



SYDNEY CONSTRUCTION MATERIALS

Trading name for Newnes Kaolin Pty Ltd
ABN: 71 065 564 794

ENVIRONMENTAL IMPACT STATEMENT

**MULTI-COMMODITY SAND EXTRACTION AND
KAOLIN PROJECT FOR SUPPLY OF
CONSTRUCTION MATERIALS TO THE
SYDNEY REGION FROM NEWNES PLATEAU**



- Construction Sand
 - Ready mixed concrete
 - Concrete products
- Kaolin Products
 - Bricks, Tiles, Pavers
 - Ceramics
 - Concrete additives
 - Refractory products
 - Fillers
- Specialty Sands
 - Glass
 - Filter media
 - Silica fillers
 - Landscaping

MAY 2003

International Environmental Consultants Pty Ltd



Declaration

Project: Newnes Kaolin Mine
Environmental Impact Statement

Proponent: Newnes Kaolin Pty Limited

I certify that I am responsible for the preparation of this Environmental Impact Statement and to the best of my knowledge:

- ☐ it is in accordance with clauses 72, 73 and Schedule 2 of the *Environmental Planning and Assessment Regulation 2000*, and
- ☐ it is true in all material particulars and does not, by its presentation or omission of information, materially mislead.

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Newnes Junction Kaolin Mine EIS

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1. Executive Summary

This section provides a summary of the environmental assessment process for the proposed extraction of friable sandstone at Newnes Junction. The conclusions made following the study are also summarised below.

1.1 Project Overview

Newnes Kaolin Pty Limited (NKPL) proposes to develop an open pit operation to extract and primary crush friable sandstone at Newnes Junction, on the Newnes Plateau some 10 km east of Lithgow, between the existing Clarence Colliery and Rocla Quarry (see **Plate 1** and **Figure 2.1**). The primary crushed sandstone is to be transported off-site for subsequent extraction and processing of the constituent minerals - kaolin and silica sand. Off-site processing and beneficiation will yield a range of industrial minerals and construction materials.

This Environmental Impact Statement (EIS) covers the extraction and primary crushing of the friable sandstone resource on site and the delivery of the material to the Clarence Rail Loop for transport to Sydney for further processing. This downstream processing will be the subject of a separate EIS and is only addressed conceptually in this document. A number of sites within the Greater Sydney Area have been identified and are the subject of ongoing commercial negotiations.

NKPL holds Exploration Licence 4192 (EL4192) that covers a deposit of high quality friable sandstone with a kaolin matrix. The Newnes Junction area has not been previously worked for industrial minerals (kaolin and industrial grade silica sand), although adjacent areas are currently being extensively quarried for construction sands. The proposed development is located adjacent to three existing extractive industries, these being the Rocla sand quarry immediately south, the Clarence Colliery immediately north, and Pioneer's sand quarry to the north west. These existing quarrying and mining operations comprise a concentration of extractive industries on the eastern margin of the Newnes Plateau.

Exploration work conducted to date has indicated that the kaolin and silica sand are of high quality and of considerable commercial value. NKPL has applied for a Mining Lease over a portion of EL4192 for kaolin, as well as an extractive industries licence to cover extraction of industrial and construction grade, silica sands to allow commercial development of this multi-commodity resource.

The proposal consists of developing an open pit extractive operation on the ridgeline between the Rocla quarry to the south and Clarence Colliery pit top to the northwest. The village of Newnes Junction is located to the southwest and currently contains six dwellings with several undeveloped blocks and road and rail infrastructure. To the east, the site is bordered by the Blue Mountains National Park, which is part of the Blue Mountains World Heritage Area.

The resource and its location are unique in terms of geology and proximity to rail transport. The resource is a friable sandstone, traditionally quarried and processed as a source of construction sand. However, unlike other friable sandstone deposits located in relative proximity to Sydney Metropolitan market areas, the matrix clay content is dominantly pure kaolin. The clay matrixes of alternative friable sandstone deposits (at Maroota, Somersby, Penrose-Wingello and elsewhere) comprise a mixture of clay minerals that need to be separated and disposed of as waste during sand processing. The Newnes sandstone is unique in that all constituent minerals have commercial value. Unlike any other friable sandstone operation in the Sydney Basin area there will be no on-site washing operations nor settlement ponds and associated waste management issues.

Although the bulk of product sales will be to construction and industrial sand market sectors, the bulk of revenue will be derived from refined kaolin products from approximately year 5 onwards. This situation will result from increased kaolin yields and beneficiation as sand volumes increase. The project will be effectively sand and kaolin sales driven, with sales projections and detailed financial modelling based on extensive market research by highly experienced industry consultants.

The extractive industry proposed for the subject site is comparatively limited in extent, with secondary, tertiary and quaternary processing all to be undertaken off-site. Site operations will essentially comprise an open cut pit development, a small primary crushing operation, conveyors, stockpiles, and a train loading facility. Mobile plant will usually comprise one or more bulldozers, dump trucks, a front end loader and a water cart. Associated infrastructure will essentially comprise a site office and amenities and a water treatment plant. The location is ideal in that it is adjacent to an existing rail loop that facilitates the transport of the raw material to Sydney for processing.

While year one kaolin sales are projected at less than 30,000 tonnes, it is estimated that average sales will be around 96,300 tpa over the 21 year period of the initial mining lease and the maximum annual tonnage will be in the order of 119,000 t. Kaolin product will be supplied to the building materials industry, the ceramic and refractories industries, as well as being sold as a cement pozzolan and as a mineral filler.

Silica sand sales (including gravel and silt fractions) are projected to increase from less than 300,000 tonnes in year one to an average of nearly 1.034 Mtpa over the 21 year period, peaking at 1.28 Mtpa. Sales of premium quality, fully graded sand to the construction industry will account for an average 90% of total sand sales, with the bulk of these going to the ready mixed concrete and concrete product sectors. High quality industrial sands will be principally sold for glass manufacture and as filter medium.

With the gravel and silt components included, maximum production is anticipated to be 1.4 Mtpa.

1.2 Objectives of the Proposed Development

The objectives of the proposed extractive operation are to:

- ☐ develop the commercially viable resource of silica sand and kaolin at Newnes Junction to supply existing and projected shortages in the Sydney Metropolitan area;
- ☐ optimise the resource by off-site processing and beneficiating all of the constituent minerals into saleable products;
- ☐ establish a long term source of white firing industrial grade kaolin in relative proximity to Sydney markets currently supplied from remote NSW localities, interstate and/or, from overseas;
- ☐ develop and manage the proposed operation in a manner that minimises associated environmental and social impacts;
- ☐ undertake extraction in a way that will result in a well drained, stable landform able to be successfully and progressively rehabilitated;
- ☐ provide direct long-term employment for 6 to 10 people at Newnes Junction and 12 to 15 people in Sydney; and
- ☐ provide indirect employment to a substantial number of drivers, tradesman, suppliers, consultants and other associated persons, both in Sydney and in the local region.

1.3 Description of the Proposed Extractive Operation

The project represents a significant advancement in resource utilisation and value adding which has not been previously available in the Lithgow region. Plans presented in this EIS cater for the extraction of an estimated 23.7 Mt of reserves over the next 21 years. It is estimated that there will be sufficient reserves remaining at the site after 21 years to support a subsequent application for a further six to twelve year operation. The proposed open cut operation covers an area of 25 ha, adjacent to three existing quarry / mine operations.

Key activities at the site will involve:

- ☐ removing and stockpiling of topsoil using bulldozers;
- ☐ extracting friable sandstone in a series of shallow benches by ripping and/or excavating with bulldozers;
- ☐ loading ripped sandstone to haul trucks for transport to the crushing station;
- ☐ primary crushing ripped sandstone at the crusher station;
- ☐ dust suppression using water carts;

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- ☐ conveying material to covered stockpiles before removal off site via train to the processing site; and
 - ☐ progressive rehabilitation of the small benches with native species.

Friable sandstone will be won by selectively ripping a series of shallow benches using a bulldozer. Ripped material will be stockpiled using front-end loaders to be subsequently trucked to the primary crusher and conveyed to covered stockpiles. From here the crushed sandstone will be conveyed to a surge bin adjacent to the Clarence railway loop and loaded onto trains for transportation to the processing site in Sydney.

Sandstone extraction is scheduled to be conducted in a number of stages, progressing in a north to south direction. Rehabilitation of the pit walls will be carried out progressively with the completion of each bench of mining.

Since secondary, tertiary and quaternary processing of crushed sandstone will be conducted off site, large stockpiles of material will not be required on site. However, there will be temporary stockpiling of material in-pit before rail transportation to the Sydney processing site.

Proposed hours of operation will be 10 hours per day, 5.5 days per week and 50 weeks per year.

1.4 Pit Production and Sales

The Company is planning a staged entry into the market, with progressive increases in production up to 1.4 Mtpa.

Capital investment in processing and product beneficiation plant in the Sydney area will be linked to market demand for the individual sand and kaolin products to be produced. Initial investment will be for plant capable of processing crushed sandstone to produce:

- ☐ building material and ceramic clays (white firing clays), and metakaolin (cement pozzolan);
- ☐ construction sand (quartz sand);
- ☐ pea gravels (landscaping);
- ☐ filter sand (quartz sand);
- ☐ silica flour; and
- ☐ glass sand (flint grade).

Plant design will be modular in order to allow additional processing and beneficiation plant to be installed as higher value product quality is proven and markets penetrated /

captured.

