological potential are not assessed and not included in the recommendations.

SURVEY OF THE NORTH-WESTERN EMPLACEMENT AREA

This report does not assess the sites and the same comments as for the previous report apply. There is no analysis, interpretation or tabulation of the data. The recommendations are not supported.

COPY SENT 30/4/97

Elizabeth White
28 Cavell Road
Rhodes
NSW 2138

30/4/97

Dear Ms White,

RE: REVIEW OF SURVEY REPORT FOR MT PLEASANT COAL LEASE

NPWS received the report "Mt Pleasant Coal Lease, near Muswellbrook, NSW: archaeological survey for Aboriginal sites" 1995 in January 1997. This report has now been reviewed and a copy of that review is attached.

The review identifies a number of major issues that need to be addressed:

- The assessment of the archaeological evidence as being of low significance is not supported by the data presented. Because the survey data is inconclusive, the archaeological evidence present across the lease area has not been assessed. A strategy needs to be developed which addresses this problem in the context of the possible management options available (for example conservation, further investigation).
- The regional overview needs to be more fully interpreted to provide a basis for the development of predictive models that are pertinent to the development of a survey strategy (eg. the size, distribution, locations and total extent of sample(s)).
- Landforms not included in the survey need to be more fully assessed (there is a very clear bias towards "gullies" and the proportion of ridgetops and slopes are very much underrepresented in the sample of land surface surveyed).
- The degree of disturbance needs to be more fully documented. The criteria on the basis of which ploughing has been clearly identified need to be provided and the actual disturbance of archaeological material evaluated. Ploughing alone (ie without an idea of frequency, type) may not have seriously compromised the archaeological evidence.
- The development of different management options needs to be set out within a framework of the regional archaeological models, possible conservation outcomes, and the views of the Aboriginal community.

If you have any queries please contact Margrit Koettig on (02) 9585 6922.

Yours sincerely

Katharine Sale
Acting Manager Cultural Heritage Unit
Sydney Zone

cc Coal & Allied Pty Ltd
ERM Mitchell McCotter
Wonnarua Tribal Council
Wannaruah LALC

REPORT REVIEW: ARCHAEOLOGICAL SURVEY OF THE MT PLEASANT COAL LEASE, BETH RICH 1995

General Comments

The report on the survey of the Mt Pleasant Lease area is reviewed below. The general presentation of data is clear and generally easy to follow. Site descriptions and tabulation of data are also well presented. Mapping of the results is on the whole very good and supplements the presentation of data.

However, while mindful of the limitations of the data set the author proceeds to assess the archaeological material within the lease area as being of low significance, and this is not supported by the data presented.

The review has identified a number of basic problems with the data set and the conclusions derived from that information. The major limitation for assessment is that there is insufficient information available on variation of assemblages and site structure across the lease area. The author suggests that there is some indication of variation across the lease area, but this is not adequately supported so that an assessment of the archaeological evidence is not possible. The specific comments throughout the review highlight the specific problems.

The Aboriginal community has not included their assessment of the cultural values for the area and these are significant to any assessment of the area and any possible management options to be considered.

Specific Comments on the Report

1. Introduction

This section provides a brief overview of the project, its extent, type and extent of survey undertake, a summary of the results and the recommendations. Good maps are provided of the location of the lease area, the location of recorded sites and the extent of the proposed impacts.

2. Archaeological Context

Local Area

Very brief overview of the results of previous surveys in adjacent areas to Mt Pleasant, particularly the survey undertaken at Bengalla (primarily in terms of raw materials used and where sites were recorded in the landscape).

Regional Context

This section presents a very brief summary of a selection of results of some previous work undertaken in the Hunter Valley (site distribution, stone reduction, site function and age, are the general topics listed). There is no discussion or interpret this information with the view to identifying issues that should be addressed within the context of the present survey.

A glossary would have been useful.

3. Methods
This section describes the following: that there were two survey teams: how long the survey took; the types of recording procedures used. There is no rationale (ie in terms of sampling strategy, targeting certain locations etc) presented for the adoption of any particular type of survey methodology. In section 1.2 reference is made to an "even spread survey" but this is not defined or described. There is no rationale presented for the division of the landscape into catchments.

Map 4 is useful for illustrating the survey transects and it is evident that there is a very heavy bias towards the inclusion of creek flats in the survey and that the slopes and ridgetops have been poorly sampled.

Aboriginal consultation is included in this section. The Wanaruah LALC and Wonnarua Tribal Council were consulted for the project and reports have been included in the report. Both groups have given in principle support to the development.

4. Environment
The study area has been divided into a number of catchment areas with the view to *"assist with the analysis of archaeological variation across the lease"* (p.17).

Five land units have been identified and they are mapped (Map 5). The rationale for this system of division is not presented, though each of the units is described. It is unclear why all watercourses are included as the one category (gullies) when they obviously vary considerably in their geomorphic context. It is also unclear why the hillslopes and ridges (71% of the study area) have been grouped together as one land unit class, when they are likely to have very different archaeological content.

Ground surface exposure is estimated to be 1.3% for the entire study area. Map 6 shows the distribution of exposures, and it appears that some creeks within specific catchments provide good exposure and others much less (eg:catchment A has more exposure than catchment I) but it is difficult to interpret this information in a meaningful way.

It is stated that ploughing has disturbed *"most of the lease* (p.21). The basis of this is air photo interpretation and ground inspection. This requires further documentation. The survey did not cover large tracts of land, so the extent of ploughing would be very difficult to determine for those areas not inspected. Air photos may indicate where ploughing has taken place if they happen to have been taken at the time when such activity was evident. The areas identified on Map 7 as "relatively undisturbed" appear to be very odd shapes, not consistent with how ploughing patterns are usually made . It is unclear what "relatively" disturbed means and thus the implication of this evaluation for the archaeological evidence.

5. Sampling the Landscape

This section is a description of the results of the survey. No rationale is presented for the sampling procedure used, nor are the sampling biases taken into consideration when comparing data sets. For example: statements are made about the relative density of artefacts in the different catchments (p.24). Table 2 presents information about the extent of each catchment, the extent of exposures and the average density of artefacts per hectare. There is no allowance made for the very different sampling frequency within each catchment. It appears that the percentage figures given are for the whole catchment, when in fact only for specific locations (usually creek flats) within and differential proportions of each catchment were surveyed (sampled). Thus the percentage figure for "exposure" is in fact the percentage of ground covered by survey, not land surface within a catchment.

It is also not clear why a selection of land units and other categories not previous defined within the landscape division being proposed (Hunter R flats/Watersheds/West of Mt PL) are included as separate classes and are not included in the catchments within which they fall. And conversely why the other land units are not included.

Table 3 (same comments as for Table 2).

It is suggested that (p.25) because 16+>17 hectares of ground was exposed within each of the land units hillslopes/ridgetops and gullies, that the results are comparable. However, 16/17 hectares of hillslopes and ridgetops represents very a different proportion than 16/17 hectares of gullies (see Table 4). Thus, to what degree the density of artefacts in the area of exposure can be considered to be representative of density in all portions of that land unit is questionable. If the density were to be considered "representative" then there are more (projected) artefacts in the slope/ridge class than in the gullies class (34918 in the former and 27940 in the latter). Because the slopes and ridgetops are amalgamated it is not possible to ascertain which of these landforms is associated with more artefacts. Regional models suggest that ridges are more likely to have been the focus of Aboriginal activity than slopes.

The author suggests that artefacts density should be taken as indicative only (p.27) and that the reported variations in artefact density are not particularly meaningful.

The Tables 6-8 present information about exposure. It si unclear how these figures are arrived at, as there appears to be no allowance made for the fact that each of the land units and catchments were not fully surveyed. It appears that the calculations (for example, % of unit exposed) are for the whole land unit, when they should be for the actual area surveyed. If estimates are derived from the survey data then they should be distinguished from the results derived from the actual surveys areas.

In the conclusion the author suggest that the confluences AB and IJ had higher artefact densities than "other catchments" (p.29 and 30). There are problems inherent with this conclusion.

- these small areas are NOT catchments, they are a sub-category of the catchment classification, (they are classed as confluence areas).
- if other sub-sets of sites are grouped (on the basis of confluence or even just on the basis of clusters) and artefact numbers amalgamated they include comparable artefact numbers to those in the areas defined as being of "high density". The artefact densities were not calculated for these examples (below), but artefacts from sites in areas of roughly similar size were grouped together. They are from very different parts of the creek in each catchment where they fall. For example:

  1) minor confluence AB = 18
  2) major confluence IJ = 170

  3) minor confluence I = 74
  4) middle?reaches/tributary B2,33-39 = 86
  5) upper reaches/tributary B23-29 = 58
  6) upper reaches/tributary C14-33 = 34
  7) upper reaches/tributary F5-14= 26

  Without calculating the actual exposure figures it is a little difficult to determine whether the artefact numbers (above) represent similar densities to those calculated for AB and IJ. However, from the above it is possible to see that AB represents a very small number of artefacts, smaller than groups of sites from a variety of other locations from similar sized areas (though possibly not levels of exposures). From the generalised exposure data (Table 2) it would appear that along tributary B is 0.8% and along I it is 0.9%. Thus for this example it can be assumed that the above sample groups (3, 4 and 5) are from areas of similar exposure. It does appear that area IJ may represent a relatively higher concentration of artefacts. However, without the same level of analysis of the exposure data for other locations of comparable size along each creek system, it is not possible to say that it is the only one and that other parts of each catchment system might not also contain such concentrations. The above rough calculations also suggests that that confluences are not the only portions of the creek systems which could be locations for artefact concentrations. The above example illustrates that it is essential to compare comparable data sets when assessing the results.

- artefact density was lower on hillslopes and ridges. This conclusions is not supported (see previous comments on sampling frequency).

6. Artefact Analysis

The artefacts are described as being from two "groups" (p.31. No clear explanation is presented for this grouping other than differentiation on the basis of size and to some extent raw material (except that all raw materials represented in the second group are included in the first group).

A general summary of the types of artefacts recorded during the survey is presented (total of 1385). There is a reiteration of the results describing density of artefacts presented in previous section. It is concluded that different catchments contained different artefact densities, but this not supported (see comments above) It is proposed that "knapping events" are present in catchments A, C and E. There is no discussion of what these features are or how they have been identified.

The author concludes that the overall low artefact density (especially close to the Hunter River) could reflect past agricultural activity. Considering the inherently unreliable nature of surface indications this appears an interesting conclusion. Similar landscapes in other parts of the Hunter Valley Lowlands have been associated with much larger amounts of archaeological evidence and the frequency of artefacts within the Mt Pleasant lease appears to be anomalous.

The low numbers of artefacts requires further investigation and explanation. The photos indicate that much of the gully erosion was characterised by steep, straight sides. While this has been classed as "gully erosion" it is not necessarily a form of erosion that will reveal artefacts. The proportion of sheet wash and track (Table 4) along the "gullies" land unit is in fact quite small, only 10% of all types of exposures in all areas surveyed. There needs to be a greater evaluation of the relationship between exposure and the potential for the exposure to reveal artefacts.

The artefacts are described according to raw materials and types. There is a discussion on the relationship between raw material sourcing of silcrete and artefact size. While the data present indicates that there is no clear relationship between the proposed source of this material at Bengalla, it is concluded that the sample size is too small for a meaningful analysis.

There is a short discussion on the age of the archaeological evidence (p.41) within the lease area. No conclusion is reached about when occupation commenced (on the basis of the types of artefacts recorded). There is no geomorphic analysis of the lease area to identify potential areas for stratified deposits such as valley infill or alluvial deposits or terraces.

In conclusion it is suggested that any interpretations must be seen as being inconclusive because of the limitations on the visible archaeological record (limited exposure).

Map 8 is an excellent representation of the recorded artefacts numbers to show possible patterning of the evidence. It would have been very useful to present this information in conjunction with a mapping of the exposure data and the survey transects to illustrate the relationship between exposure and artefact density.

*7. **Statement of Significance***
Archaeological Significance
The author concludes that

"Mt Pleasant does not contain a substantial archaeological resource".

This conclusion is **not** supported by the data presented. The author states that 98.8% of the lease area has not been effectively surveyed (p.45). It is not clear how this conclusion could be reached on the basis of the previous discussions which have clearly highlighted the limitations on the survey.

The archaeological evidence within the lease area has not been adequately assessed.

Aboriginal Significance
The Aboriginal community have not yet provided a statement of cultural values for the lease area.

Potential for Public Interpretation
No criteria are set out on the basis of which this would be assessed.

8. Development Impact and Archaeological Salvage
The development would impact on approximately 75% of the area within the lease. A general salvage program is suggested for sites within the impact area. Because the archaeological evidence across the lease area has not be assessed it is not clear on what basis a salvage program is warranted or the scope of such work to be defined.

There is no discussion of other management options (than salvage) such as further investigations to more adequately assess the archaeological evidence within the lease area and conservation options. The requirement for salvage needs to be considered in the light of possible conservation outcomes.

9. Recommendations
These recommendations include the development of a plan of management, establishing Aboriginal values, avoidance of areas which have not been heavily disturbed by past land use practices, salvage of sites and mitigation works for sites close to impact areas.

No framework or strategy has been developed to structure these options.

D2 E. WHITE RESPONSE TO NPWS SUBMISSION

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ERM Mitchell McCotter Quality System
Reference: Alison No. 94099
23 MAY 1997
Verification record
Verification not required
Project Manager Date: 23/5/97

22nd May 1997

Ms Katharine Sale
Sydney Zone
National Parks and Wildlife Service
PO Box 1967, HURSTVILLE, NSW, 2220.