1.5 Project Justification

A large part of the justification for developing the Newnes Junction resource relates to its unique geological characteristics and location relative to established extractive industries, transport links and markets. These factors in turn relate to the:

- ☐ size and extractability of the friable sandstone resource;
- ☐ relative lack of iron concentrations and induration compared to alternative resource areas on the Newnes Plateau (Pecover 1986);
- ☐ quality and ‘fully graded’ characteristics of resultant sand products;
- ☐ high quality of diagenetic kaolin present in the sandstone as matrix;
- ☐ location adjacent to established sand quarries and the Clarence Coal Colliery;
- ☐ ability of the proponent to develop, operate and rehabilitate the site in an environmentally sustainable manner;
- ☐ possibility of developing a joint rehabilitation and end use strategy in conjunction with adjacent mining and quarrying operators;
- ☐ proximity to an existing rail siding providing a direct rail link to off-site processing locations and Sydney Metropolitan area markets;
- ☐ quality and range of industrial minerals and premium quality construction sands able to be produced;
- ☐ current and growing regional demand for products to be made available after processing;
- ☐ finite and diminishing availability and supply of premium quality, industrial and construction sands (particularly fully graded construction sands within the greater Sydney Metropolitan area; and
- ☐ non-availability of any substantial quantities of equivalent quality kaolin within the Sydney Metropolitan area;

The project represents a significant advancement in resource utilisation, product beneficiation and value adding when compared to conventional friable sandstone quarries supplying product into Sydney markets. The project is considered further justified by:

- ☐ resource optimisation (with little or no waste product); and
- ☐ impact minimisation (with off-site processing and limited, if any, requirement for settling ponds).

Thus, key planning decisions made by the proponent in formulating this application include provision for:

- ☐ transport of all raw material to a processing site in the Greater Sydney Region;
- ☐ location of the operation adjacent to a rail loop with easy loading facilities;
- ☐ a substantial land buffer between the operation and the adjoining Blue Mountains National Park;
- ☐ full containment of the 1 in 50 year storm event;
- ☐ development of a unique terraced landform allowing early and progressive rehabilitation; and
- ☐ commencement of extraction at the furthest point away from residences in Newnes Junction.

1.6 Planning Issues

The project is subject to both State and Commonwealth environmental legislation.

The provisions of the *Environmental Planning and Assessment Act 1979* determine the EIS process for this proposal. The proposed extractive industry is a designated development under Schedule 3 of the Environmental Planning and Assessment Regulation 1994. The development therefore requires planning consent and, being designated development, an EIS must be prepared to accompany the Development Application.

The proposal is also of State Significance and has been called in by the Minister for approval under Section 76A(7) of the Environmental Planning and Assessment Act. Consequently, the State's determining authority will be the Minister for Infrastructure and Planning.

Since the proposed open pit development is located near the Greater Blue Mountains World Heritage Area, the *Environment Protection and Biodiversity Conservation Act 1999* may apply and therefore the project has been referred to Environment Australia for its consideration and has been determined to be a "Controlled Activity".

1.7 Key Environmental Issues

This EIS for the proposed development represents a culmination of a wide variety of environmental investigations addressing the key environmental issues associated with the mining activities. NKPL have adopted a proactive approach to environmental management from the outset of the project by undertaking both engineering and environmental studies concurrently. This enabled decisions identified during the environmental assessment studies to be incorporated into the design of the open pit.

Consequently, effective mitigation measures have been incorporated into the project from the outset, limiting the environmental impacts associated with the development.

The key environmental issues for the Newnes Kaolin Project include hydrology and water quality, noise, dust, flora, fauna, archaeology, and traffic and transportation. Specialist consultants were engaged to undertake the necessary environmental studies in these areas. The results are summarised in the following sections.

1.7.1 Hydrology and Water Quality

A surface and ground water study has been prepared (see Section 6 of the EIS) and to manage water on site, clean and dirty water flows will be separated. The surface water management system has been designed to minimise clean water inflow by constructing diversion channels as necessary. The dirty water system has been designed to fully contain and treat all the 50 year ARI, 72 hour storm event.

Given that the ore will be transported offsite for processing, there will be little requirement to store or manage process water on site. Water contained in the pollution control structures will be used for dust suppression. Water treatment systems will be employed prior to any controlled discharge to enhance settlement of the very fine clay particles (which is high quality product) and enable the water quality to meet discharge requirements.

Groundwater inflows have been modelled and incorporated into the design of the pollution control system. Depth to the potentiometric surface over the site area could be expected to be at a depth from ground surface in the range of less than 2 m to 25 m. These depths, however, are consistent with the emergence of seepages in the lower lying sections of the drainage gullies that cross the western boundary of the site. Final pit inflow is expected to average around 0.2 ML/day, but the major proportion of this is expected to be lost via evaporation from the high walls of the pit and storages within the floor of the pit. No groundwater would exit the pit during active mining operations since the watertable gradient will be directed toward the pit.

As groundwater flows into the pit, the watertable will be lowered progressively around its periphery. The drawdown will migrate outwards from the pit until it reaches equilibrium. Outside this zone of influence the groundwater flow directions will remain unaffected and unchanged from pre-mining flow directions. It is anticipated that the proposed pit will not have any hydraulic effect on the groundwater system within the Clarence Village.

Any significant drawdown influence will be restricted to within about 500 m or so from the pit under maximum development. Ultimate steady state conditions will be reached within a year or so once the 21-year pit floor depth has been achieved. Note however, that these are predicted maximum levels, which will develop slowly over time as the mining progresses.

Drawdown around the periphery of the pit will not affect vegetation since these species rely largely on soil moisture. This is verified by the sound condition of tree species evident in the areas surrounding the adjacent Rocla quarry pit where drawdown conditions also occur.

The drawdown influence on the tributary streamflow will also be small. Some baseflow and surface water seepage will be lost to the easterly drainage gullies, but the volume would not be measurable in the lower reaches of the main draining tributaries. Any change would be well within that created naturally by climatic variations. No groundwater would exit from the pit during active sandstone extraction operations since the watertable gradient will be directed toward the pit.

Once extraction ceases the resultant voids will fill with groundwater, rainfall and rainfall runoff. Filling of the pit will occur until a new equilibrium is established between the ponded water depth, evaporation and natural groundwater seepage. It is currently proposed that a new lake system will be finally established as regrowth occurs and natural seepage of good quality water re-enters the catchment area. The rehabilitation plan is flexible and will enable alternative final landforms to be developed if appropriate. These alternatives include a free draining model. The final alternative will be developed with the Department of Mineral Resources in consultation with other government agencies.

Effects on groundwater will be monitored by the construction of three bores fitted with piezometers for sub surface monitoring, located progressively to the west. Water level measurements initially be conducted on a monthly basis in each hole over time to establish seasonal trends and then at 3 monthly intervals to verify the impacts predicted.

1.7.2 Noise

A noise impact assessment, carried out by Atkins Acoustics, is contained in full in Appendix G and summarised in Section 6. The study showed that the extractive operation will meet acceptable noise impact assessment criteria for the first four stages, however noise exceedences will occur on a section of the Newnes Junction community in later years of operation.

Prior to operations commencing, an Environmental Management Plan (EMP) for the Mine will be prepared. This will include a “Noise Management Plan” (NMP) that will involve noise monitoring during initial stages of pit development to confirm noise levels and, where required, assess the practicability of additional noise controls. Subsequent annual noise audits would be undertaken if considered necessary to ensure that all noise control measures are installed and maintained, and that the environmental noise levels (criteria) are satisfied. The program shall incorporate a complaint management protocol that facilitates investigation and addressing of noise related complaints.

The noise assessment undertaken as part of this EIS has shown that Stages 1 to 4, that is the first nine years of an estimated twenty-one year lifespan of the mine generally comply with the recommended noise goals, with possible technical exceedences of 1-2dB(A), considered marginal. Noise predictions during the final extraction for all stages, has shown that the recommended goals are satisfied at 5 Sandham Road (R1). However, during Stage 5 noise exceedences of 3-5dB(A) (calm) and 1-3dB(A) (west wind) are predicted at Sandham Road (R2).

The proponent (Newnes Kaolin Pty Ltd) has consulted with the local community comprising six residential premises on Sandham Road, and discussed potential mitigation strategies including purchase.

1.7.3 Dust and Air Quality

Air quality in the proposed pit area is considered good. The current air quality in this area would be influenced mainly by local industries and residential development in the area.

An air quality study was undertaken by Holmes Air Sciences assessing the air quality impacts due to the proposed extractive operation. Results from dispersion modelling indicate that off-site dust impacts would be minimal and that the proposed operations would contribute very little to existing dust levels in the area. These estimates assume some control of dust emissions is achievable through the use of watering carts on all unsealed haul roads and by enclosing some of the processing areas.

Compliance with air quality goals would be expected during all stages of the proposed extractive operations.

1.7.4 Traffic and Transportation

It is proposed to transport the material off-site through the rail transport system, which is considered to be the most environmentally responsible option. There is an existing rail loop associated with Clarence Colliery, which is used currently to transport coal to Port Kembla. A purpose designed train loader will be constructed adjacent to the existing coal loader.

A reclaim system and conveyor will be designed with a new train loader located adjacent to the existing Clarence Colliery coal loader. It is intended to use similar rail wagons to those commonly used for coal. The loading system is anticipated to be a continuous, automatic, flood loading system. The Newnes Junction Rail Loop is a Class "A" system and a unit train holds 3,000 t. It is anticipated that 9 unit trains will be required per week.

The operation of the reclaim system, the train loading conveyor and the train loader will all be interlocked, automatic and controlled from the train loader control cabin by the operator.

1.7.5 Flora and Fauna

A flora and fauna survey was conducted over the proposed development site and identified one vegetation community within the study area, the Silvertop Ash – Sydney Peppermint Forest. During the initial surveys the vegetation showed signs of severe devastation due to the 1997 wildfire that swept across the Newnes Plateau. Further surveys were conducted in 2003 to update the surveys and conduct further targeted searches for rare or threatened species that may have colonised the area since the initial surveys. No rare or threatened species were identified on site, and it is considered that if present in the surrounding area, the resulting impact would be negligible.

The potential fauna habitat type that has been identified in the area of the proposed development is open forest. Few fauna species were detected during the survey and no rare or threatened species were found. No areas of critical habitat are present.

The proposed development is therefore considered unlikely to have a significant impact on the flora and fauna of the region, and no rare or threatened species will be impacted on.

1.7.6 Aboriginal and European Cultural Heritage

An archaeological survey was conducted in the area, in consultation with the Bathurst Local Aboriginal Land Council. No sites or areas of potential archaeological deposit were identified in the survey. The absence of sites may be the result of physical characteristics of the area.

Since no sites or areas of potential archaeological sensitivity were identified in the survey, it is concluded that there is no archaeological impediment to the project proceeding as planned.

1.7.7 Visual Issues

The main visual impacts associated with the project will occur from elevated remote vantage points surrounding the open pit development. This is the case for all industrial activities in the area, which can be invariably seen from the higher vantage points in the district. In this case, views of the site can, with some difficulty, be seen from elevated points within the adjacent Blue Mountains National Park / World Heritage Area. These locations are not easily accessible and when located, provide a view of the adjacent industrial sites also. This is also the case along other sections of the park boundary that abut residential areas, agricultural land, industrial sites and major public infrastructure.

Views of the pit area from residential receptors in Newnes Junction will be mitigated by intervening vegetation that will be maintained throughout the life of the operation, and augmented as necessary. A buffer zone between the proposed development area and the Blue Mountains National Park has been incorporated into the design of the proposed extractive operation. Although the project will result in some visual impacts, the net effects are considered acceptable.

1.7.8 Soils

The soils within EL4192 are sandy, shallow and well drained. The sub-strata across the site is predominantly weathered, medium grained, cream to white sandstone. A characteristic of this sandstone is that it forms a thin hardened surface crust, rarely exceeding a few millimetres, which mantles a friable, crumbly sandstone with a clay matrix of kaolin. There are no outcrops of sandstone visible in the proposed development area. Soils derived from the friable sandstone are low fertility sandy soils with a moderate to extreme erosion hazard.

1.7.9 Socio-economic Impacts

The proposed development will employ a number of workers during both the construction and operational phases. The construction workforce will be a skilled team employed to carry out specialised work. It is anticipated that the workforce employed during construction will include local contractors.

The proposed operation will result in direct long term employment opportunities for approximately 6 to 10 people, some of whom may be drawn from the local Newnes Junction village providing the relevant skills are available. Off-site processing and administration will provide direct employment for a further 12 to 15 people in Sydney as well as indirect employment to truck drivers, tradesmen (electricians, mechanics, fitters, plumbers etc), suppliers (fuel, consumables, spare parts, stationery etc), consultants and so on. Tradesmen, suppliers and consultants will also be required at Newnes Junction.

It is anticipated that the workforce at Newnes Junction will be locally available, as evidenced by the high proportion of unemployed people in the region, many of whom will have mining and/or quarrying experience. Consequently, with the exception of some management staff, it is expected that project employment can be mainly satisfied from the surrounding region with little or no in-migration.

1.7.10 Land Ownership and Use

The majority of land designated for the proposed development is located on Crown land, vegetated with eucalyptus woodland and used primarily by the local residents to access the adjacent Blue Mountains National Park. The proposed conveyor route from the mine to the existing Clarence rail loop, and the rail loading facilities would be located on land leased by Centennial Coal Company. The land was formally owned by the Commonwealth (Department of Defence) and title has been recently transferred to Lithgow City Council. Transfer of the land to Centennial Coal Company is now underway.

The site has little agricultural potential. Neighbouring land is used for coal mining, sand quarrying, recreation, environmental protection, residential dwellings, transport routes and forestry activities.

The proposed development would be confined to an area within EL 4192, located almost entirely on vacant Crown land. It will have minimal impact on surrounding land uses during the first three stages of extraction providing the mitigation measures outlined in this EIS are implemented. With the development of Stage 4, additional noise assessment will be required, based on measured data, to determine whether or not extractive operations can meet pre-determined noise criteria.

Noise modelling indicates that some of the residences may experience noise in excess of the stringent 35 dBA criteria. If required by either the planning consent or the affected residences, NKPL would propose to undertake additional noise mitigation works at the effected residential locations and/or agree to purchase the properties and/or negotiate alternative arrangements with landholders.

Following extraction of the friable sandstone resource and rehabilitation of the landscape, the future land capability of the site would be similar to that of the current site, although the topography would be different. The land could be used for recreational purposes or left as vegetated land as is currently the case.

1.8 Conclusion

This EIS has identified and assessed the key environmental issues relating to the proposed silica sand and kaolin extraction operation. As with all development projects, the proposed development will cause some environmental impacts. The purpose of this EIS is to identify and quantify these impacts, to assess their significance and to propose ameliorative measures to be undertaken to minimise and/or eliminate impacts.

The results of the various environmental investigations have demonstrated that most of the resultant impacts are within acceptable criteria, and the impact on the environment will be limited to within acceptable parameters as set down by the various statutory authorities. The main environmental cost of the development proceeding will be the impacts on some residents at Newnes Junction, particularly in the later stages of extraction when noise assessment criteria are expected to be exceeded.

Although the anticipated level of environmental impact has been determined as acceptable in the initial stages of development, it is important with any project of this type to monitor ongoing environmental performance. The ongoing environmental monitoring program will allow early identification and rectification of potential problems.

It is considered that the balance between environmental impacts and benefits resulting from the proposed development, strongly favour the development proceeding.

2. Introduction and Planning

This section provides background information on the proponent and an outline of the proposed development and its regional setting. The project objectives, the environmental planning and approval process and the consultation program for the development are also described.

2.1 Project Outline

Newnes Kaolin Pty Limited (NKPL) propose to develop an open pit operation to extract and primary crush friable sandstone at Newnes Junction, on the Newnes Plateau some 10 km east of Lithgow, between the existing Clarence Colliery and Rocla Quarry (see **Plate 1** and **Figure 2.1**). The primary crushed sandstone is to be transported off-site for subsequent extraction and processing of constituent kaolin and quartz sands.

This EIS covers the extraction and primary crushing of friable sandstone as well as the subsequent stockpiling, materials handling, conveying, train loading and dispatch of the primary crushed sandstone. The downstream processing of the primary crushed sandstone will be the subject of a further EIS and is addressed conceptually only in this document.

NKPL holds Exploration Licence 4192 (EL4192) covering investigations relative to the mineral kaolin which forms the matrix of the friable sandstone. Geological test work within this licence area has shown that the area contains deposits of a friable quartz sandstone that is highly weathered and consists of fine to coarse graded ('fully graded') quartz grains loosely bonded by a matrix of fine graded silt sized silica and kaolin. Deposits of friable sandstone on the Newnes plateau have not been previously worked for kaolin, although adjacent areas are currently being extensively quarried for concrete sand (Rocla and Kable Sands Quarries). Previous test work done by the Department of Mineral Resources (DMR) and others has proven that the kaolin is of high quality and has considerable, potential commercial value.

NKPL has applied to the Department of Mineral Resources (DMR) for a Mining Lease over a portion of EL4192 to allow for extraction of the friable sandstone resource as a prerequisite for off-site extraction of kaolin. NKPL has also applied to the Department of Land and Water Conservation (DLWC) for an Extractive Industries Licence over the same area to extract the friable sandstone for off-site processing of silica sand.

The proposal consists of developing a silica sand and kaolin extractive operation on the flank of the ridgeline running between the Rocla Quarry and Clarence Colliery pit top (see **Figure 2.2**). The proposed extraction area is bounded on the west by Clarence Colliery's rail loop, to the south by Rocla Quarry, to the north by a coal reject emplacement within the Clarence lease and to the east by the Blue Mountains National Park.

The proposed operation will produce kaolin and a high quality silica sand product.

Key activities at the site will involve:

- ☐ removal and stockpiling of topsoil using bulldozers;
- ☐ extraction of friable sandstone by ripping and/or excavating ;
- ☐ loading ripped sandstone to haul trucks for transport to the crushing station;
- ☐ primary crushing ripped sandstone at the crusher station; and
- ☐ conveying material to covered stockpiles before removal off site via train to the processing site.

Extraction will be undertaken in stages, with the activities progressing from the north to the south. Rehabilitation of the pit walls would be carried out progressively after the completion of extraction from individual pit benches.

Since the processing of the friable sandstone will be conducted off site, large stockpiles of material will not be required on site. However, temporary stockpiling of material will occur on site before the material is loaded for transportation to the processing site.

The proposed Mining Lease area will be developed as an open cut pit from which the friable sandstone will be extracted, a primary crushing and materials handling infrastructure area (containing conveyors and a crusher), a crushed sandstone stockpile as well a demountable site office and amenities block.

Friable sandstone will be won by selectively stripping and ripping a series of shallow benches using a bulldozer. Ripped material will be stockpiled using front end loaders. It will then be trucked to a small primary crusher and conveyed to covered stockpiles. From here the crushed sandstone will be conveyed to a surge bin adjacent to the Clarence railway loop and loaded onto trains for transportation to the processing site.