Dear Ms Sale,

Re: NPWS review of the Mt Pleasant survey report

Thankyou for your letter of 30th April 1997. I have read the review and specific comments on this are listed below. With regard to the issues raised in your letter I note that:

- Recorded archaeological evidence in the study area has been broadly assessed. There are likely to be problems inherent in any data set recorded during surface survey and the report discussed this (pages 45-46). In the context of this development, avenues for site protection formed the basis of the first three recommendations made and a recommendation for further archaeological investigation followed (page 54).

- There is much debate about how archaeology should proceed; the development of predictive models and their testing in field situations is only one way in which archaeology might be carried out (e.g. Bell 1994). In my view it is not NPWS's role to dictate archaeological practice. In this study the survey strategy was designed to maximise existing field opportunities for the detection of "relics" to which the NPW Act would apply.

- The analysis was based on the extent of exposures on which "relics" might have been found, not on the total land surface surveyed. In the majority of catchments the total extent of exposures on hillslopes and ridges exceeded the total extent of exposures along gullies. Additional survey may find previously undetected exposures but it is questionable whether they would add further vital information to the extensive survey coverage already achieved.

- As stated in the report ploughing was identified on the basis of air photo and ground inspection. I agree that the actual impact on the archaeology of ploughing, other land disturbance and natural soil processes, could vary considerably. Subsurface assessment may provide further information on the effects of disturbance; conjoining of recovered artefacts would be an aid here. Further archaeological investigations have been recommended in part to assess the effects of past land disturbance.

- The management options are likely to relate to whether the project gains development consent or not. The survey identified no archaeological sites, areas or landscapes demonstrably of sufficient significance to prevent the project proceeding. A series of recommendations were made in the report, in the event that the project does proceed. Both the Wanaruah Local Aboriginal Land Council, and the Wonnarua Tribal Council have presented their views.

The following comments refer to the NPWS review.

General comments - First page of the review.

The review has not demonstrated the problems claimed. Assemblage variation and its distribution was examined in section 6 and part 2 of the report.

Both the Wanaruah Local Aboriginal Land Council, and the Wonnarua Tribal Council made reports in relation to this study in the manner which they saw fit.

Specific comments

Archaeological context

- First page last sentence. The general topics listed provided a framework for discussing the results of the survey.
- Second page first paragraph. Definitions for artefact terms were provided on page 1 of Appendix D.

Methods

- Second page second paragraph. There were not two survey teams. There were three sub-teams, each having two people, the combination of which changed daily (page 15).
- Second page second paragraph. The survey was carried out so as to achieve an even spread (page 4), to ensure that all parts of the study area were visited; rather than adopting a restricted-area sampling approach which would have left parts of the area unvisited and potentially unassessed. This was achieved by visiting all catchments (Map 4). To maximise the discovery of artefacts ground exposures were targeted using maps and air photos (page 15).
- Second page third paragraph. Map 4 shows the location of transects, the locations of which were determined by the locations of exposures and access to them. The transects show uneven coverage because exposures were unevenly spread. Exposure data was analysed in section 5 of the report to examine potential biases in the data.

Environment

- Second page sixth paragraph. The land units were the same as those used for the Bengalla lease to the south (pages 18-19) to assist with comparability. They were based broadly on possible resource availability, particularly in relation to possible water sources and food plants favouring moist habitats. It was thought that the Hunter River and/or its alluvial flats may have had some different resources (e.g. different vegetation) so it, and land close to the flats (within 500m), were described as separate units.
- Second page sixth paragraph. All drainage lines were included in a single "gullies" unit, because water was potentially available along drainage lines. Geomorphic variation within this unit was not necessarily "obvious", except that the upper parts of catchments tended to be steeper than the lower parts of catchments. On the second page third paragraph of the review reference is made to "creek flats" (undefined); but flattish areas beside creeks were not extensive. The AB and IJ confluences, the lower reaches of catchments A and B, small parts of catchments C and E and the lower reaches of catchment I, could be described as having flatter areas near drainage lines (see plates in Appendix A). Apart from the Hunter flats, alluvium was very restricted (page 18); alluvial valley fills were not present. The relationship of the archaeology to gross changes in valley form were investigated in the analyses of catchments in Part 2 of the report.
- Second page sixth paragraph. Ridges and hillslopes were grouped as a single unit since their food and water resources are unlikely to have differed. The statement in the

review that the hillslopes and ridges "... are likely to have very different archaeological content ..." is unsupported by references to other data sets or studies carried out in the central lowlands. The data set recorded during the present survey (Appendices B and D) included only 11 artefacts on catchment watersheds (= ridges) (Appendix B13) being two cores, a flake and 8 other non-platform pieces of debitage. For the purposes of statistical comparison of ridge-top archaeology, this sample would not be particularly enlightening.

- Second page seventh paragraph. Hence the analyses of exposure data in section 5 of the report!

- Second page eighth paragraph. As stated on page 15, a series of air photos were examined for information on land use: 1953, 1982 and 1992; and the survey covered extensive tracts of land! "Relatively disturbed" areas were those which probably did not retain *in situ* archaeological evidence, as indicated by mixed or stripped soil profiles and surface ground disturbance. Relatively less disturbed areas were those which appeared to have more substantial A unit soils, did not appear to have been greatly disturbed and did not show evidence of ploughing or disturbance visible on air photos. The word "relative" was used as the effect on the archaeology of natural soil processes such as bioturbation and colluvial soil movements were not assessable during the survey. The approach taken in the report provided a general framework for considering ground disturbance, but it is acknowledged to be imperfect. This is reflected in the recommendations for further archaeological work which make reference to exploratory investigations, assessment of disturbance and geomorphological input (e.g. pages 65, 85-86, 90).

Sampling the landscape

- Third page second paragraph. The second sentence appears inexplicable, since section 5 is an analysis of sampling and possible sampling biases! As to the fifth sentence, uneven sampling was highlighted on page 24 of the report. With regard to Table 2, the column titled "% of catchment exposed" was the % of the catchment made up of ground exposures on which artefacts might have been found; i.e. it gives the total effective coverage for each catchment, not the % area surveyed (which would have included survey transects over ground surfaces with no ground visibility and on which artefacts could not be expected to have been found).

- Third page second paragraph, second last sentence. Data on exposure along gullies vs. hillslopes/ridges within each catchment was presented in Part 2 of the report. The data shows that more ground exposure was present along gullies in catchments A and B and the AB confluence, and in catchment I and the IJ confluence (pages 58, 63, 82). However, contrary to the reviewer's statement, more exposure was present on hillslopes/ridges than along gullies in catchments C, D, E, F, G, H and J (pages 67, 70, 72, 74, 76, 79, 87)!

- Third page third paragraph. On Table 2 the Hunter River flats were listed separately since they do not occur within any of the defined catchments. Watersheds were listed separately, since they are shared by more than one catchment. The ten hectares west of Mt Pleasant occurred in catchments other than those defined during the study, but had been excluded from the survey (within the authorisation, but outside the area of the study brief).

- Third page fourth paragraph. The comments made regarding Table 2 do not apply to Table 3.

- Third page fifth paragraph. At the scale of the survey, artefact density can be broadly compared between gullies and hillslopes/ridges. The reviewer referred to Table 4 as showing marked discrepancies between the proportion of exposure along gullies and on hillslopes/ridges; but Table 4 shows that the % area of exposure along gullies was similar to the % area of exposure on hillslopes (41% and 45% respectively)! One may forecast higher numbers of artefacts on hillslopes/ridges but calculated artefact density (i.e. number of artefacts per unit area of exposure) was greater along gullies.

- Third page fifth paragraph. The review makes reference to regional models but there are no references to support this statement. What regional models?

- Third page sixth paragraph. Yes, but the review appears to have taken this statement out of the context of the whole of the second and following paragraphs on page 27 of the report.

- Third page last paragraph. The presence of grass cover meant that ground surfaces on which artefacts may have occurred were not fully visible across the whole area, hence the analyses of ground exposures! The calculations are based on the total numbers of artefacts recorded divided by the total extent of ground exposures recorded, and presented as artefact density. Table 6 states "...(artefact density/ha of exposure; exposures summing to >100m^2 only). The data does not relate to "the whole land unit" but to areas of exposed/visible ground.

- Fourth page. Exposure data was presented in Appendix B of the report. It is clear that the artefact density - i.e. total number of artefacts per total area of exposure - varied and the IJ confluence had the highest artefact density. The data suggests that artefact density within the AB confluence may not be very high in this context.

NPWS area	Samples	My comments	Calculated density	
1. confluence	AB		78/ha	
2. confluence	IJ		**913**/ha	
3. confluence	I	what area?		
4. mid-reaches/tributary	B33-39	B2 is hillslope	494/ha	gully unit data only
5. upper reaches	B23-B26,B29	B27+B28 on hillslope	148/ha	gully unit data only
6. upper reaches	C14-C33	mix gullies & hillslopes	22/ha	
7. upper reaches	F5-F14		42/ha	

- Fourth page second last paragraph. The data clearly supports the finding that artefact density was lower on hillslopes and ridges than along gullies.

Artefact analysis

- Fourth page last paragraph. The assemblage was analysed initially on the basis of artefact size and artefact type, and variations in raw material use were identified. It was thought that this distinction might indicate something of a difference between larger chopping or hand-held tools and smaller finger-held or hafted tools like backed blades used for piercing/cutting/scraping/shaving tasks. This way of describing artefact assemblages (from a tool kit perspective) was exploratory.

- Fifth page first paragraph. For the term "knapping event" read "knapping floor".

- Fifth page second paragraph, especially the last sentence. The review gives no references to indicate comparable projects or data sets to support the conclusion that the Mt Pleasant area is anomalous. The only available data set which may be broadly comparable in terms of scale or land units (of which I am aware) is for the adjacent Bengalla survey area (Rich 1993). Artefact density on land units showed some variation (see over), but overall artefact density between the two areas was of a similar magnitude. By comparison exposure data collected for Narama (a smaller project area focussed on the valley of a major creek) was an order of magnitude higher at c.678/ha (10,308 surface artefacts on 15.1996ha of exposures - Rich 1992:46). The available evidence suggests that artefact density within the Mt Pleasant study area is low, and data from the adjoining Bengalla area suggests that this might be typical of the general locality - not anomalous as suggested by the NPWS review.

Land unit	Mt Pleasant	Bengalla	Narama
River flats	0/ha	2/ha	
Rise above flats	-	55/ha	
Gullies 0.5km	41/ha	33/ha	
Bluffs 0.5km	32/ha	4/ha	
Hillslopes and ridges	17/ha	7/ha	
AB & IJ conflunces	482/ha	-	
Gullies generally	55/ha	>85/ha	
Main creek	-	>787/ha	
Raw material source	-	>78/ha	
Total	**36/ha**	**>25/ha**	**678/ha**

- Fifth page third paragraph. The Mt Pleasant study analysed exposure and artefact density data in a way which, so far as I am aware, is unprecedented. With regard to cliffed erosion (steep, straight sides) I note that extensive exposures of this kind were present at Narama and these were sometimes 'littered' with artefacts.

- Fifth page fifth paragraph. Alluvium is extremely limited and no alluvial terraces were identified by the soils study for this project (see page 18 of the report). Stratified deposits are highly unlikely to be present.

- Fifth page sixth paragraph. There are limitations on the recorded data and these are discussed on pages 45 and 46, and with these limitations in mind further archaeological investigations were recommended.

- Fifth page seventh paragraph. Exposure data (Map 6) and survey transects (Map 4) were presented at the same scale as Map 8 and direct overlay (e.g. photocopying onto transparency) is possible. The report (section 5) presented a statistical analysis of the data.

- Fifth page last paragraph and top of sixth page. The NPWS review has not demonstrated that the conclusion is erroneous. The statement in the review that "*...The archaeological evidence within the lease area has not been adequately assessed...*" is not supported by this response to the NPWS review.

Development impact and archaeological salvage

- Sixth page. The basis for a salvage program is given (pages 50-51 and Map 9). Further archaeological work to further investigate the archaeology of the area is recommended - in the form of a salvage project. Conservation measures are the substance of the first three recommendations made (page 54).

References

Bell, A. 1994 Reconstructing prehistory: scientific method in archaeology Temple University Press, Philadelphia.

Rich, E. 1992 Narama salvage project, Lower Bayswater Creek, Hunter Valley, NSW. Vol.1: Overview. Report prepared by Brayshaw McDonald Pty Ltd for Envirosciences Pty Ltd and Narama Joint Venture.

Rich, E. 1993 Proposed Bengalla Coal Mine, Muswellbrook, NSW: archaeological survey for Aboriginal sites. Report prepared for Envirosciences and Bengalla Joint Venture.

White, E. 1997 Bengalla Aboriginal sites management plan. Prepared for the Bengalla Mining Company.