Heads of Agreement are in place between NKPL and Centennial Coal Company Limited to allow NKPL to install a loading facility and use the rail loop on a toll basis. The rail loop has more than sufficient capacity to cater for the colliery and NKPL operations both now and in the foreseeable future.

Other than the topsoil, all material extracted will be primary crushed then transported off-site for processing. There will be no waste generated at the Newnes Junction site by scalping or screening of fines and other material.

Whilst year one kaolin sales are projected at less than 30,000 tonnes, it is estimated that average sales will be around 88,000 tpa over the 21 year period of the initial mining lease. Kaolin product will be supplied to the building materials industry, the ceramic and refractories industries, as well as being sold as a cement pozzolan and as a mineral filler.

Silica sand sales are projected to increase from less than 300,000 tonnes in year one to an average of nearly 1.034 Mtpa over the 21 year period, peaking at 1.28 Mtpa. Sales of premium quality, fully graded sand to the construction industry will account for an average 90% of total sand sales, with the bulk of these going to the ready mixed

concrete and concrete product sectors. High quality industrial sands, will be principally sold for glass manufacture and as filter medium.

An off-site processing plant will be constructed within the greater Sydney region to process the material. NKPL is at an advanced stage in negotiating for the use of one of four possible sites identified to date, adjacent to rail, within the Sydney region. All of the identified sites have the required rail access and unloading facilities, stockpile capacity and sufficient area to house the processing plant. Two of them have approvals in place for the processing of sand and/or crushed sandstone. End products will be transported to markets by either road or rail. Approvals for this facility will be sought separately.

2.1.1 Development Objectives

The objectives of the proposed extractive operation are to:

- ☐ develop the commercially viable resource of silica sand and kaolin at Newnes Junction to supply existing and projected shortages in the Sydney Metropolitan area;
- ☐ optimise the resource by off-site processing and beneficiating all of the constituent minerals into saleable products;
- ☐ establishing a long term source of white firing kaolin in relative proximity to Sydney markets currently supplied from remote NSW localities, interstate and/or, from overseas;
- ☐ develop and manage the proposed operation in a manner that minimises associated environmental and social impacts ;
- ☐ undertake extraction in a way that will result in a well drained, stable landform able to be successfully and progressively rehabilitated;
- ☐ provide direct long-term employment for 6 to 10 people at Newnes Junction and 12 to 15 people in Sydney; and
- ☐ provide indirect employment to a substantial number of drivers, tradesman, suppliers, consultants and other associated persons, both in Sydney and (to a lesser extent) in the Newnes Junction areas.

2.1.2 EIS Objectives

The objectives of this EIS are to:

- ☐ identify and where possible, quantify the environmental impacts of the proposed mining operation to assist government authorities assess the project;
- ☐ identify appropriate environmental protection measures so that the proponent can develop an environmentally acceptable project; and

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- ❑ provide a basis for the development of ongoing environmental management and impact verification.

2.2 The Proponent

NKPL was formed for the specific purpose of developing an extractive industry operation including the ripping and primary crushing of the friable sandstone resource at Newnes Junction. The company has been formed to develop and manage the extraction and downstream processing of the resource as well as the marketing and sales of the refined sand and kaolin products. NKPL directors have retained the services of a number of highly qualified and experienced consultants in relation to all key aspects of the project. It is the intention of the company to develop the prospect into a world class industrial minerals and construction materials operation, producing a range of high quality kaolin and quartz sand products for sale to domestic and potentially international markets.

2.3 Development Application Area

The Development Application supported by this EIS covers all activities described in Chapter 3 as well as all environmental mitigation measures described in Chapters 5, 6, 7, and 8. The area covered by the Development Application is the same as the Mining Lease Application Area shown on **Figures 2.2 and 3.1 to 3.8**.

2.4 Land Ownership

The majority of the land designated for the proposed extractive operation is currently vacant crown land (see **Figure 2.3**). A portion of the proposed conveyor route from the pit to the existing Clarence rail loop, and the rail loading facilities themselves, will be located on land currently leased by Centennial Coal Company. The land was formally owned by the Commonwealth (Department of Defence) and title has been recently transferred to Lithgow City Council. Transfer of the land to Centennial Coal Company is now underway.

The parcel of land covers a portion of the rail loop, Centennial's coal loading bin and water storage tanks. These facilities have been used for mining purposes since the late 1970's. There is also a pumping station owned by Lithgow City Council which will be covered by a lease within the land owned by Centennial. All other land affected by the project is owned by the Crown.

2.5 Legislative Framework

2.5.1 Integrated Development

Although the Minister for Infrastructure and Planning will be the consent authority for the proposed Kaolin Mine, additional approvals will be required from other government authorities. These additional approvals define the project as Integrated

Development, that is, before the project can proceed it requires development consent and one or more approvals from other government agencies. When consent is issued for the project, the conditions attached to the approval will also include any conditions specified by Integrated Development Agencies.

Integrated approval bodies will be: Environment Protection Authority (EPA) and the Department of Land and Water Conservation (DLWC). The Department of Mineral Resources (DMR) is required to approve the issue of a mining lease but is not an Integrated Approval body.

The requirements of these approval bodies are described below.

An Environment Protection Licence issued under the *Protection of the Environment Operations Act, 1997* will be sought from the Environment Protection Authority. The licence will cover emissions such as noise and dust, and discharge of water.

Based on the flora and fauna surveys and eight part tests included in the associated reports prepared for this EIS, approval under the *Threatened Species Conservation Act, 1995* is not required from NPWS, since species of conservation significance, or their habitat will not be significantly affected by the project. The project will however be referred to National Parks and Wildlife Service for comment.

Approval from DLWC for the clearing of vegetation is not required, since approved mining operations are exempt under Section 12 of the *Native Vegetation Conservation Act, 1997*. Licensing details and information requirements under the *Water Management Act 2000* have yet to be finalised. Approval to mine from the DMR (see below) exempts the project from the Crown Lands Act, 1989. The project affects some ephemeral creeks on the site. Under a mining lease, it will not be subject to the Rivers and Foreshores Act 1948. In their review of the EIS, DLWC will assess whether the open cut extension will require a groundwater interference licence under the *Water Management Act 2000* and a licence for production and monitoring bores (*Water Act 1912*).

Approval of the general mine plan for the project will be sought from the DMR. Further ongoing approvals will be required from the DMR including the Lease application and Mining Operations Plan.

2.5.2 Summary of Statutory Procedures

Commonwealth Legislation

The *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) came into effect on 16 July 2000 and emphasises aspects of the environment that are considered to be of national significance. It was introduced to give the Commonwealth greater control and input in development approvals. The main provision of the Act requires that Commonwealth approval be obtained for any actions that are likely to have a significant impact on a matter of National Environmental Significance (NES), in addition to any State approvals.

Areas of World Heritage are considered to be of national significance and the Greater Blue Mountains World Heritage Area, located to the east of the proposed development, was declared on 29 November 2000.

Under the *Commonwealth Environment Protection Biodiversity Conservation Act, 1999*, approval from the Commonwealth Minister for the Environment is required for developments that may have a significant impact on matters of National Environmental Significance (except in circumstances set out in the EPBC Act). Under the Act, matters of National Environmental Significance include: World Heritage properties; RAMSAR wetlands; threatened species or ecological communities listed in the EPBC Act; migratory species listed in the EPBC Act; the environment in a Commonwealth marine area and nuclear actions.

The assessment and approval process in the Act is triggered by any proposal that may have a significant impact on a matter of national environmental significance. Since the proposed kaolin mine is located near the Greater Blue Mountains World Heritage Area, the EPBC Act may be invoked and the Commonwealth Environment Minister may have decision-making powers in regard to the project.

The project was referred to the Commonwealth to determine if the project will have a significant impact on issues of NES and hence require Commonwealth approval. Environment Australia advised that the project is considered a “Controlled Action” under the EPBC Act (refer Appendix A). Environment Australia has also advised that the environmental impact assessment process must be accredited and therefore should proceed in accordance with the NSW Environmental Planning and Assessment Act 1979 and include all requirements set out in Schedule 1 to the most recent bilateral agreement between the Commonwealth and New South Wales.

State Legislation

The provisions of the Environmental Planning and Assessment Act 1979 determine the EIS process for this proposal. The proposed mine will involve disturbance of a total surface area greater than 4 ha and consequently, the mine is a designated development under Schedule 3 of the Environmental Planning and Assessment Regulation 1994. The proposal is also considered to be a designated extractive industry due to the area of extraction (> 2 ha) and large volumes of sand being extracted during the kaolin mining process (in excess of 30,000 m³ per annum).

The development requires planning consent and, being designated development, an EIS must be prepared to accompany the Development Application.

The Minister for Infrastructure and Planning has declared certain developments to be of state significance. These developments are important to the NSW community and the Minister’s approval is required before they can be built.

The Minister for Infrastructure and Planning issued a declaration relating to extractive industry on the 3rd August 1999 whereby extractive industries with a total resource of greater than 5 million tonnes and annual extraction rates of more than 200,000 tpa are considered to be of State Significance. Given that the amount of sand to be obtained through the kaolin mine exceeds these thresholds, the proposal is of State Significance

and has been called in by the Minister, for approval under Section 76A(7) of the Environmental Planning and Assessment Act. Consequently, the State's determining authority will be the Minister for Infrastructure and Planning.