Yours sincerely,

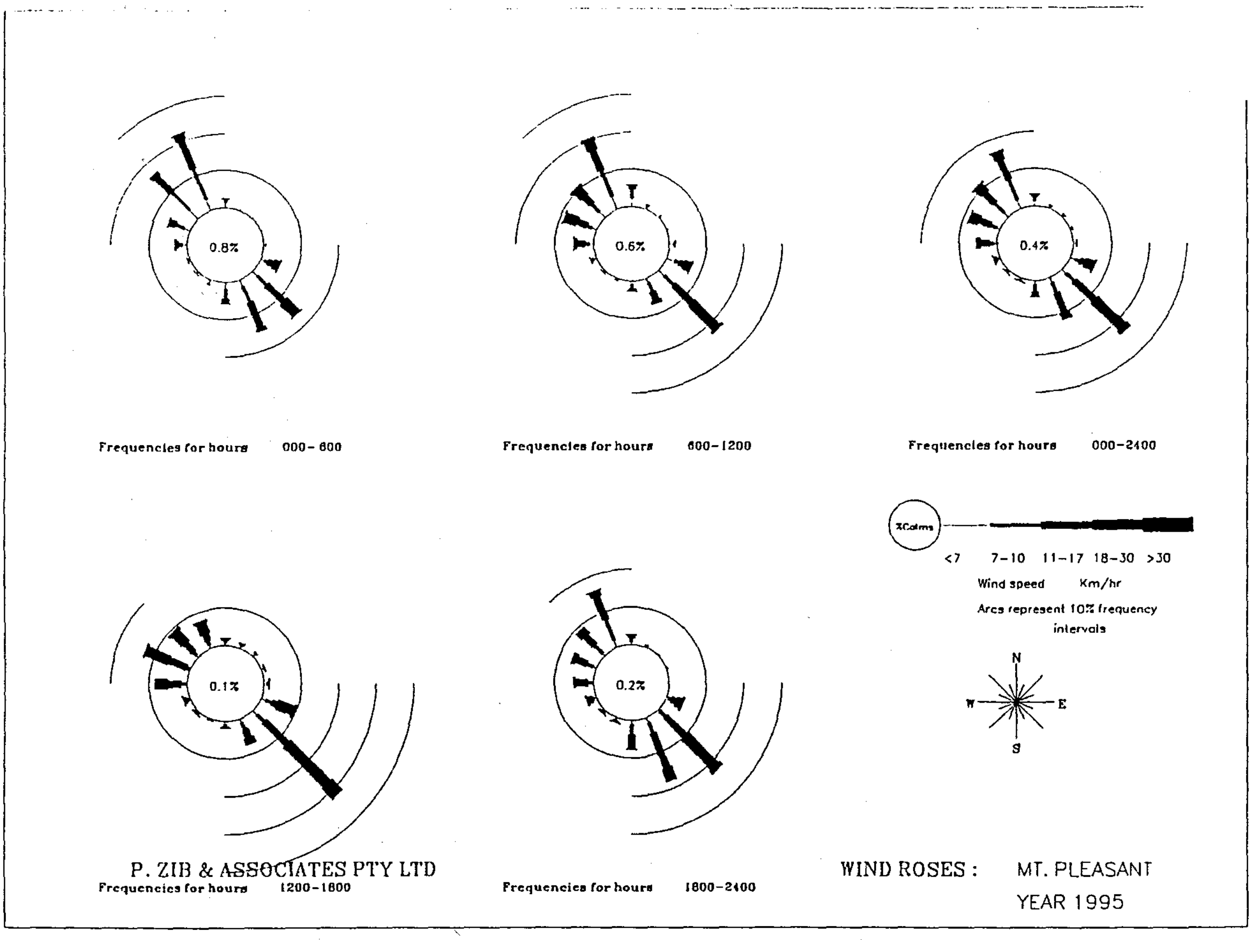
Elizabeth J White

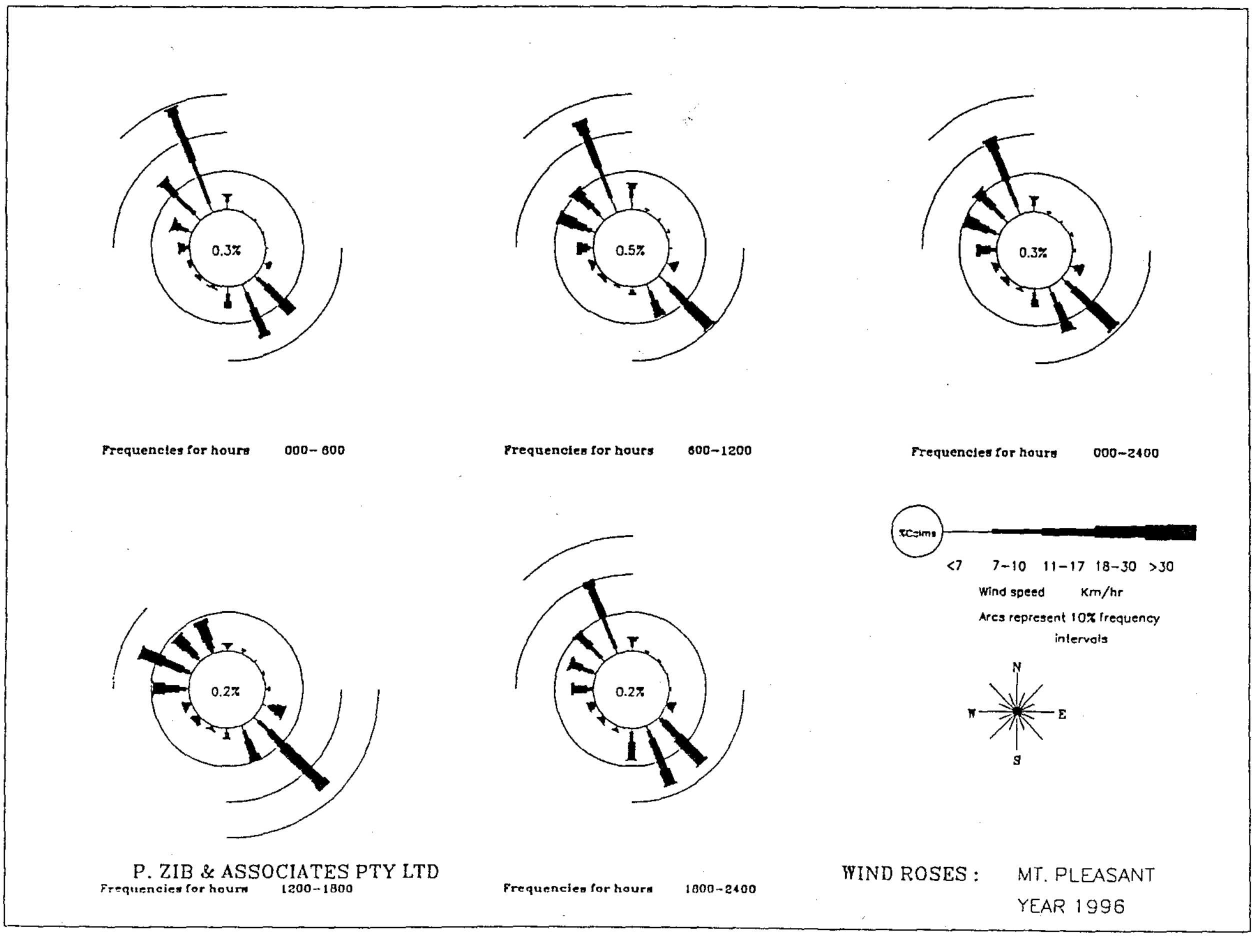
Elizabeth White.

Appendix E

AIR QUALITY

E1 WIND ROSES FOR MT. PLEASANT


0.8%
0.6%
0.4%
Frequencies for hours 000- 600
Frequencies for hours 600-1200
Frequencies for hours 000-2400
%Calms
<7 7-10 11-17 18-30 >30
Wind speed Km/hr
Arcs represent 10% frequency intervals
N
W
E
S
0.1%
0.2%
P. ZIB & ASSOCIATES PTY LTD
Frequencies for hours 1200-1800
Frequencies for hours 1800-2400
WIND ROSES : MT. PLEASANT
YEAR 1995


0.3%
0.5%
0.3%
Frequencies for hours 000- 600
Frequencies for hours 600-1200
Frequencies for hours 000-2400
%Calms
<7 7-10 11-17 18-30 >30
Wind speed Km/hr
Arcs represent 10% frequency intervals
N
W
E
S
0.2%
0.2%
P. ZIB & ASSOCIATES PTY LTD
Frequencies for hours 1200-1800
Frequencies for hours 1800-2400
WIND ROSES : MT. PLEASANT
YEAR 1996

E2 NSW EPA AMENITY CRITERIA

In New South Wales in the past, the EPA used an annual average of 4.0 g/m2/month as the level at which amenity was likely to be affected causing complaints of nuisance dust. More recently, the EPA adopted new amenity based criteria for dust deposition. The EPA criteria are summarised in Table 6.1.

Table 6.1. NSW EPA criteria for dust fallout.

Existing Dust Level (g/m2/month)	Maximum Acceptable Increase Over Existing Dust Level (g/m2/month)	
	Residential Suburban	Rural, Semi-Rural Urban Commercial & Industrial
2	2	2
3	1	2
4	0	1

NOTE: If the existing dust level in any area is greater than 4 g/m2/month (i.e. 5 or above) then no increase in dust fallout is acceptable as a result of any proposed dust emitting works.

E3 NSW EPA AIR QUALITY

INTRODUCTION

This report is one of a regular series containing air monitoring data from the Environment Protection Authority's (EPA) statewide air monitoring network. This report also contains air quality data telemetered to the EPA by industry from sites in Camden and Campbelltown as required under EPA licence conditions. The data from these sites are reproduced as they are received by the EPA.

AIR QUALITY CRITERIA

Air quality standards for urban air pollutants have not been defined in New South Wales since there are insufficient Australian data on the health effects of these pollutants to allow their adequate determination. In the absence of such standards, the EPA notes National Health and Medical Research Council (NHMRC) Guidelines, World Health Organisation (WHO) long-term goals and US Environmental Protection Agency (US EPA) Air Quality Standards. These air quality guidelines have been determined in light of current international knowledge on the adverse effects of air pollutants on health. Damage to plants and materials and reduction to visibility have not been considered in establishing these goals. Selected air quality criteria, together with their agency sources, are listed below.

POLLUTANT	GOAL	AVERAGING TIME	AGENCY
Total suspended particulates	90 $\mu g/m^3$	12 months	NHMRC
Particulate matter < 10 μm	50 $\mu g/m^3$ 150 $\mu g/m^3$	12 months 24 hours	US EPA US EPA
Lead	1.5 $\mu g/m^3$	3 months	NHMRC
Carbon monoxide	87 ppm 25 ppm 9 ppm	15 minutes 1 hour 8 hours	WHO WHO NHMRC
Nitrogen dioxide	16 pphm 5 pphm	1 hour 12 months	NHMRC US EPA
Ozone	10 pphm 8 pphm 6 pphm	1 hour 4 hour 8 hour	NHMRC NHMRC WHO
Sulfur dioxide	25 pphm 20 pphm 2 pphm 17.5 pphm 12.5 pphm	10 minutes 1 hour 12 months 10 minutes 1 hour	NHMRC NHMRC NHMRC WHO WHO

E4 AIR QUALITY FIGURES

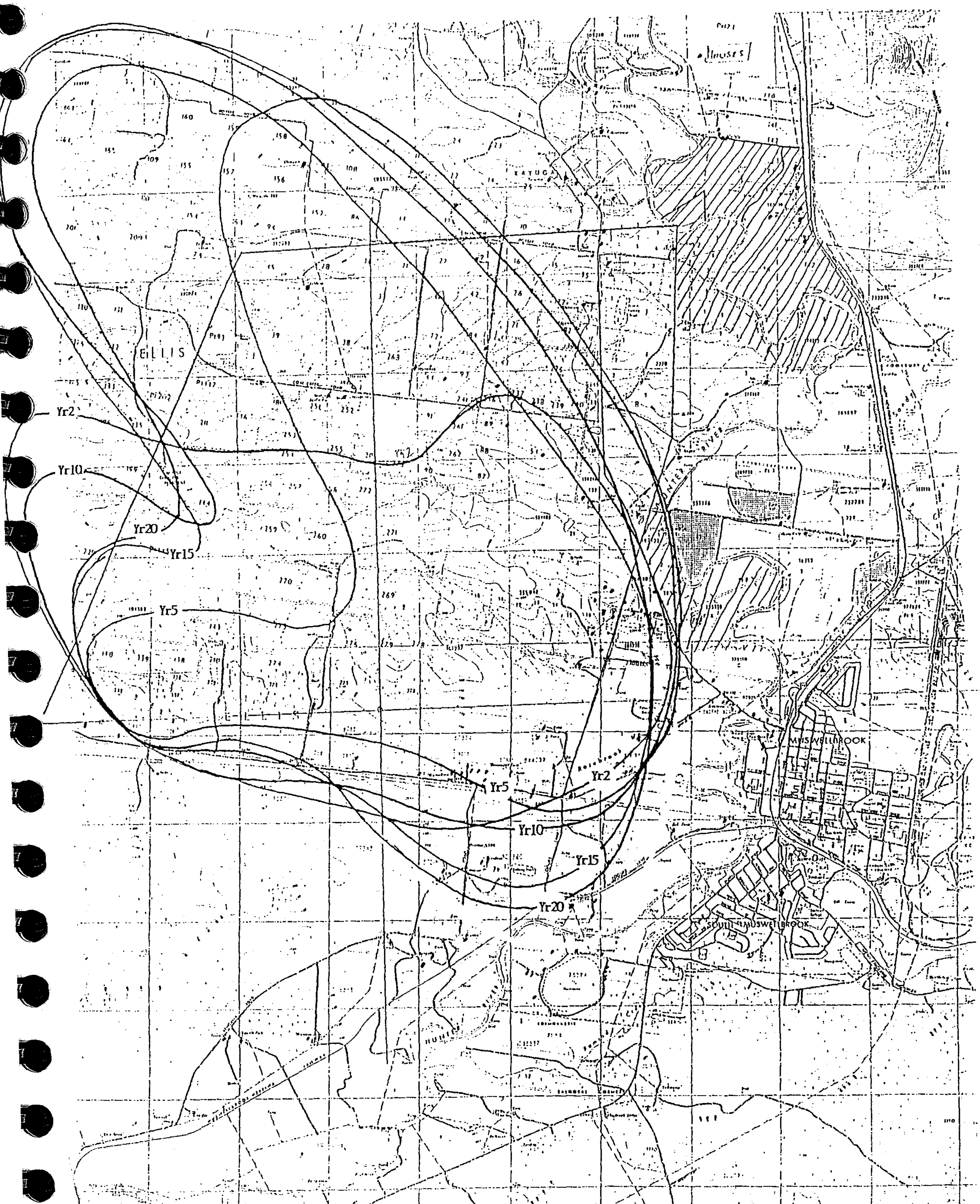


Figure 6.2. Envelope of contour lines corresponding to a predicted increase in mean annual dust deposition of 2.0 g/m2/month.