State Environmental Planning Policies

NSW government landuse planning is administered through the Department of Urban and Transport Planning (DUTP), which until recently was known as Planning NSW. DUTP supervises local planning initiatives and undertakes regional planning through State Environmental Planning Policy (SEPP) directives under Section 117 of the EP&A Act and Departmental Planning Circulars. There are four SEPPs potentially relevant to this proposed development:

- ☐ SEPP No. 11 - Traffic Generating Developments;
- ☐ SEPP No. 44 - Koala Habitat Protection;
- ☐ SEPP No. 45 – Permissibility of Mining;
- ☐ SEPP No. 58 – Protecting Sydney's Water Supply.

Each of these is discussed below.

SEPP No. 11 - Traffic Generating Developments

SEPP No. 11 - Traffic Generating Developments provides that applications for developments listed in Schedules 1 and 2 of the Policy shall be referred to the Roads and Traffic Authority (RTA) for its view prior to determination. The proposed development, as an *extracting industry or mining* development, is included in Schedule 1, subclause (m) of the policy.

SEPP 11 establishes the RTA as the sole traffic management authority to be consulted and ensures that the RTA is given the opportunity to make representations on a development application before the consent authority makes a determination. Under Clause 7(3) the consent authority is required to forward a copy of the submitted Development Application to the Authority within seven days of receipt.

Consultation has taken place with the RTA during the preparation of this EIS and their comments taken into consideration during the preparation of this document.

SEPP No. 44 - Koala Habitat Protection

SEPP No. 44 - Koala Habitat Protection encourages the conservation and proper management of areas of natural vegetation that provide habitat for koalas, to ensure permanent, free-living populations will be maintained over their present range. To achieve this, it must be determined whether or not the proposed area of development contains core koala habitat, and if so, the habitat must be investigated and a plan of management prepared prior to development consent. The whole of the Lithgow area is covered by the SEPP and therefore this issue has been considered in the flora and fauna report. In summary, no potential koala habitat is found on the site and therefore no koala plan of management is required.

State Environmental Planning Policy No. 45

SEPP 45 ensures that there are clear planning controls to determine the permissibility of mining. The policy allows mining on land with consent, where an environmental

planning instrument requires the consent authority to make a value judgement as to whether such development is permissible. The policy aims to *inter alia* promote economic development in the State, facilitate development of the State's natural resources and facilitate significant export earning industries for the State.

Mining is permissible under the current Rural 1(a) zoning.

SEPP No. 58 - Protecting Sydney's Water Supply

Under State Environmental Planning Policy (SEPP) No 58 - Protecting Sydney's Water Supply, designated developments as defined under Schedule 3 of the *Environmental Planning and Assessment Regulation 2000* may not be carried out in the hydrological catchment from which Sydney's drinking water is drawn without the concurrence of the Catchment Authority.

In assessing the proposed development under SEPP 58, the Catchment Authority is to consider the following:

- ☐ whether the development or activity will have a neutral or beneficial effect on the water quality of rivers, streams or groundwater in the hydrological catchment, including during periods of wet weather;
- ☐ whether the water quality management practices proposed to be carried out as part of the development are sustainable over the long term; and
- ☐ whether the development or activity is compatible with relevant environmental objectives and water quality standards for the hydrological catchment when these objectives and standards are established by the Government.

Sydney's hydrological catchment for its drinking water supply includes the Warragamba, Upper Nepean, Woronora, Blue Mountains and Shoalhaven catchments. The proposed mine site is located within the upper reaches of the Wollangambe River catchment, which flows into the Colo River, and is not included within Sydney's drinking water catchment. It will therefore have no impact on the relevant hydrological catchment and consequently, SEPP 58 does not apply to this project.

Local Government Planning Provisions

The local planning instrument relevant to this project is the Greater Lithgow City Council Local Environmental Plan (LEP), 1994. The aim of the LEP is to recognise and promote the City of Greater Lithgow as a desirable and viable place to live, visit and invest. The LEP also encourages the proper management, development and conservation of natural resources and the built environment, and is designed to facilitate growth and development in the region in an appropriate manner.

This includes:

- ☐ ensuring that such developments minimise the environmental cost to the community of fragmented and isolated development of rural land which has less than full provision of services;

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- ☐ facilitating the efficient and effective provision of amenities and services;
 - ☐ ensuring that the safety and efficiency of arterial roads is not adversely affected by development on adjacent land;
 - ☐ encouraging the separation of conflicting land uses; and
 - ☐ facilitating the protection of catchment areas and preserving the water quality in the regions waterways.

The zoning of the land within the proposed mining lease is 1(a) Rural (general). The main objective of the Rural General zoning is to promote the proper management and use of natural resources. Within this zone, agriculture, bushfire hazard reduction and forestry activities are permissible without development consent. Mining developments are permissible with development consent.

Lands zoned Rural (1) where industrial developments are permitted under the LEP are also covered by the *Greater Lithgow Development Control Plan (DCP) No. 6*. The plan provides detailed guidance for the development of land for industrial purposes. This EIS has been prepared in accordance with and meets the relevant requirements of DCP No 6.

2.5.3 Environmental Assessment Process

The EIS forms one component of the environmental impact assessment (EIA) process for State Significant Developments. The key elements of the process that are relevant to this proposal are listed below and shown in **Figure 2.4**.

- ☐ Initial inquiry to the Department of Urban and Transport Planning to determine requirements;
- ☐ review of the development by government authorities, the public and community groups through the Planning Focus Meeting and associated documentation;
- ☐ Department of Urban and Transport Planning seeks the requirements of other integrated approval bodies for the EIS and incorporates them into the Director-General's requirements;
- ☐ EIS preparation;
- ☐ Development Application lodged with the Department of Urban and Transport Planning together with EIS;
- ☐ Public exhibition of the Development Application and EIS by the Department of Urban and Transport Planning;
- ☐ Consideration by the Department of Urban and Transport Planning of submissions made by the public and government agencies in response to the EIS;
- ☐ Assessment of the project by the Department of Urban and Transport Planning;

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- ❑ Determination of the project by the Minister for Infrastructure and Planning in light of public submissions and project scrutiny.

The purpose of the EIS is to provide information to decision makers on environmental factors in order to weigh these factors against other considerations in making project decisions. The environmental impact assessment process provides the opportunity for public review and comment, and forms part of the decision making process. This systematic review process, leading to an ultimate determination by the Minister, aims at providing a balanced approach to impact assessment.

Key features of an EIS are the identification of environmental issues, the prediction of potential impacts and the commitment to incorporate protection measures that will safeguard against adverse impacts on the biophysical and social environment. In broad terms, the EIS must contain sufficient information to enable an informed decision on the proposed development. The commitments made in this EIS will be incorporated into the Environmental Management Plan (EMP) for the project that will provide the basis for ongoing environmental management on site.

As with all development projects, the proposed Newnes Junction Kaolin Project will have some environmental impact. The EIS has evaluated both potential negative and positive impacts in order to provide a balanced information base to assist in the decision making process.

2.5.4 Scope of This Development Application

The DA accompanying this EIS covers the proposal to develop a kaolin mine on vacant Crown Land to the north of Newnes Junction as described in **Section 3**. Mining methods will involve ripping the ore with a dozer and loading it by Front End Loader (FEL) onto trucks to transport it to a crushing and conveying system. The crushed ore will be directed to a rail loading facility so it can be conveyed off site by rail. The DA covers only the proposed mining and rail loading operations. The unloading and processing operations associated with the proposed development will be subject to a separate approval process.

Approval is sought to mine and rail transport off-site of up to 1.4 Mtpa of friable sandstone which will generate approximately 119,000 tpa of kaolin and approximately 1.154 Mtpa of construction sand and 0.127 Mtpa of high grade silica sand as described in Section 3. The resource is extensive and although approval is sought for a 21 year mine plan, there will be significant remaining resources which could easily extend mining operations well beyond this period.

2.5.5 Environmental Planning and Assessment Procedures

The form and content of this EIS are in accordance with the requirements of the *Environmental Planning and Assessment Regulation*. The Director-General of the Department of Urban and Transport Planning has been consulted pursuant to the requirements of the Regulation and the document has been prepared in accordance with the Director's Requirements, a copy of which is included as **Appendix A**.

All relevant government departments and authorities have been contacted and their comments, where appropriate, have been incorporated into the document (see **Appendix B**). Consultation with various government agencies commenced early in the planning stages of the project and their input over this period has been taken into account during the preparation of this EIS.

This document will be publicly exhibited and will act as an invitation for comment. The public should forward submissions to the Department of Urban and Transport Planning, for review prior to assessment and ultimate determination by the Minister.

2.5.6 The Environment Impact Statement

The EIS is the culmination of the studies undertaken to date in the assessment of the proposed mine development. Further work on refining the details of the mine plan and environmental management aspects of the project will continue prior to mining commencing but the development concept, as described in this study, is considered adequate to enable the prediction and evaluation of potential environmental impacts.

An essential component in the assessment of environmental impacts of proposed developments is the issue of verification. The impact statement, in some respects, needs to make certain value judgements based on available information and generalised assumptions. It is important, therefore, for monitoring to be undertaken to verify the impact predictions made and further refine the projects impacts.

Additional data gathered during monitoring of the project will assist in verifying the predicted impacts. The mine plan, extraction methodologies, and the environmental protection measures associated with the development can also be fine tuned in response to monitoring results. These results will be reported annually as part of the regular reporting required by the DMR.