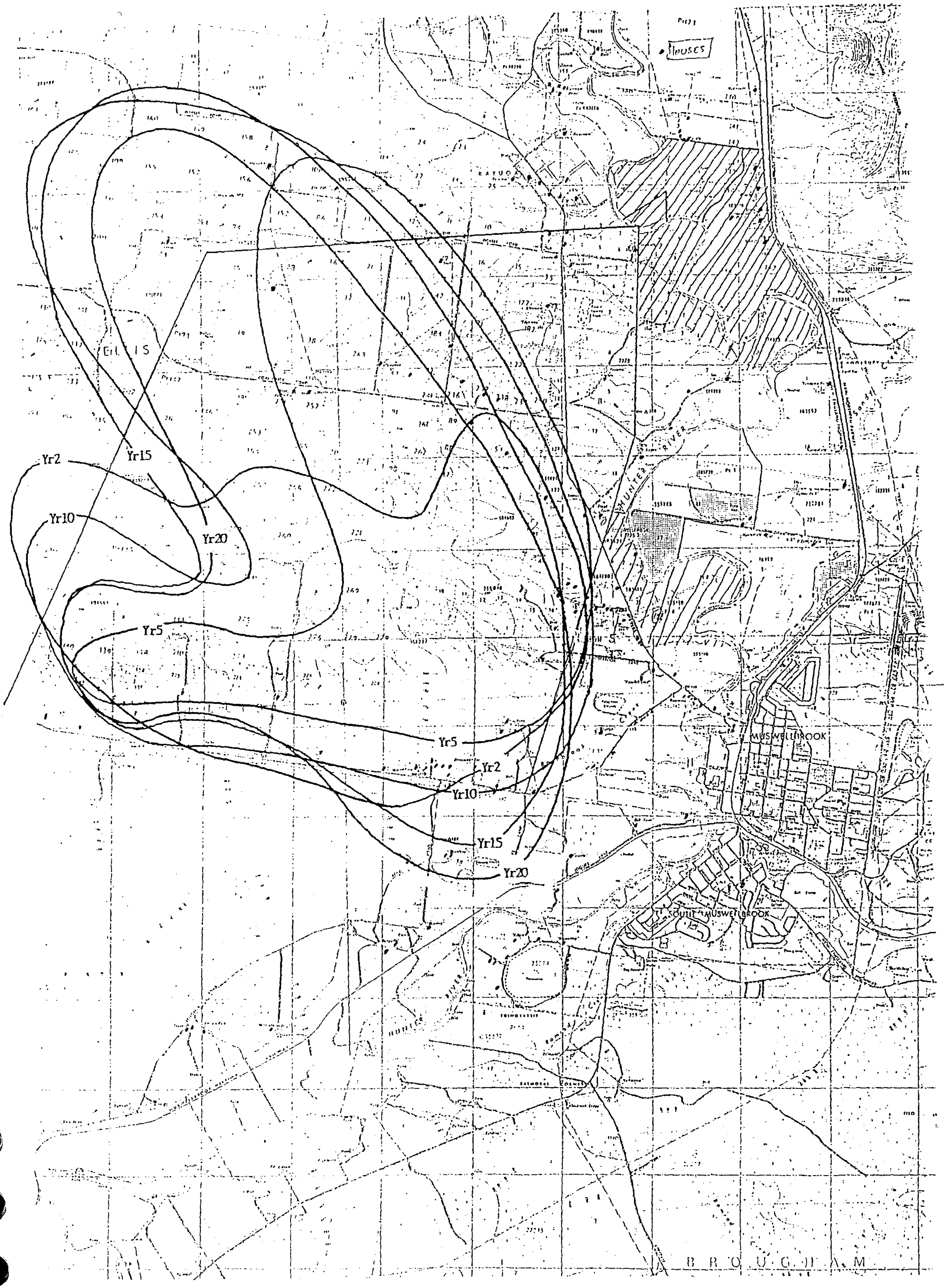


Figure 6.4. Envelope of contour lines corresponding to a predicted increase in mean annual concentration of TSP of 50 micrograms/m3.

BAYSWATER NO.3

Figure 6.5. The position and extent of 2.0 g/m2/month isopleths predicted for Dartbrook, Mt. Pleasant, Bengalla and Bayswater No.3 developments.

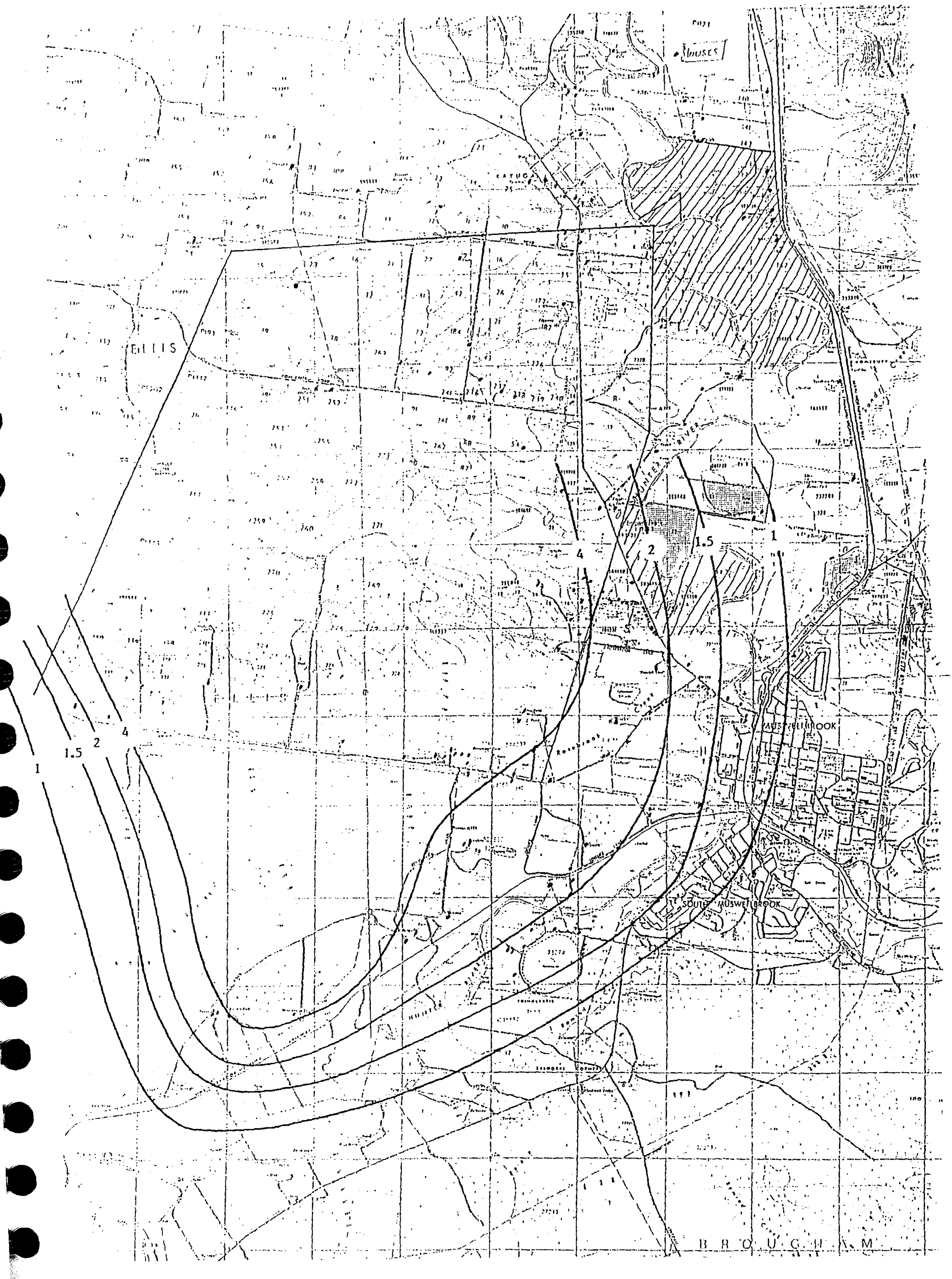


Figure 6.6. Combined isopleths of mean annual increments in dust deposition from mining at Bengalla (Year 14) and Mt. Pleasant (Year 10).

Figure 6.7. The position and extent of 2.0 g/m2/month isopleths predicted for Mt. Pleasant and Kayuga proposals.

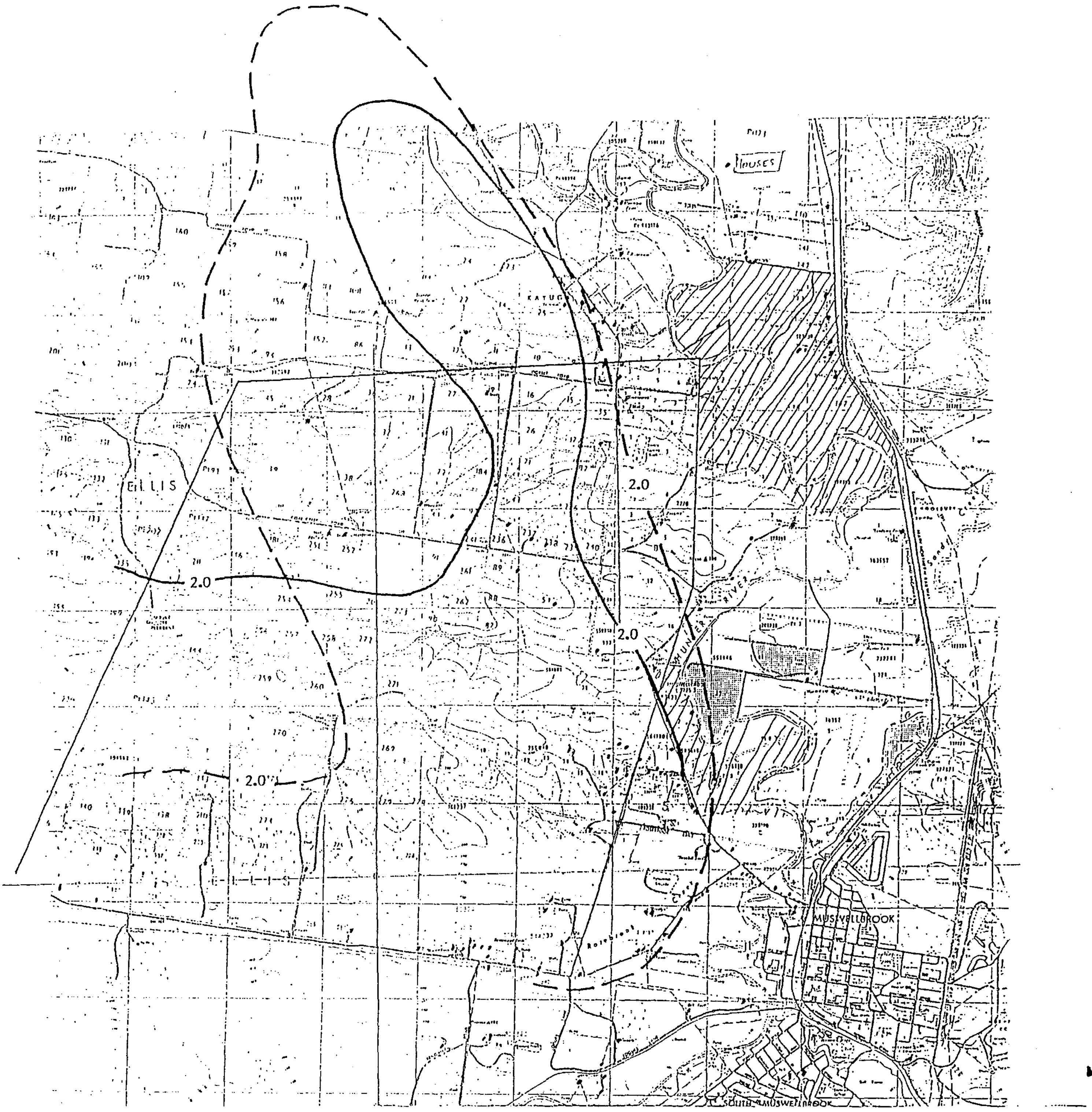


Figure 6.8(a). Combined isopleth corresponding to a mean annual increment of 2.0 g/m2/month from mining at Mt. Pleasant (Year 2) and Kayuga (Year 2). The broken line shows the combined isopleth for Year 5 at Mt. Pleasant and Year 2 at Kayuga.

Figure 6.8(b). Combined isopleth corresponding to a mean annual increment of 2.0 g/m2/month from mining at Mt. Pleasant (Year 20) and Kayuga (Year 21).