This EIS is structured to provide an initial summary of the EIS findings, existing and proposed development descriptions followed by several chapters assessing potential impacts of the project. The impact assessment chapters have been grouped into key issues relevant to the project. An expanded structure of the EIS is as follows:

Section 1 - Executive Summary - briefly outlines the proposed mine development, the environmental aspects of the project and the resultant impacts likely to arise due to the proposal.

Section 2 - Introduction and Planning - outlines the project, describes the objectives of the development, introduces the main aspects of the development proposal, and gives a resume of the legislative framework and environmental assessment procedures.

Section 3 - Description of the Proposed Development - provides a description of the Company's proposals for the kaolin mine, extraction methods, material handling systems and transportation of the material. The geological characteristics of the resource and proposals for rehabilitation are described in sufficient detail to enable the environmental consequences to be addressed.

Section 4 - Project Justification and Alternatives - an overview of the market for the kaolin and sand products generated by the project is provided and the reasons for developing the resource are given. Possible alternatives to the development are also discussed.

Section 5 - Land Use and Environmental Effects - this section describes the existing land use, flora, fauna, archaeological and heritage environments occurring within the future mining area and assesses the potential impacts on these systems.

Section 6 - Emissions and Environmental Effects - emissions from the plant associated with the mine have been addressed and where possible, quantified. Specifically, the issues of air, water and noise emissions associated with the mining and transportation operations are covered.

Section 7 - Social and Economic Considerations - the existing social framework within the area is described in sufficient detail to assess the potential effects of the development of the mine. Ecologically sustainable development issues are also discussed.

Section 8 - Environmental Management and Conclusions - this section discusses management issues and summarises the key findings of the various environmental studies contained in this EIS in a format consistent with the requirements of the Department of Urban and Transport Planning. The mechanism for verifying the impact predictions made in this document is also provided.

2.6 Consultations

An integral component of the project has been the consultation program that has included both government agencies and the local community.

2.6.1 Authority Consultation

In accordance with the EP&A Act, the Director General of the Department of Urban and Transport Planning was consulted regarding the form and content of the EIS. A copy of the response received from the Director General is provided in **Appendix A**.

As required by the Department of Urban and Transport Planning, this EIS has been prepared in accordance with Part 4 of the Environmental Planning and Assessment Act 1979. The EP&A Regulation 2000 outlines matters that must be considered in preparing a Part 4 EIS. Clause 72 of the Regulation (cf Cl 54 of the EP&A Regulation 1994) sets out matters that should be included in this EIS as outlined in Schedule 2 of the Regulations to the Act. **Table 2.1** shows the requirements of Schedule 2 and indicates where each requirement is addressed in the EIS.

Table 2.1 - EIS Statutory Requirements

Matters to be considered in the EIS Under Schedule 2 EP&A Regulation 2000	EIS Section
1 A summary of the environmental impact statement.	Chapter 1

Table 2.1 - EIS Statutory Requirements

Matters to be considered in the EIS Under Schedule 2 EP&A Regulation 2000		EIS Section
2	A statement of the objectives of the development or activity.	S2.1.1
3	An analysis of any feasible alternatives to the carrying out of the development or activity, having regard to its objectives, including:	S4.7
	(a) the consequences of not carrying out the development or activity; and	S4.9
	(b) the reasons justifying the carrying out of the development or activity.	S4.1-4.8
4	An analysis of the development or activity, including:	
	(a) a full description of the development or activity; and	Chapter 3
	(b) a general description of the environment likely to be affected by the development or activity, together with a detailed description of those aspects of the environment that are likely to be significantly affected; and	Chapter 5, 6
	(c) the likely impact on the environment of the development or activity, having regard to:	
	(i) the nature and extent of the development or activity	
	(ii) the nature and extent of any building or work associated with the development or activity	Chapter 5, 6
	(iii) the way in which any such building or work is to be designed, constructed and operated; and	
	(iv) any rehabilitation measures to be undertaken in connection with the development or activity; and	
	(d) a full description of the measures proposed to mitigate any adverse effects of the development or activity on the environment.	Chapter 5, 6
5	The reasons justifying the carrying out of the development or activity in the manner proposed, having regard to biophysical, economic and social considerations and the principles of ecologically sustainable development.	Chapter 3, 5, 6, 7
6	A compilation (in a single section of the environmental impact statement) of the measures referred to in item 4(d).	S8.3
7	A list of any approvals that must be obtained under any other Act or law before the development or activity may lawfully be carried out.	S8.4
8	For the purposes of Schedule 2, the principles of ecologically sustainable development are as follows:	
	(a) The precautionary principle - namely that if there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation.	S7.7.1
	(b) Inter-generational equity - namely, that the present generation should ensure that the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations.	S7.7.2
	(c) Conservation of biological diversity and ecological integrity.	S7.7.3
	(d) Improved valuation and pricing of environmental resources.	S7.7.4

Specific areas were identified by the Director-General as needing to be addressed in the EIS, under the *Environmental Planning and Assessment Regulation*. These issues and the section of the EIS in which they are addressed are provided below in

Table 2.2.**Table 2.2 - Requirements of the Director General**

Specific Issues to be Addressed	EIS Section

Table 2.2 - Requirements of the Director General

- Detail impacts on Blue Mountains National Park and Wollangambe Wilderness Reserve and mitigation measures to prevent any part of the proposed facility from intruding into the National Park.	Chapter 5
- Details of the proposed location of the processing plant, including an outline of transportation methods and any upgrades necessary.	Concept in S3.10 & App C. Separate EIS will cover this
- Details of any Native Title claims in relation to Crown Land	S5.7
- Details of cumulative environmental impacts	S8.2.2
- Consideration of objectives and relevant provisions of SEPPs and REPs, in particular SEPP 58 and SEPP 11	S2.4.1
- Impact on flora and fauna, including threatened species and critical habitat	S5.6.6
- Issues raised at the Planning Focus Meeting	S2.5.1
- Provide details of a nominated contact who will be available to answer public enquiries about the proposal	S2.5
- Community Consultation	S2.5.2
- Consultation with Local Council and advise regarding the most appropriate newspapers circulating in the area affected by the proposal	S2.5.1
- Particular attention should be given to the visual impact of the proposal, including an assessment of the proposal from the Blue Mountains National Park, and the cumulative visual impact with other development located in the Newnes Junction and Clarence areas.	S5.5
- An assessment of the proposed means of access to the site for employees and consideration of how the development will interact with the transport systems currently operating from the Clarence Rail loop.	S6.5
- Consideration of the final land use of the site, with attention to security and safety issues.	S3.12
- The proposal has been determined by Environment Australia to be a controlled action under the EPBC Act due to potential impacts on the Blue Mountains World Heritage Area. Details of this should be included.	Noted
- Discuss the cumulative impacts the development will have on the surrounding environment, including cumulative impacts associated with other sand and mining activities in the surrounding area. Cumulative impacts that should be discussed include noise, visual impact, ground and surface water and traffic.	S6.2, S6.3, S6.4, S6.5, S8.2.2
- Include a comprehensive assessment of potential direct and indirect impacts on flora and fauna and their habitats. Should include the Blue Mountains Water Skink and the Bathurst Copper Butterfly.	S5.6
- The Aboriginal cultural heritage assessment should be in accordance with the attached NPWS guidelines.	Noted
- A greenhouse gas assessment should be included, incorporating the following: a. A quantitative model showing the tonnages of each greenhouse gas produced per year. These figures should be expressed as a percentage of the total national greenhouse gasses produced for that year; b. A discussion of the types of greenhouse gases being emitted; c. A discussion of the alternative options considered for the chosen fuel source used, and the technology adopted to reduce greenhouse gas emissions; d. Justification for the chosen fuel source and technology in terms of	Appendix F

Table 2.2 - Requirements of the Director General

greenhouse gas emissions.

Other Consultation

During the formulation of the proposal a Planning Focus Meeting was organised to present the proposal to relevant government authorities and was attended by representatives of the following organisations:

- ☐ Department of Mineral Resources;
- ☐ Greater Lithgow City Council;
- ☐ Department of Land and Water Conservation; and
- ☐ Environment Protection Authority.

The Planning Focus Meeting was held in March 2000 and involved a series of presentations that described the background to the proposal, site geology and constraints, proposed mining operations and associated infrastructure and environmental considerations. A site inspection of the mining and surface infrastructure area followed. Issues and concerns these authorities wished to see addressed in the impact assessment process were identified at this meeting and have been considered during the EIS preparation.

Throughout the project planning and assessment phase, consultation was also undertaken with other relevant local and state government authorities and interested parties, including the National Parks and Wildlife Service. Relevant comments and requirements have been included as **Appendix B**.

Matters raised as a result of the planning focus meeting, follow-up letters and discussions, have been addressed in this EIS.

2.6.2 Community Consultation

Prior to undertaking the field component of the EIS studies, each residence within Newness Junction was visited. If they were home, discussions were held with the residents outlining the project and informing them of the proposed works. Those who were not home were left details and were invited to contact IEC personnel to discuss the project if they wished to. A number of residents took up this offer.

Following further development of the project, further discussions were held with affected residents in May 2001, outlining the proposed mine plan and environmental issues associated with the project.

The proposal has received a mixed reaction with some vehemently opposed, some reserved and others supportive. Key issues raised by the Newnes community included:

- ☐ potential for employment opportunities at the mine;

-
-
- ☐ noise and dust emissions from the operation;
 - ☐ reduced privacy and loss of amenity;
 - ☐ reduced land values;
 - ☐ proximity to National Park and loss of vegetation communities;
 - ☐ local assess to the National Park currently obtained via EL4192;
 - ☐ general environmental impacts of the operation.