E5 REVISED USEPA NATIONAL AMBIENT AIR QUALITY STANDARDS FOR PARTICULATE MATTER

EM Feature

Implementing the Revised NAAQS and the FACA Subcommittee for Ozone, Particulate Matter, and Regional Haze

by Greg Schaefer, ARCO Coal Company, Denver, CO; William Hamilton, U.S. Environmental Protection Agency, Research Triangle Park, NC; and C.V. Mathai, Arizona Public Service Company, Phoenix, AZ

INTRODUCTION

Last July, the U.S. Environmental Protection Agency (EPA) promulgated revisions to the National Ambient Air Quality Standards (NAAQS) for ozone and particulate matter (PM) and proposed regulations to deal with visibility impairment resulting from regional haze (RH). The EPA is accepting public comments on the RH rules through December 4, 1997; the rules are expected to be finalized by February 1998. The revised NAAQS for ozone and PM became effective September 18, 1997, subject to congressional review. The EPA is planning to implement the NAAQS and RH rules in an integrated manner. In a directive to EPA Administrator Carol Browner, President Clinton stated,[1] "It is critically important that these standards be implemented in the most flexible, reasonable, and least burdensome manner, and that the federal government work with state and local governments and other interested parties to this end."

In preparation for implementing the revised standards in September 1995, the EPA established the Subcommittee for Ozone, Particulate Matter, and Regional Haze Implementation Programs as a subcommittee of the Clean Air Act Advisory Committee (CAAAC) under the provisions of the Federal Advisory Committee Act (FACA). This FACA subcommittee has been charged with the responsibility of providing advice and recommendations to the EPA relating to integrated approaches to implement the revised regulations. The subcommittee is composed of 82 members representing the federal, state/tribal, and local governments, environmental and public interest groups, industry, and academia. It has met regularly since its inception and has presented a progress report to the CAAAC in April 1997. The subcommittee has been encouraged to think "outside the box" and develop innovative, flexible, and cost-effective implementation strategies that utilize a mix of control measures to address ozone, PM, and RH. Over the next several months, the subcommittee will continue to develop recommendations for consideration by the EPA as it implements the revised NAAQS and RH rules. Consistent with the President's directive, the EPA is expected to rely on the subcommittee's advice and recommendations in developing strategies to implement the revised ozone, PM, and RH rules.

The purpose of this article is to briefly summarize the subcommittee's activities to date, and to provide an overview of issues it will address over the next several months. We begin with a brief overview of the revised ozone and PM standards, the proposed RH rules, and the President's directive on implementing the revised air quality standards.

REVISED OZONE AND PM STANDARDS

Ozone Standards

The EPA's July 1997 rules[2] replaced the level, form, and averaging period of the primary ozone standard: the 1-hour, 0.12 ppm standard was replaced with a 8-hour, 0.08 ppm standard. An area will attain the new standard when the three-year average of the annual fourth-highest daily maximum 8-hour concentrations are

Table 1. Revised National Ambient Air Quality Standards for particulate matter.

NAAQS	Averaging Time	Level	Form
Primary $PM_{2.5}$	Annual	15 µg/m³	Three-year average of the annual arithmetic mean $PM_{2.5}$ concentrations, spatially averaged across an area
Primary $PM_{2.5}$	24 Hours	65 µg/m³	Three-year average of the 98th percentile of 24-hour $PM_{2.5}$ concentrations at each monitor
Primary PM_{10}	Annual	50 µg/m³	Three-year average of the annual arithmetic mean PM_{10} concentrations at each monitor
Primary PM_{10}	24 Hours	150 µg/m³	Three-year average of the 99th percentile of the monitored PM_{10} concentrations at each monitor

E6 PM10 EMISSION INVENTORY

Table B.5(a). PM10 emission inventory for South pit - Year 20

Operation	Extent of operation	Annual emission	Comments
OVERBURDEN MINING			
Shovel / Excavator operation			
Topsoil removal (scraper)	1520 hrs/yr	11.0 t/yr	
Overburden drilling	23 436 holes/yr	7.8 t/yr	Depth = 15 m Pattern = 9.1 m x 9.1 m
Overburden blasting	93 blasts/yr	95.6 t/yr	Area of blast = 20 900 m2 Moisture content = 2%
Overburden loading	25.28 Mbcm/yr	537.9 t/yr	Density = 2.3 t/m3
FEL operation			
Overburden drilling	35 872 holes/yr	11.8 t/yr	Depth = 3.5 m Pattern = 5.6 m x 5.6 m
Overburden blasting	76 blasts/yr	15.4 t/yr	Area of blast = 14830 m2
Overburden loading	3.95 Mbcm/yr	84.2 t/yr	Density = 2.3 t/m3
Dozer ripping	1860 hrs/yr	1.9 t/yr	
Overburden haulage to North pit (21.37 Mbcm)			217 t trucks
In-pit:	545 050 km/yr	414.2 t/yr	In-pit distance = 1.0 km
Out-of-pit:			
to main dump:	920 510 km/yr	699.6 t/yr	Out-of-pit distance = 2.5 km
to south dump:	144 160 km/yr	109.6 t/yr	Out-of-pit distance = 1.7 km
to South pit (7.86 Mbcm)			
Northern route (3.92 Mbcm)			
In-pit:	100 090 km/yr	76.1 t/yr	In-pit distance = 1.2 km
Out-of-pit:	83 410 km/yr	63.4 t/yr	Out-of-pit distance = 1.0 km

Table B.5(a) cont.

Operation	Extent of operation	Annual emission	Comments
Central route (1.97 Mbcm)			
In-pit:	37 580 km/yr	28.6 t/yr	In-pit distance = 0.9 km
Out-of-pit:	25 060 km/yr	19.0 t/yr	Out-of-pit distance = 0.6 km
Southern route (1.97 Mbcm)			
In-pit:	50 110 km/yr	38.1 t/yr	In-pit distance = 1.2 km
Out-of-pit:	37 580 km/yr	28.6 t/yr	Out-of-pit distance = 0.9 km
Wind erosion			
Pre-stripping area	29.9 ha	52.4 t/yr	2 strips ahead of mining
	Subtotal	2295.2 t/yr	
Dragline operation			
Overburden drilling	5 292 holes/yr	1.8 t/yr	Mean depth = 15 m Pattern = 9.1 m x 9.1 m
Overburden blasting	21 blasts/yr	21.6 t/yr	Area of blast = 20 900 m2 Moisture content = 2%
Dragline	5.60 Mbcm/yr	184.0 t/yr	Mean drop height = 12 m Moisture content = 2%
Rehandle	3.71 Mbcm/yr	121.9 t/yr	
Dozer operation	800 hours/yr	0.8 t/yr	
	Subtotal	330.1 t/yr	

Table B.5(a) cont.

Operation	Extent of operation	Annual emission	Comments
OVERBURDEN PLACEMENT			
Dumping			
to South pit:	7.86 Mbcm/yr	80.1 t/yr	
Dozer (spreading)	2400 hrs/yr	3.5 t/yr	
to North pit:	29.23 Mbcm/yr	218.2 t/yr	
Dozer (spreading,shaping)	4000 hrs/yr	5.7 t/yr	
Wind erosion			
Spoil piles, dump	90.0 ha	157.7 t/yr	
Grading of roads	32 000 km/yr	6.9 t/yr	Grading of haul and access roads, 4000 hrs/yr Mean speed = 8 km/hr
	Subtotal	472.1 t/yr	
COAL MINING			
Coal drilling	25 760 holes/yr	8.7 t/yr	4.78 Mtpa of coal drilled and blasted Depth = 5 m Pattern = 6.1 m x 6.1 m
Coal blasting	80 blasts/yr	11.8 t/yr	Area of blast = 12 000 m2
Coal ripping (dozer)	5160 hrs/yr	27.4 t/yr	3.30 Mtpa ripped Mean silt content = 4% Mean moisture content = 5%
Coal loading	8.08 Mtpa	114.8 t/yr	

Table B.5(a) cont.

Operation	Extent of operation	Annual emission	Comments
Coal haulage			160 t trucks
Northern route (40%)			
In pit:	40 000 km/yr	30.4 t/yr	In-pit distance = 1.0 km
Out-of-pit:	106 000 km/yr	80.6 t/yr	Out-of-pit distance to CPP = 2.65 km
In South pit:	140 000 km/yr	106.4 t/yr	In-pit distance = 3.5 km
Southern route (60%)			
In-pit:	91 500 km/yr	69.5 t/yr	In-pit distance = 1.5 km
Out-of-pit:	161 650 km/yr	122.8 t/yr	Out-of-pit distance to CPP = 2.65 km
	Subtotal	572.4 t/yr	
	TOTAL (SOUTH PIT)	3669.8 t/yr	

Table B.5(c). PM10 emission inventory for coal preparation plant - Year 20

Operation	Extent of operation	Annual emission	Comments
COAL PREPARATION			
ROM coal (10.5 Mtpa)			
Dumping to hopper	10.5 Mtpa	43.1 t/yr	
Conveyor transfer	10.5 Mtpa	2.3 t/yr	Total of 3 transfers
Loading to stockpile (stacker)	7.9 Mtpa	0.1 t/yr	Assume 75 per cent of ROM coal to stockpiles
Maintenance, wind erosion		28.3 t/yr	Total frequency of u > 20 kph of 20.1% Base area = 3.3 ha
Reclamation, conveyor transfer	7.9 Mtpa	1.8 t/yr	
Haulage of rejects	2.0 Mtpa	52.3 t/yr	Mean distance to turn off = 2.75 km
Central route	0.7 Mtpa	20.0 t/yr 4.0 t/yr	3.0 km in South pit 0.6 km out-of-pit
Southern route	1.3 Mtpa	39.9 t/yr 11.1 t/yr	2.0 km in South pit 0.9 km out-of-pit
Product coal (7.6 Mtpa)			
Conveyor stacking	7.6 Mtpa	0.1 t/yr	
Maintenance, wind erosion		40.2 t/yr	Base area = 4.7 ha
Reclamation, conveyor transfer, train loading	7.6 Mtpa	0.4 t/yr	
	Subtotal	243.6 t/yr	
	TOTAL (CPP)	243.6 t/yr	

TOTAL (ALL OPERATIONS)	=	3669.8 t/yr	(South Pit)
		998.8 t/yr	(North Pit)
		243.6 t/yr	(Coal preparation)
		4 912.2 t/yr	

Table B.5(b). PM10 emission inventory for North pit - Year 20

Operation	Extent of operation	Annual emission	Comments
OVERBURDEN MINING			
Excavator operation			
Overburden drilling	756 holes/yr	0.3 t/yr	Depth = 15 m Pattern = 9.1 m x 9.1 m
Overburden blasting	3 blasts/yr	3.1 t/yr	Area of blast = 20 900 m2 Moisture content = 2%
Overburden loading	0.94 Mbcm/yr	19.9 t/yr	Density = 2.3 t/m3
FEL operation			
Overburden drilling	3 304 holes/yr	1.1 t/yr	Depth = 3.5 m Pattern = 5.6 m x 5.6 m
Overburden blasting	7 blasts/yr	1.4 t/yr	Area of blast = 14 830 m2
Overburden loading	0.36 Mbcm/yr	7.9 t/yr	Density = 2.3 t/m3
Dozer ripping	210 hrs/yr	0.2 t/yr	
Overburden haulage			217 t trucks
to North pit:			
In-pit:	35 940 km/yr	27.3 t/yr	In-pit distance = 1.3 km
Out-of-pit:	27 650 km/yr	21.0 t/yr	Out-of-pit distance = 1.0 km
	Subtotal	94.8 t/yr	

Table B.5(b) cont.

Operation	Extent of operation	Annual emission	Comments
Dragline operation			
Overburden drilling	2 534 holes/yr	0.8 t/yr	Mean depth = 40 m Pattern = 9.1 m x 9.1 m
Overburden blasting	7 blasts/yr	1.6 t/yr	Area of blast = 30 000 m2 Moisture content = 2%
Dragline	8.48 Mbcm/yr	278.6 t/yr	Mean drop height = 12 m Moisture content = 2%
Rehandle	3.90 Mbcm/yr	128.1 t/yr	
	Subtotal	409.1 t/yr	
OVERBURDEN PLACEMENT			
Dumping			
to North pit	1.30 Mbcm/yr	13.3 t/yr	
Dozer (spreading)	480 hrs/yr	0.7 t/yr	
Wind erosion			
Spoil piles, dump area	120.0 ha	210.3 t/yr	
	Subtotal	224.3 t/yr	

Table B.5(b) cont.

Operation	Extent of operation	Annual emission	Comments
COAL MINING			
Coal drilling	7 728 holes/yr	2.6 t/yr	1.43 Mtpa of coal drilled and blasted Depth = 5 m Pattern = 6.1 m x 6.1 m
Coal blasting	24 blasts/yr	3.5 t/yr	Area of blast = 12 000 m2
Coal ripping (dozer)	1550 hrs/yr	8.2 t/yr	Mean silt content = 4% Mean moisture content = 5%
Coal loading	2.42 Mtpa	34.4 t/yr	
Coal haulage			160 t trucks
In pit:	75 630 km/yr	57.5 t/yr	In-pit distance = 2.5 km
Out-of-pit:	110 420 km/yr	83.9 t/yr	Out-of-pit distance = 3.65 km
In South pit:	105 880 km/yr	80.5 t/yr	In-pit distance = 3.5 km
	Subtotal	270.6 t/yr	
	TOTAL (NORTH PIT)	998.8 t/yr	

E7 PARTICLE SIZE DISTRIBUTIONS AND SOURCE OF DATA

Table 5.4. Particle size distributions used in the study and the source of data.