The noise impact assessment has shown that the operation will exceed noise criteria from approximately year 10 onwards on some residences in Newnes Junction. NKPL will offer compensation in the form of additional noise treatment at these identified residences or outright purchase. The offer of purchase and lease back should the residences not wish to be relocated will also be offered, and if required, the offer will be extended to all residents of Newnes Junction as at the lodgement date of this EIS.

Should community members wish to contact the proponent in relation to this EIS the following contact will be available:

Ian Wisken
The Fifth Estate
Telephone (02) 9232 8282
Fax (02) 9232 8275

Dr Ron Goldbery
NKPL
Telephone (02) 9439 1411

2.7 Project Team

This EIS has been prepared and managed by International Environmental Consultants Pty Ltd. The project team is listed below and the various experts have provided material in the relevant sections of the document:

Robert Byrnes	IEC	Project Director
Margot Jamieson	IEC	Project Manager
Don Reed	Don Reed and Associates	Sand Market Research, Financial Modelling & Project Justification
Igor Bojanic	Mine Consult Pty Ltd	Mine Planning and Modelling
Roger Smith	Roger Smith and Associates	Process Design
Murray Lines	Stratum Resources	Marketing & Justification, Kaolin and Specialty Sands
Peter Stitt	Peter Stitt and Associates	Kaolin Marketing & Justification
Jane Barnett	Holmes Air Sciences	Air Quality Assessment
Graham Atkins	Atkins Acoustics	Noise Assessment
Julie Gander	IEC	Flora & Fauna Assessment
Arthur White	Biosphere Environmental	Frog Survey
Franz Kalf	Kalf & Associates Pty Ltd	Hydrogeological Assessment
Robynne Mills	Consulting Archaeologists	Archaeological Assessment
Dean Oliver	Dean Oliver Graphics	EIS Figures and Graphics

Ron Goldbery of NKPL has also provided valuable assistance in the preparation of this document.

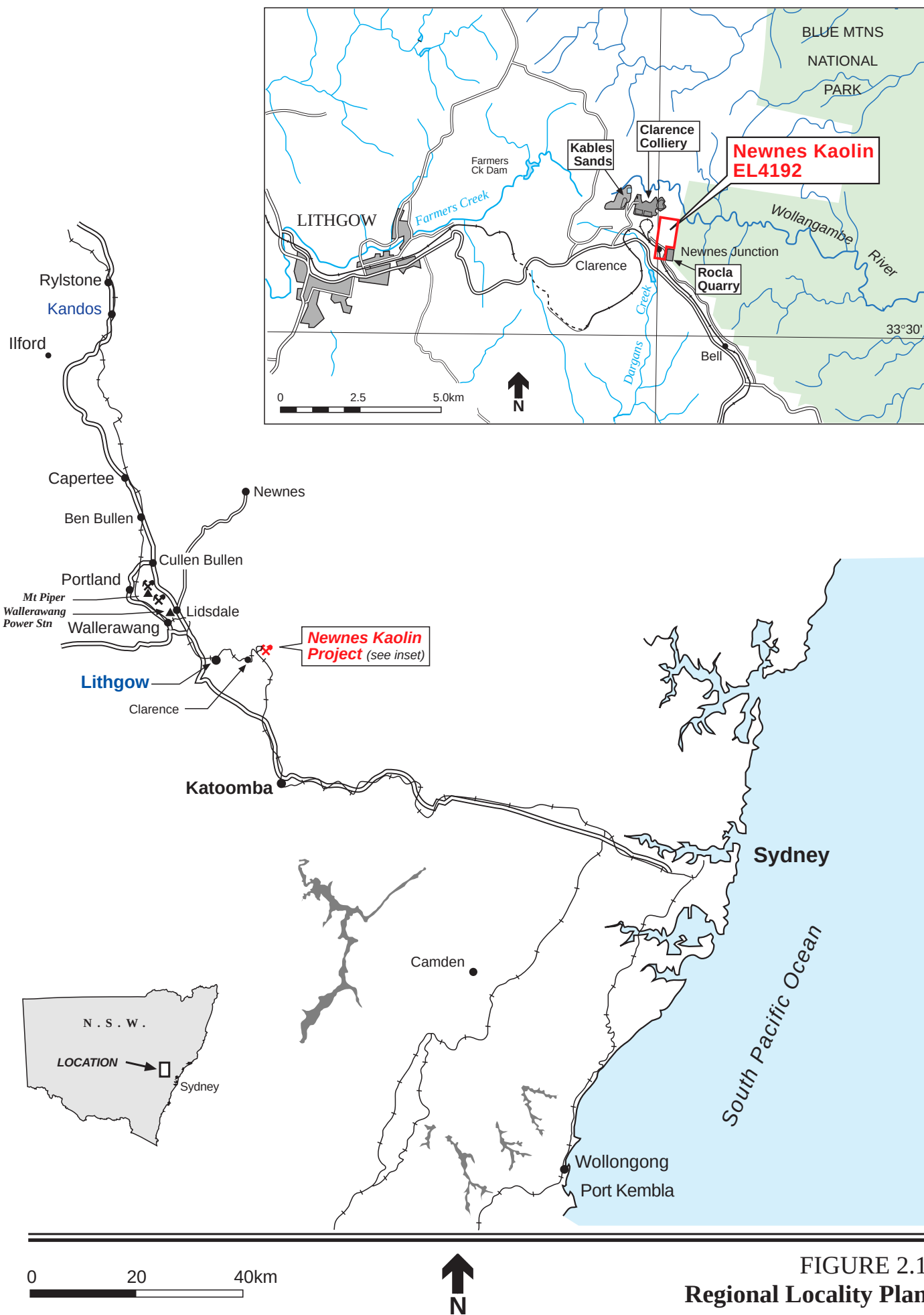


FIGURE 2.1
Regional Locality Plan



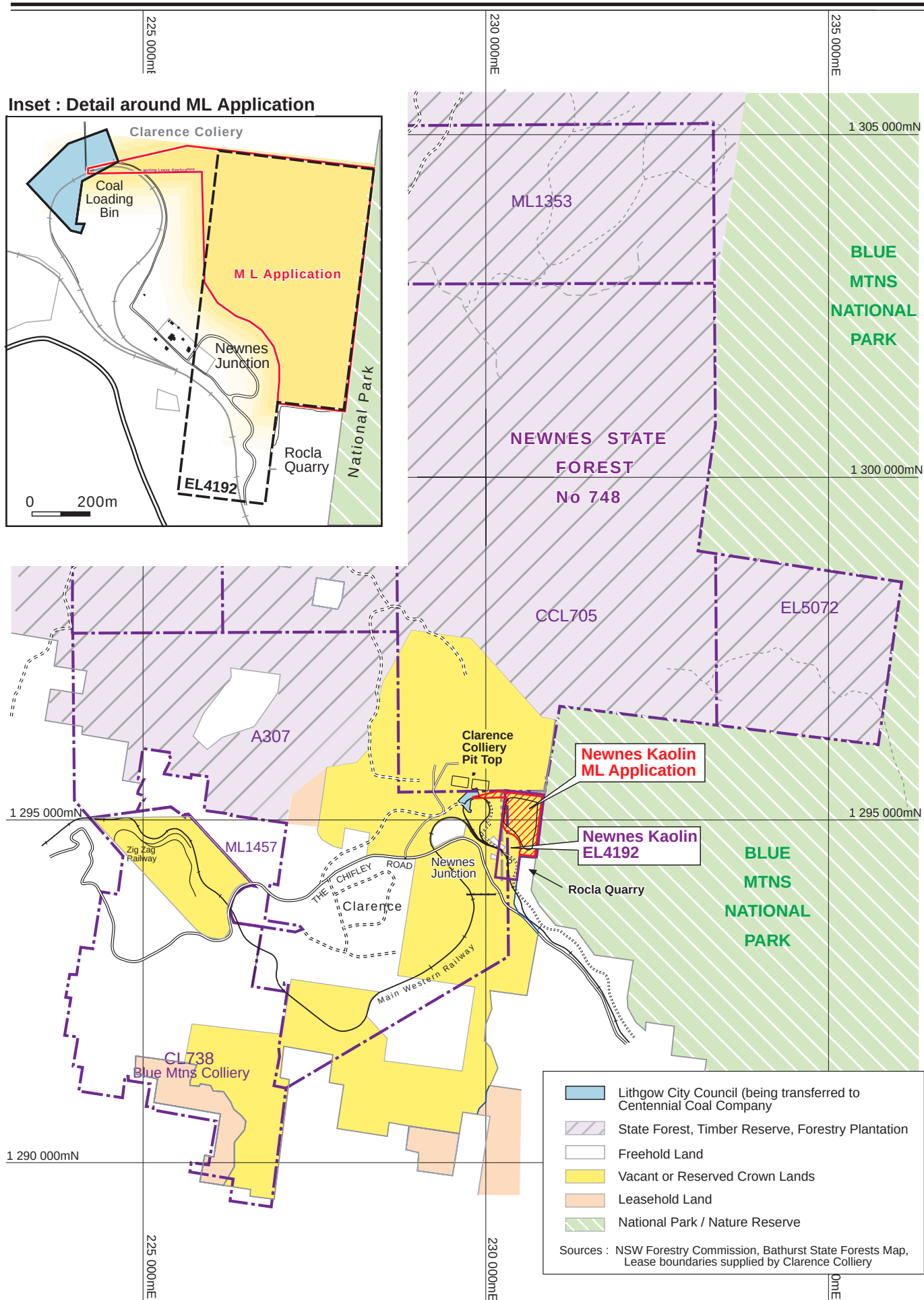
-  Mining Lease Application
(Development Application Area - location approximate)
-  Exploration Licence 4192 (location approximate)