Operation	PM2.5	PM10-PM2.5	TSP-PM10	Reference Operation
	Particle size ranges			
O/B stripping				
Topsoil removal (scrapers)	19.6	32.4	48.0	USEPA (1981) as PM10 = 0.60 PM15
O/B drilling	9.0	47.0	44.0	Dames & Moore (1986) as PM10 = 0.75 PM15
O/B blasting	5.1	46.0	48.9	USEPA (1981)
O/B loading - shovel	4.0	33.0	63.0	as O/B dumping
O/B removal - dozer	10.5	7.8	81.7	USEPA (1991) - Supplement D
Dragline operation	7.0	38.0	55.0	Dames & Moore (1986) as PM10 = 0.75 PM15
Graders on roads	3.1	31.8	65.1	USEPA (1991) - Supplement D
O/B haulage	6.0	32.0	62.0	Dames & Moore (1986) as PM10 = 0.60 PM15
O/B dumping	4.0	33.0	63.0	Dames & Moore (1986) as PM10 = 0.75 PM15
Reshaping - dozer	10.5	9.1	80.4	USEPA (1991) - Supplement D
Coal mining				
Coal drilling	9.0	47.0	44.0	Dames & Moore (1986) as PM10 = 0.75 PM15
Coal blasting	5.1	46.0	48.9	USEPA (1981)
Coal ripping - dozer	2.2	20.7	77.1	USEPA (1991) - Supplement D
Coal loading - FEL	5.0	44.0	51.0	Dames & Moore (1986) as PM10 = 0.75 PM15
Coal haulage	6.0	32.0	62.0	Dames & Moore (1986) as PM10 = 0.60 PM15
Exposed areas				
Wind erosion - Coal	20.0	30.0	50.0	USEPA (1981) - see also AWMA
- O/B	20.0	30.0	50.0	USEPA (1981) Air Pollution Engineering Manual (1992)

Table 5.4 continued

Operation	Particle size ranges			Reference Operation
	PM2.5	PM10-PM2.5	TSP-PM10	
<u>Coal preparation</u>				
Coal dumping	4.0	37.0	59.0	Dames & Moore (1986) as PM10 = 0.75 PM15
Conveyor transfer	11.0	28.0	61.0	USEPA (1988) as PM10 = 0.75 PM15
Maintenance, wind erosion of stockpiles	4.0	46.0	50.0	USEPA (1981) as PM10 = 0.75 PM15
Reclamation of product coal	0.5	9.2	90.3	USEPA (1988) as PM10 = 0.75 PM15

E8 PREDICTED 24 HOUR PM10 CONCENTRATIONS

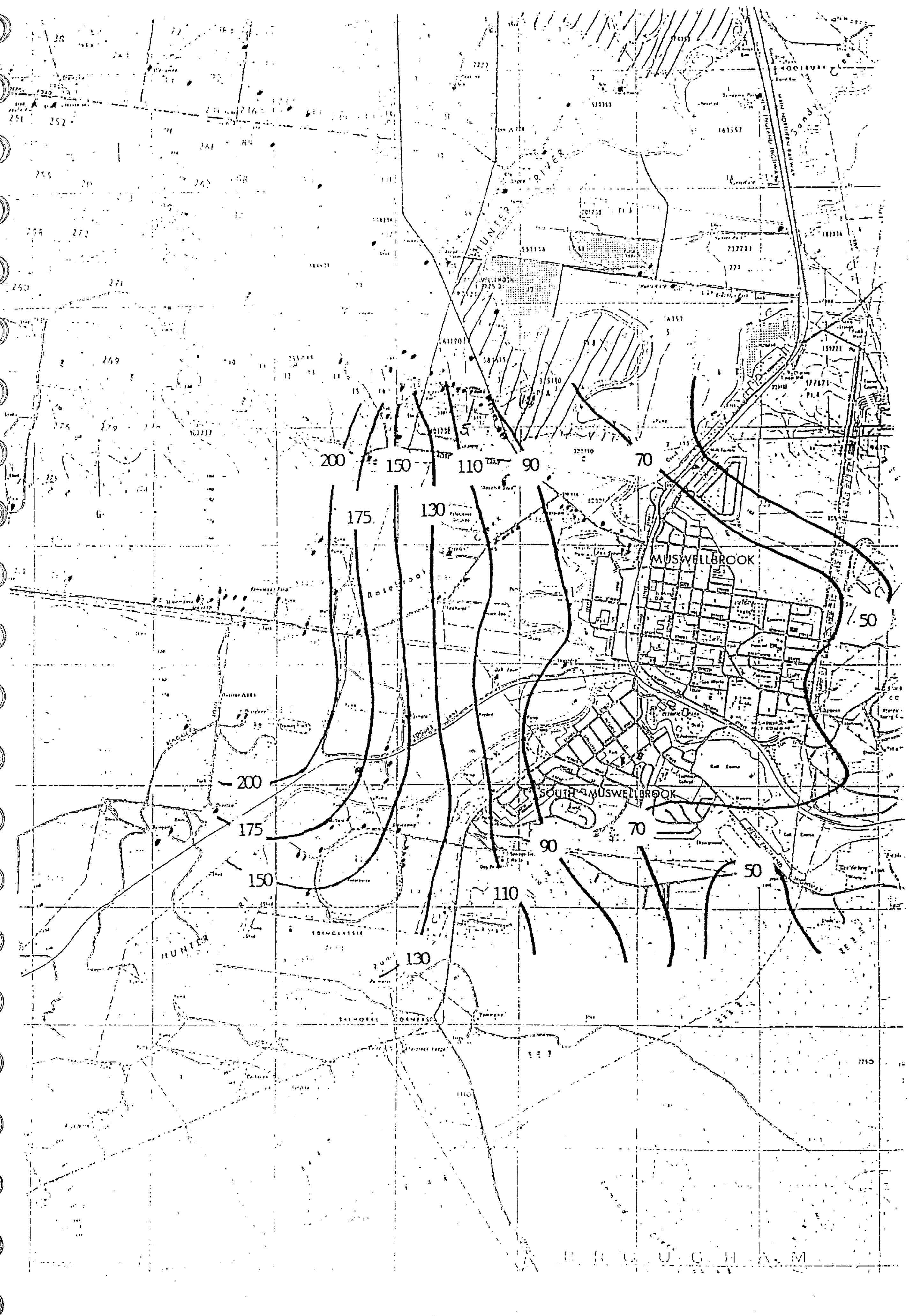


Figure 7.1. Envelope of predicted 99.0 percentile of 24-hour PM10 concentrations (micrograms/m3) - Year 20.

Appendix F

LAND AQUISTION POLICIES

Coal & Allied Industries Ltd

Land Acquisition Policy

Coal & Allied is committed to ensuring that landowners impacted by the mine will have their interests and reasonable requirements met by the Company. The Company will continue to inform landowners of the extent and timing of the project and it's expected impacts on their properties.

The Environmental Impact Statement will identify the extent of impact on properties.

The Company will enter into a agreements with the landowners where impacts are identified with the result that continuation of their present use, is no longer suitable.

These agreements with the land owners can be for acquisition, lease or ameliorative measures as may be negotiated with the landowner.

Acquisition of properties will be in accordance with the approval conditions set down in the Development Consent. Those landowners who have not been identified as impacted by the Environmental Impact Statement but consider the impacts to be excessive should contact Coal & Allied.

Coal & Allied will make arrangements for independent monitoring in consultation with the Muswellbrook Shire Council, the Environment Protection Authority, Department of Urban Affairs and Planning and the landowner. If these results are found to be adverse the Company will take ameliorative measures or purchase the property with the landowners agreement.

JOINT POLICY FOR CUMULATIVELY AFFECTED BY THE PROPOSED MOUNT PLEASANT AND KAYUGA COAL MINES

Coal & Allied Operations Pty Limited and Kayuga Coal Pty Limited recognise that there will be areas affected by the cumulative activities of the proposed Mount Pleasant and Kayuga Coal mines that will not be impacted by either mine on its own. The companies have therefore prepared this joint policy to assist in the resolution of possible land use conflicts.

- the area jointly affected by the mines will depend on when each begins operations. The exact timing and rate of development for both mines will be determined by market demand and it is likely that the mines will commence at different times.

- the companies believe that the property owners affected by the joint operations of the mines should be treated on a comparable basis to those in the individual areas of affectation.

- It is proposed that once the initial open cut mining approval is lodged for the second mine, the area of cumulative affectation shown in the exhibited Environmental Impact Statements will be assessed in accordance with the exhibited mine plans as assessed in the individual Environmental Impact Statements. Property owners within the area as assessed will then be protected by;

    * environmental safeguards;
    * agreements to lease the property;
    * agreements to provide other forms of compensation for the duration of any cumulative impacts or;
    * undertakings to purchase under the same terms as apply to those in the individual mine areas of affectation.

- Mount Pleasant and Kayuga Coal will develop a procedure which ensures owners of cumulatively affected properties are dealt with equitably and promptly.

- This objective of this policy is to ensure that the interests of property owners are appropriately safeguarded well before impacts are experienced and that they are given the same level of protection as those closer to and impacted by the individual mines.

Appendix G

WATER POLICY

Coal & Allied Industries Ltd

Water Policy

Coal & Allied is committed to ensuring that the existing surface and groundwater resource available to surrounding landowners is not significantly affected by the Mount Pleasant Mine development.

In committing to this policy Coal & Allied will:

- develop a comprehensive surface and groundwater management plan for the Mount Pleasant project;
- ensure that clean runoff from undisturbed areas is conveyed around mining operations to minimise losses in downstream water flows;
- maximise the collection and storage of water from active mining areas to provide an operational water supply for dust suppression, coal washing and other on-site uses;
- minimise the need to draw surplus water from the Hunter River;
- ensure that the release of surplus water to the Hunter River complies with the Hunter River Salinity Trading Scheme and EPA licence requirements;
- initiate a long-term surface and groundwater monitoring program; and
- offer to replace water supplies either by borehole deepening or provision of alternative water sources where an economic loss from surface waters or boreholes is demonstrated by a proper and appropriate government authority in conjunction with Coal & Allied and the landowner.

Appendix H

REVISED PROPERTY FIGURES

Table.H.1 SUMMARY OF DUST AFFECTED RESIDENCES

Property No. (1)	Property Owner	Affected by Dust Deposition	Property No. (1)	Property Owner	Affected by Dust Deposition
1.	Kropp R&J	✓	113.	Bengalla Mining Co	✓
2.	Lonergan JA	✓	115.	Steman LH	✓ (2)
8.	Dartbrook Joint Venture	✓ (3)	116.	McLean D & R	✓
14.	Dartbrook Joint Venture	✓	117.	Coal & Allied	✓ (2)
16.	Casey GM	✓	121.	Skippen SE	✓
22.	Lonergan JA	✓	124.	Bengalla Mining Co	✓
25.	Fell CM	✓	130.	Moore C & JM	✓
31.	Coal & Allied	✓	131.	Moore DL & PA	✓
32.	Coal & Allied	✓	132.	Coal & Allied	✓
33.	Coal & Allied	✓	134.	Coal & Allied	✓
34.	Lonergan PJ	✓	135.	Marshall DJ	✓
35.	Watts WF & PJ	✓	136.	Budden GB & DM	✓
43.	Coal & Allied	✓	137.	Budden GG & PE	✓
44.	Coal & Allied	✓	138.	Coal & Allied	✓ (2)
48.	Farrel MJ	✓	139.	Brotherton RL	✓
57.	Lecky KG & JA	✓	141.	Gray ML	✓
58.	Turner G	✓	142.	Coal & Allied	✓
59.	Blake TJ	✓	143.	Barry TD	✓
63.	Bates CF & GP	✓	144.	Coal & Allied	✓
66.	Rosebrook P/L	✓ (2)	145.	Coal & Allied	✓
67.	Coal & Allied	✓	146.	Chalker BGM & JA	✓
69.	Schlegel JG & FA	✓	148.	Gibson JS	✓
72.	Googe RK & NV	✓	149.	Wilton BL	✓
73.	McLean MA & RE	✓ (2)	150.	Coal & Allied	✓
75.	Hugo D & J	✓	151.	Coal & Allied	✓
76.	Bengalla Mining Co	✓	152.	Hayes MA	✓
77.	O'Keefe OJ & Others	✓	153.	Coal & Allied	✓
78.	Thompson K & M	✓	154.	Mather AJ	✓
79.	Riley AJ & A	✓	155.	Austin C	✓
80.	Scriven GJ	✓	156.	Collins WF	✓
81.	McKinnon P & B	✓	157.	Gray RP	✓
82.	Ellis N & R	✓	158.	Coal & Allied	✓
83.	Hamson L & C	✓	159.	Seaby EA & MD	✓
84.	Bengalla Mining Co	✓	160.	Roach FW & YL	✓
85.	Lawrence R & M	✓	161.	Coal & Allied	✓
86.	Bengalla Mining Co	✓	162.	Coal & Allied	✓
87.	Bengalla Mining Co	✓	163.	Jazipa P/L	✓
88.	Reynolds J	✓	170.	Simpson JM	✓
89.	Bengalla Mining Co	✓	172.	George VC & NA	✓
91.	Gardiner AL	✓	173.	Coal & Allied	✓
94.	Gamper HJ & JA Ellul	✓	174.	Galivin RJ	✓
95.	Coal & Allied	✓	175.	Coal & Allied	✓
108.	Bengalla Mining Co	✓	176.	Coal & Allied	✓
110.	Bengalla Mining Co	✓	228.	Bengalla Mining Co	✓
111.	Carter FJ DJ & JM	✓			

Note: 1. Property Number as shown on Figures 24 and 25.

Table H.2 PROPERTIES IN THE DEVELOPMENT APPLICATION AREA

Property No.[1]	Owner	Property Details
8	Dartbrook	Por 114 & Lot 1 DP 505544
14	Dartbrook	PT Por 12 DP 750926
21	Lonergan J & NM	Pors 73 & 74 DP 750926
✓22	Lonergan JA	Por 28, 45 Lot 1, DP 313392
23	Lonergan PJ	Por 21, 268 DP 750926 36, 37, DP 432713
24	Watts WF & PJ	Portions 41 & 72 Lot 1/2 DP 915913
✓25	Fell CM	PP 19 DP 750926
26	Collins GC & KM	Portion 42 DP 750926
✓27	Casey JO	Por 15 & PT 35 DP 750926
30	Casey EJ & JO	Lots 14 & 15 DP 2770
✓31	Coal & Allied	Lots 238,239,240 DP 750926
✓32	Coal & Allied	Lot 237 DP 750926
✓33	Coal & Allied	Lot 236 DP 750926
✓34	Lonergan PJ	Pors 92, 184, 241 DP 750926
✓35	Watts WF & PJ	Portions 44, part Portion 202 DP 750926
36	Temporary Common	Permissive occupancy 1961/18
37	Partridge DJ	Pors 38/39 DP 750926
38	Lonergan JA	Part Portion 93 & Lot 1 DP 174071
39	Coal & Allied	Part Lots 5 & 6 & Lot 7 & closed roads DP 750926
40	Lonergan PJ	Por 147, 211 DP 750926
41	Partridge DJ	Por 146 DP 750926
42	Lonergan PJ	Por 181 DP 750926
✓43	Coal & Allied	Por 251 DP 750926
✓44	Coal & Allied	Lot 1 DP 634490
45	Coal & Allied	Lot 1 DP "1731 Lot 2 DP 634490
46	Coal & Allied	Lot 90,91,261,262,251,253,254,256, 273 236-240 DP 750926
47	Farrell RM & SD	Lot 1 DP 791576
✓48	Farrel MJ	Lot 2 DP 791576
49	Mather GA & S	Lot 3 DP 791576
✓58	Turner G	Lot 132 DP 558246
✓59	Blake TJ	Lot 1/7 Section Rosebrook Estate
60	Blake TJ	Lot 1/3 DP 194043 Lots 8/15 DP 255048
61	Coal & Allied	Portion 259 DP 750926
62	Daniels LGJ & ME	Portion 135, 199, 242 & Part portion 144 DP 750926
✓63	Bates CF & GP	Lot 4 DP 801249 & Pors 143 & PP 144 & 145 DP 750926
64	Watson EO & DP	Portions 269 & 270 DP 750926
65	Scriven GJ	Pors 274, 275, 276, 278 & 279 DP 750926
✓66	Rosebrook P/L	Part Portion 3 DP 750926
✓67	Coal & Allied	Lot 16 DP 255048
✓77	O'Keefe OJ & Others	Lot 21 DP 554140
78	Thompson K & M	Lot 22 DP 554140
79	Riley AJ & A	Lot 1 DP 544039 Lot 2 DP 629491
✓81	McKinnon P & B	Part Portion 3 DP 750926
✓82	Ellis N & R	Lot 25 Rosebrook Estate
✓83	Hamson L & C	Part Portion 3 DP 750926
✓84	Bengalla Mining Co	Lot 27 DP 745895
✓85	Lawrence R & M	Lot 3 DP 629491
✓86	Bengalla Mining Co	Lot 1 DP 213293
✓87	Bengalla Mining Co	Lot 29 DP 731706
✓88	Reynolds J	Part Portion 3 DP 750926
✓89	Bengalla Mining Co	Lot 1 DP 629491
90	Past, Prot. Boad	Crown Reserve 156
✓91	Gardiner AL	Pors 6, 263, 264, 265 DP 750926
92	Bengalla Mining Co	Lot 5 DP 801249
93	Pearce GB	Lot 3 DP 801249
✓94	Gamper HJ & JA Ellul	Lot 2 DP 801249
✓95	Coal & Allied	Lot 1 DP 801249
100*	McLean & Ors	Part Portion of Lot 1/3 DP 998477
103*	Bengalla Mining Co	Part Portion of Lot 8 DP 236668 Lot 92 DP 620639
104*	Bengalla Mining Co	Part Portion of Lot 7 DP 236668
118	Vacant Crown	Part Portion 27
✓121	Skippen SE	Portion 282 DP 750926
124	Bengalla Mining Co	Lot 261 DP 561919
✓126	Coal & Allied	Vol 2802 Fol. 28
✓132	Coal & Allied	Lot 7 DP 749716
✓134	Coal & Allied	Lot 6 DP 749716
✓136	Budden GB & DM	Lot 5 DP 749716
✓137	Budden GG & PE	Part Port 3, Lot 10 Rosebrook Estate
✓138	Coal & Allied	Lot 1&2 DP 706645
216*	Bengalla Mining Co	Part Portion of Lot 97 DP 750919

Notes: 1. *Refer to* Figure 66 *in EIS.*
✓ *indicates residence*

Table H.3 SUMMARY OF NOISE AFFECTED RESIDENCES

Property No. (1)	Property Owner	Property No. (1)	Property Owner
8a.	Dartbrook Joint Venture	115a.	Steman LH
8b	Dartbrook Joint Venture	115b	Steman LH
8c	Dartbrook Joint Venture	121.	Skippen SE
13.	Dartbrook Joint Venture	124.	Bengalla Mining Co
14.	Dartbrook Joint Venture	125.	Bengalla Mining Co
16.	Casey GM	126.	Coal & Allied
22.	Lonergan JA	130.	Moore C & JM
25.	Fell CM	131.	Moore DL & PA
27.	Casey JO	132.	Coal & Allied
29a	Kayuga (1827) P/L	134.	Coal & Allied
29b	Kayuga (1827) P/L	135.	Marshall DJ
31.	Coal & Allied	136.	Budden GB & DM
32.	Coal & Allied	137.	Budden GG & PE
33.	Coal & Allied	138a.	Coal & Allied
34.	Lonergan PJ	139.	Brotherton R L
35.	Watts WF & PJ	141.	Gray ML
43.	Coal & Allied	142.	Coal & Allied
44.	Coal & Allied	143.	Barry TD
48.	Farrel MJ	144.	Coal & Allied
50.	Yore KJ & GM	145.	Coal & Allied
57.	Lecky KG & JA	146.	Chalker BGM & JA
58.	Turner G	147.	Gibson JS
59.	Blake T J	148.	Gibson JS
63.	Bates CF & GP	149.	Wilton BL
66a.	Rosebrook P/L	150.	Coal & Allied
66b.	Rosebrook P/L	151.	Coal & Allied
67.	Coal & Allied	152.	Hayes MA
69.	Schlegel JG & FA	153.	Coal & Allied
75.	Hugo D & J	154.	Mather AJ
76.	Bengalla Mining Co	155.	Austin C
77.	O'Keefe OJ & Others	156.	Collins WF
83.	Hamson L & C	157.	Gray RP
84.	Bengalla Mining Co	158.	Coal & Allied
85.	Lawrence R & M	159.	Seaby EA & MD
86.	Bengalla Mining Co	160.	Roach FW & YL
87.	Bengalla Mining Co	161.	Coal & Allied
88.	Reynolds J	162.	Coal & Allied
89.	Bengalla Mining Co	163.	Jazipa P/L
91.	Gardiner AL	198.	Hoath C & N
94.	Gamper HJ & JA Ellul	201.	Paton G
95.	Coal & Allied		
99.	Bengalla Mining Co		
113.	Bengalla Mining Co		

Note: 1. *Property Number as shown on Figures 24 and 25.*

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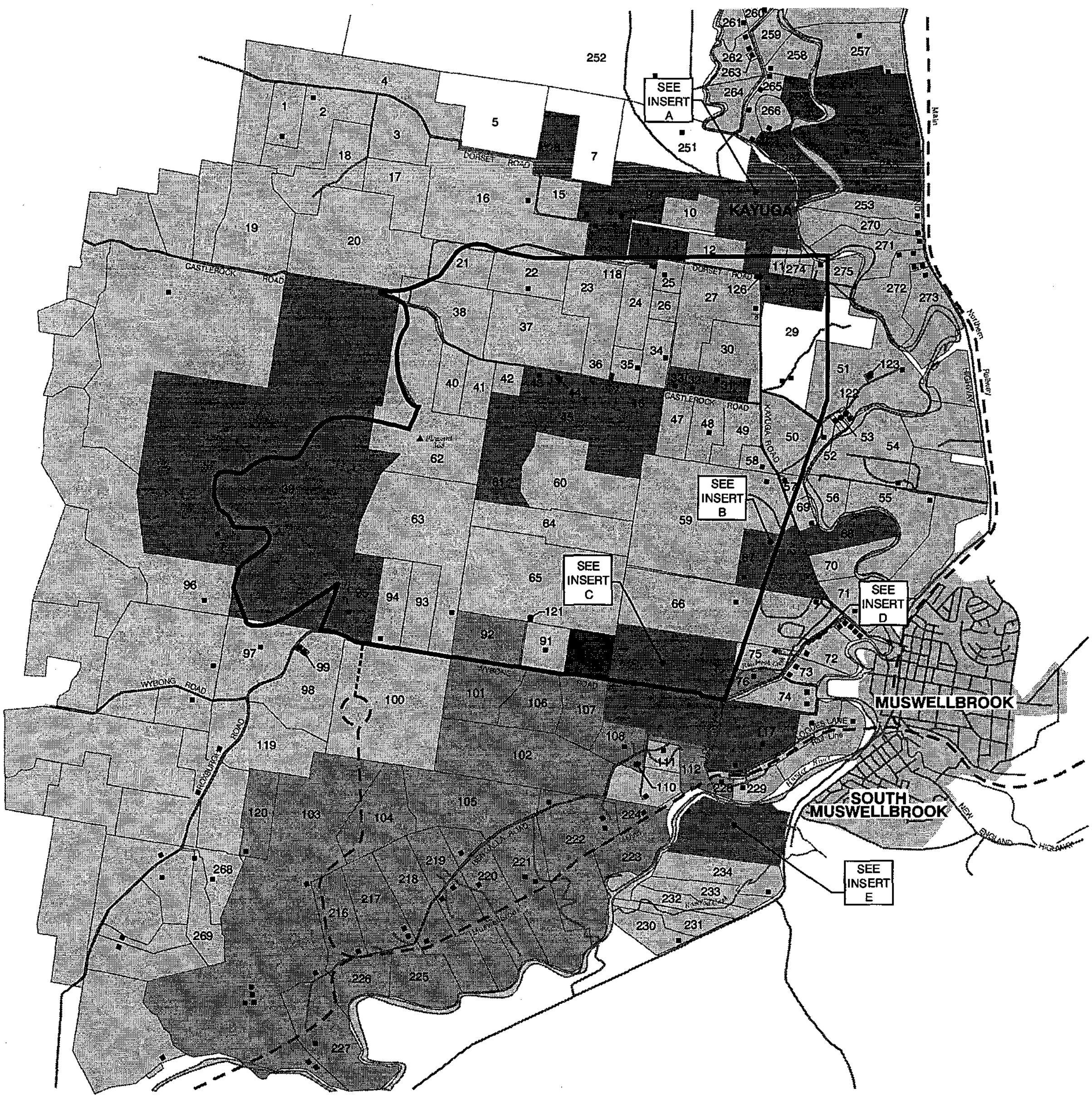
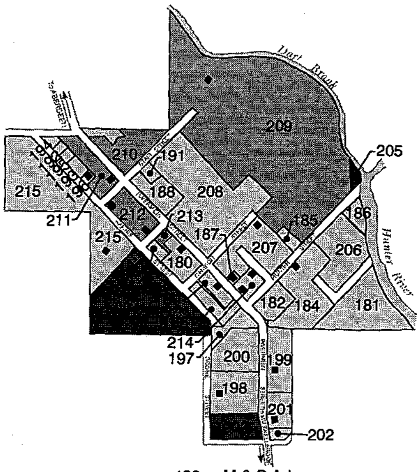


1 - R & J Kropp
2 - J A Lonergan
3 - W E Lonergan
4 - J A Lonergan
5 - Kayuga (1827) P/L
6 - Dartbrook Joint Venture
7 - Kayuga (1827)P/L
8 - Dartbrook Joint Venture
9 - Dartbrook Joint Venture
10 - J E & M S Ducey
11 - J & N M Lonergan
12 - J & N M Lonergan
13 - Dartbrook Joint Venture
14 - Dartbrook Joint Venture
15 - G M Casey
16 - G M Casey
17 - J A Lonergan
18 - J O Casey
19 - J E & J L Lonergan
20 - J S, J E & N M Lonergan
21 - J & N M Lonergan
22 - J A Lonergan
23 - P J Lonergan
24 - W F & P J Watts
25 - W F & P J Watts
26 - G C & K M Collins
27 - J O & M M Casey
28 - Coal & Allied
29 - Kayuga (1827)P/L
30 - E J & J O Casey
31 - Coal & Allied
32 - Coal & Allied
33 - Coal & Allied
34 - P J Lonergan
35 - W F & P J Lonergan
36 - Temporary Common
37 - D J Partridge
38 - J A Lonergan
39 - Coal & Allied
40 - P J Lonergan
41 - D J Partridge
42 - P J Lonergan
43 - Coal & Allied
44 - Coal & Allied
45 - Coal & Allied
46 - Coal & Allied
47 - R M & S D Farrell
48 - M J Farrell
49 - G A & S Mather
50 - K J & G M Yore
51 - Dapkos P/L
52 - K J & G M Yore
53 - S Yore
54 - Dapkos P/L
55 - R J Wingett
56 - Globe Wines
57 - K G & J A Lecky
58 - G Turner
59 - T J Blake
60 - L G J & M E Daniels
61 - Coal & Allied
62 - W F & P J Watts
63 - C F & G P Bates
64 - E O & D P Watson
65 - G J Scriven
66 - Rosebrook P/L
67 - Coal & Allied
68 - Coal & Allied
69 - J G & F A Schlegel
70 - Oafox P/L
71 - Oafox P/L
72 - R K & N V Googe
73 - M A & R E McLean
74 - C & VP Horne
75 - D & J Hugo
76 - Bengalla Mining Co
90 - Pastural Protection Board
91 - A L Gardiner
92 - Bengalla Mining Co
93 - G B Pearce
94 - H J Gamper & J A Ellul
95 - Coal & Allied
96 - B & L Bates
97 - J B Moore
98 - M J & M E Smith
99 - Bengalla Mining Co
100 - McLean & ORS
101 - Bengalla Minng Co
102 - Bengalla Mining Co
103 - Bengalla Mining Co
104 - Bengalla Mining Co
105 - Bengalla Mining Co
106 - Bengalla Mining Co
107 - Bengalla Mining Co
108 - Bengalla Mining Co
110 - Bengalla Mining Co1
111 - F J, D J & J M Carter
112 - Bengalla Mining Co
117 - Coal & Allied
118 - Vacant Crown
119 - J B & H R Hofman
120 - Bengalla Mining Co
121 - A R Skippen
122 - D L Yore
123 - R W & L P Upton
126 - Coal & Allied
216 - Bengalla Mining Co
217 - Bengalla Mining Co
218 - Bengalla Mining Co (Exchanged Contract)
219 - Bengalla Mining Co (Exchanged Contract)
220 - Bengalla Mining Co
221 - Bengalla Mining Co
222 - Bengalla Mining Co
223 - Bengalla Mining Co
224 - Bengalla Mining Co
225 - Bengalla Mining Co
226 - Bengalla Mining Co
227 - Bengalla MiningCo (Exchanged Contract)
228 - Bengalla Mining Co
229 - Jaberton P/L
230 - Electricity Commission of NSW
231 - Peabody Bengalla Investments
232 - J R Scriven
233 - R N & F Webber
234 - Reline P/L
251 - Kayuga (1827) P/L
252 - Kayuga (1827) P/L
253 - G R & E A Medhurst
254 - Dartbrook Joint Venture
255 - Dartbrook Joint Venture
256 - Dartbrook Joint Venture
257 - K L & H R Day Pty
258 - R L & C E Thompson
259 - D G Neely
260 - F A Wheatley & Son P/L
261 - B W & F G Clifton
262 - T J & M L Power
263 - R J & M R Page
264 - Pitnacree (Blairmore) P/L
265 - C S & B Wallus
266 - A L & J A Devine
267 - Dartbrook Joint Venture
268 - G W & G M Collins
269 - O G & C M Lane
270 - D J & E T Hulbert
271 - K P & A J Knight
272 - T O'Brien
273 - G M & K L Smith
274 - J O Casey
275 - J & N Lonergan

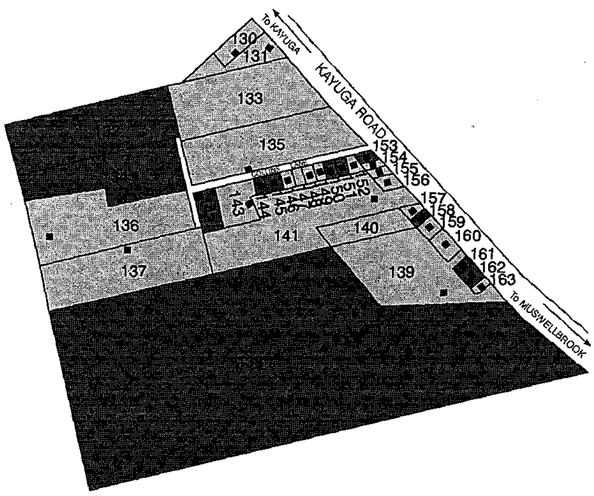
PROPERTY BOUNDARIES

0 2km



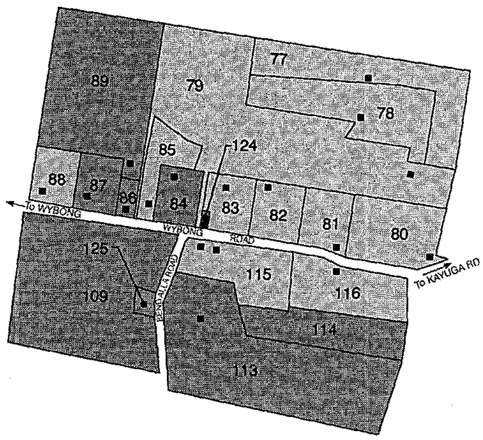
180 - J & J Lonergan
181 - J Lonergan
182 - J O Casey
183 - R B & S A Parkinson
184 - I M Hallet
185 - I M Hallet
186 - I M Hallet
187 - M B Lonergan
188 - Estate Late V Lonergan
189 - Estate Late V Lonergan
190 - Estate Late J H Sneesby
191 - Estate Late J H Sneesby
192 - Estate Late J H Sneesby
193 - Estate Late J H Sneesby
194 - M J Gaudie
195 - M J Gaudie
196 - P & F Standing
197 - C & N Hoath
198 - C & N Hoath
199 - M & R Adnum
200 - M & R Adnum
201 - G Paton
202 - A & H Paton
203 - Muswellbrook Council
204 - Denman/Singleton Rural Lands Protection Board
205 - Crown
206 - J S & N M Lonergan
207 - J S & N M Lonergan
208 - J S & N M Lonergan
209 - Dartbrook Joint Venture
210 - Dartbrook Joint Venture
211 - Dartbrook Joint Venture
212 - Dartbrook Joint Venture
213 - Dartbrook Joint Venture
214 - J & M Ducey
215 - J & M Ducey

INSERT A



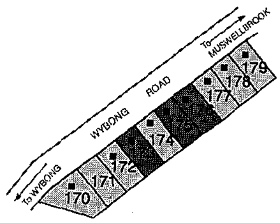
130 - C & J M Moore
131 - D L & P A Moore
132 - Coal & Allied
133 - Jim Hayes
134 - Coal & Allied
135 - D J & T L Marshall
136 - G B & D M Budden
137 - G G & P E Budden
138 - Coal & Allied
139 - R L Brotherton
140 - M L & K A Gray
141 - M L Gray
142 - Coal & Allied
143 - T D Barry
144 - Coal & Allied
145 - Coal & Allied
146 - B G M & J A Chalker
147 - G H & J T Bennett
148 - J S Gibson
149 - B L Wilson
150 - Coal & Allied
151 - Coal & Allied
152 - M A Hayes
153 - Coal & Allied
154 - A J Mather
155 - C Austin
156 - W F Collins
157 - R P Gray
158 - Coal & Allied
159 - E A & M D Seaby
160 - F W & Y L Roach
161 - Coal & Allied
162 - Coal & Allied
163 - Jazipa P/L

INSERT B



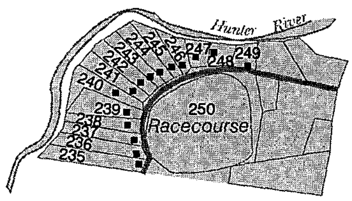
77 - O J O'Keefe and Others
78 - K & M Thompson
79 - A & A Riley
80 - G J Scriven
81 - P & B McKinnon
82 - N & R Ellis
83 - L & C Hamson
84 - Bengalla Mining Co
85 - R & M Lawrence
86 - Bengalla Mining Co
87 - Bengalla Mining Co
88 - J Reynolds
89 - Bengalla Mining Co
109 - Bengalla Mining Co
113 - Bengalla Mining Co
114 - Bengalla Mining Co
115 - L H Steadman
116 - D & R McLean
124 - Bengalla Mining Co
125 - Bengalla Mining Co

INSERT C



170 - J M Simpson
171 - R B Parkinson
172 - V C & N A Georga
173 - Coal & Allied
174 - R J Galvin
175 - Coal & Allied
176 - Coal & Allied
177 - A J Ingram
178 - W W Clark
179 - B R & J M Ellis

INSERT D



235 - B D & J Englebrecht
236 - M & D Ulrich
237 - I Q & G Z Gothard
238 - J A & L J Lamb
239 - R J & R D Quinell
240 - N H Boyle
241 - W & B Hopmans
242 - A & C Hopmans
243 - N B M C McInerney
244 - P M Farrell & Others
245 - C & R Pryor
246 - J L Bowen
247 - M J McGoldrick
248 - K B & J A Barnett
249 - D P Englebrecht
250 - Upper Hunter Racing Club Limited

INSERT E

⇧ *Not to Scale*

PROPERTY BOUNDARIES INSERTS

— Mount Pleasant Mine - All Years

— Kayuga Mine - All Years

Cumulative Effects Envelope

- - - Bengalla Mine - All Years

0 2km

PROPERTIES AFFECTED BY AIR QUALITY

50

Mount Pleasant Mine - All Years

Cumulative Effects Envelope

Kayuga Mine - All Years

Bengalla Mine - All Years

CUMULATIVE NOISE AND AFFECTED PROPERTIES

0 2km

— Mount Pleasant Mine Effects Envelope

— Mount Pleasant Survey Boundary

0 2km

PROPERTIES AFFECTED BY NOISE AND AIR QUALITY

— Mount Pleasant Mine - All Years

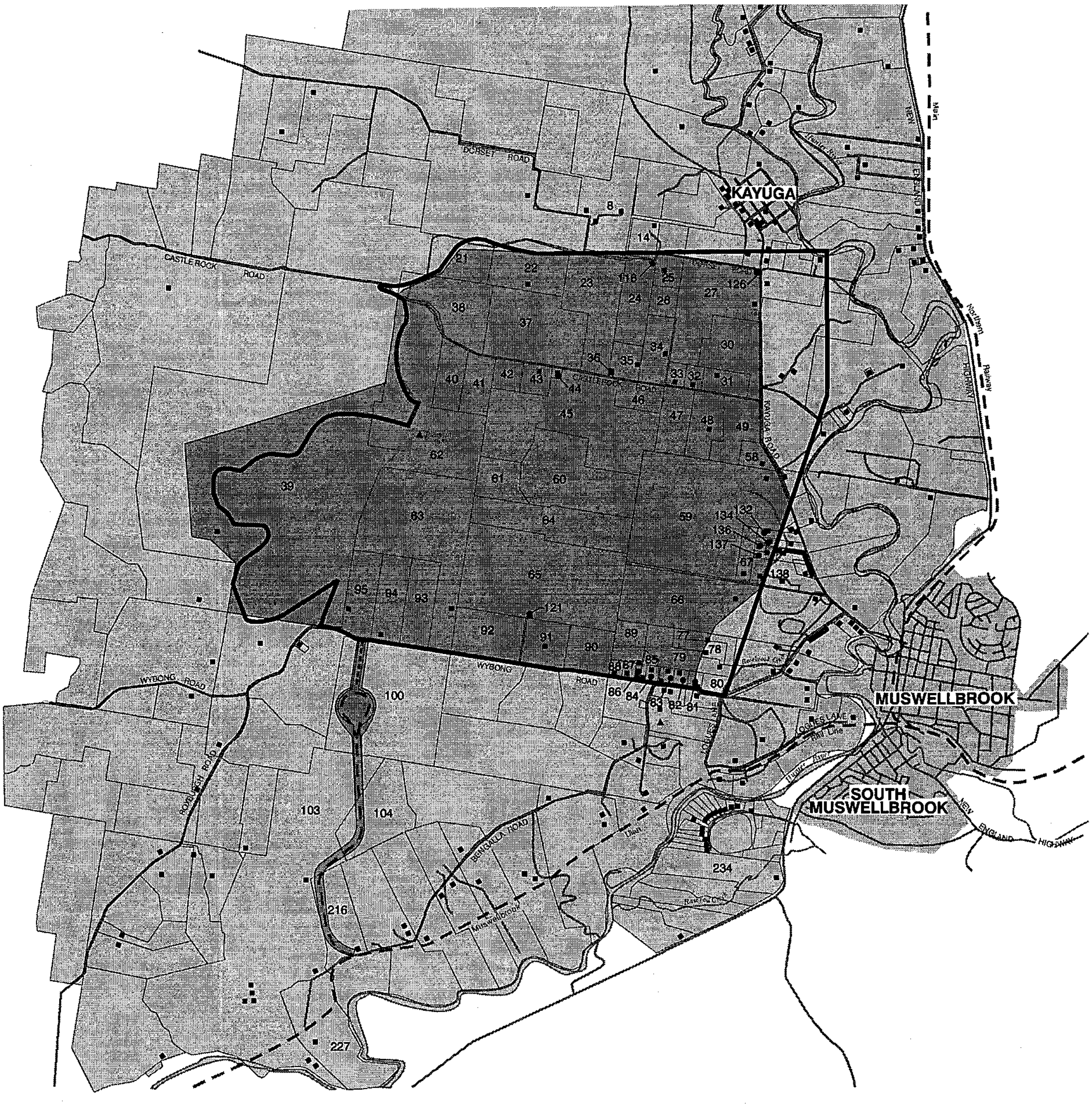
■ Cumulative Effects Envelope

— Kayuga Mine - All Years

- - Bengalla Mine - All Years

CUMULATIVE EFFECTS ENVELOPE

0 2km



Note: Refer to Table H.2 for Detailed Property Descriptions

DEVELOPMENT APPLICATION AREA

0 2km