Aerial photography date : May 2000

0 200 400metres
approximate



FIGURE 2.2
Project Location

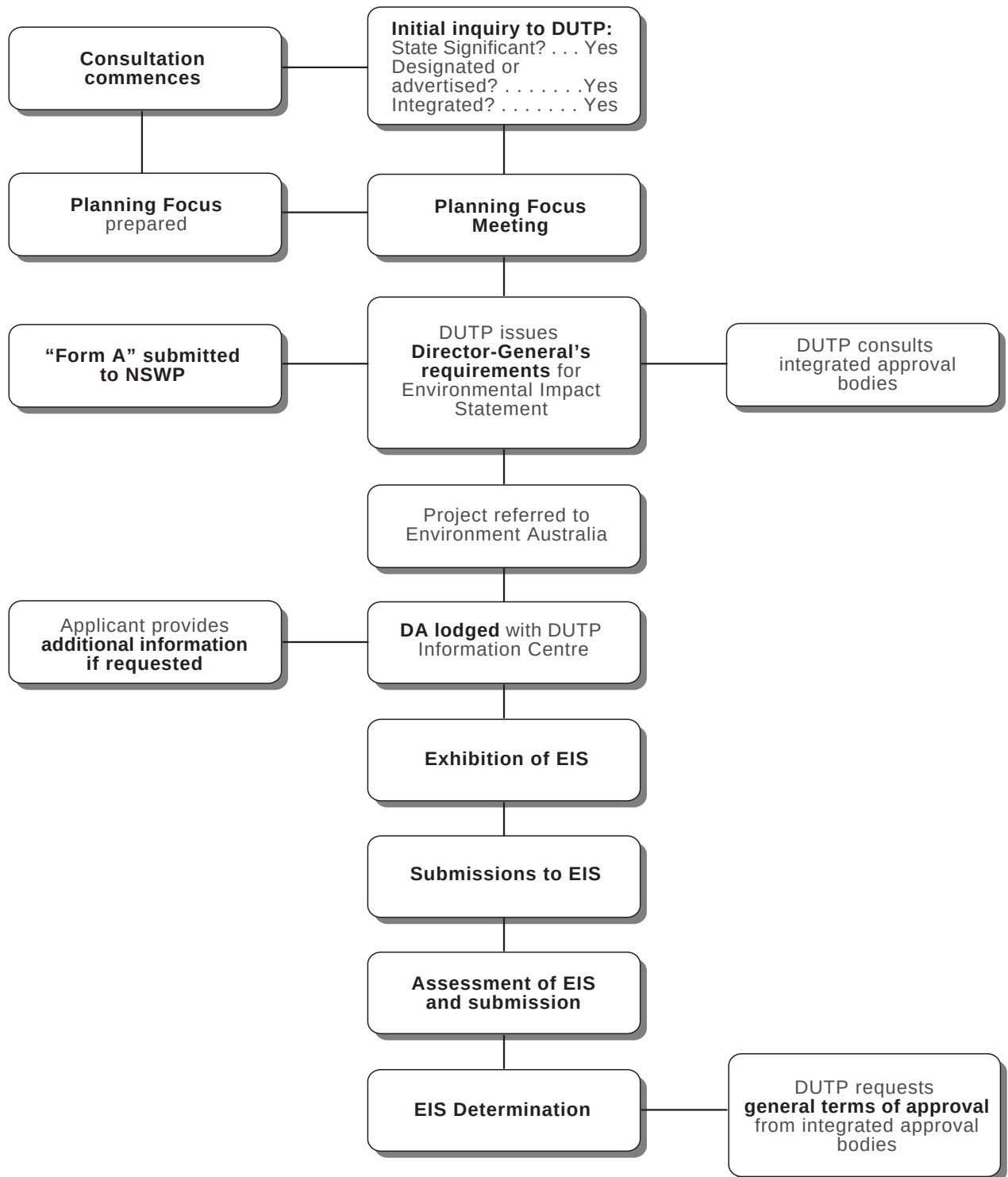


0 1000 2000 3000 metres

1: 75 000



FIGURE 2.3
Land Ownership



DUTP = Department of Urban and Transport Planning
(formerly NSW Planning)

FIGURE 2.4
Summary of Development Application Process

3. Description of the Proposed Development

This section of the document describes the proposed extractive industry in sufficient detail to allow for impact assessment. The main activities that could impact on the surrounding environment are described, while additional supporting information required for environmental assessment is provided in subsequent chapters.

3.1 Outline of the Proposal

NKPL propose to develop an open pit operation to extract friable sandstone in EL4192, near Newnes Junction, NSW as shown in **Figure 3.1**. With total estimated reserves of over 23.7 Mt, the pit life is anticipated to exceed 21 years. It is estimated that the extractive operation will have an annual average production in the order of 1.1 Mtpa of raw friable sandstone which will be transported by rail to Sydney for separation into 93,720 t of kaolin (8.52%), 99,550 t of specialty sands (9.05%) and 906,730 t of construction sand (82.43%).

Maximum annual production figures are anticipated to be in the order of 1.4 Mtpa of friable sandstone leaving the site producing 119,000 tpa of kaolin, 127,000 tpa of speciality sands and 1.154 Mtpa of construction sand. The project represents a significant advancement in resource utilisation, product beneficiation and value adding when compared to conventional friable sandstone quarries supplying product into Sydney markets.

In its raw state, the resource would be considered an acceptable friable sandstone deposit similar to that being extracted and processed at a number of quarries in the area. However, by separating kaolin and a portion of the industrial grade silica from the crushed sandstone, three separate product streams will be generated, these being:

- ☐ kaolin industrial mineral products;
- ☐ industrial grade, silica sand products; and
- ☐ premium quality construction sands.

Kaolin in its refined state has a potential value of up to 40 times that of construction sand. Removal of the kaolin from the sand has the additional benefit of optimising the quality of construction sands where an excess of clay minerals are considered as deleterious material.

It is proposed to transport all material to Sydney by train after loading at the existing rail loop servicing Clarence Colliery. A separate processing plant will be established in the Greater Sydney Area (GSA) that will have both rail access for crushed sandstone receipt and road access for final product delivery. NKPL is at various stages of negotiation with the owners / lessees of four prospective processing sites in the GSA.

Once the processing site is confirmed, a separate EIS will be prepared for Sydney based operations. The only processing of the friable sandstone undertaken at Newnes Junction will be the primary crushing necessary for materials handling, stockpiling and train loading operations. With no secondary tertiary and/or quaternary processing on-site, there is no need for settlement ponds or other infrastructure normally associated with friable sandstone quarry operations.

The principal features of the project are summarised in the following sections and illustrated in the accompanying figures.

3.1.1 Site Description

The proposed development site is situated north of Newnes Junction, which is a small village located between Lithgow and Bell near the Bells Line of Road. The village contains six houses and a few other blocks of land that may be developed at some point in the future.

The proposed extraction site is bordered on three sides by development, including residential dwellings, roads, active quarrying and coal mining infrastructure. The Clarence Colliery pit top is located immediately to the north of the site, the Clarence Colliery rail loop to the northwest, the Bells Line of Road to the southwest and south and the Rocla sand quarry to the southeast. Newnes Junction residences are located between the proposed site and the road and rail infrastructure to the southwest. Two other sand quarries are located to the northwest of the area, one owned by Boral and the other by Pioneer (Kable Sands).

EL4192 is bordered by the Blue Mountains National Park to the east and this area has recently been included in the Greater Blue Mountains World Heritage Area. Consequently, it is vital that the site be managed in an environmentally sensitive and responsible manner. Detailed environmental investigations have been undertaken as part of this EIS process to ensure that specific environmental issues are adequately addressed.

The elevation of the site ranges from 1,090 to 1,010 m AHD. The site topography is relatively steep and drains eastward into the Blue Mountains National Park. There are no major watercourses through the site, however minor ephemeral creeks exist and the general area of the site drains towards the Wollangambe River and thence into the Colo River before flowing into the Hawkesbury system. The area supports relatively open woodland, with increased tree densities in the gullies.

3.2 Geology and the Resource

The site lies towards the western edge of the sandstone of the Permo-Triassic Sydney Basin. The Triassic Sandstone of the Sydney Basin is deeply dissected by numerous canyons and valleys. The Newnes Plateau rock types consist of non-marine fluvial sediments, predominantly sandstones, with some claystones and shales. The sequence comprises the Triassic Narrabeen Group that overlies the Permian Illawarra Coal Measures.

A feature of the Newnes Plateau sandstones is that they are friable and therefore readily ripped and processed to yield a range of construction materials and industrial minerals products. Pecover (1986) studied the Newnes Plateau friable sandstones in substantial detail and concluded that their friable nature resulted from a strongly developed joint pattern and weathering. He described the process as '*...fracture assisted deep weathering.*' An added factor may be the presence of feldspar grains deposited with the sediments. Any such feldspars would have weathered to clay under the conditions postulated by Pecover, contributing to sandstone friability and to the clay content of the sandstone.

The friable sandstones of the plateau are mainly developed on the Banks Wall Sandstone, the formation that outcrops on EL4192. The material is predominantly weathered, medium grained sandstone that is generally cream or white in colour. Surface hardening occurs but rarely exceeds a few millimetres and mantles are friable, crumbly sandstone with a clay matrix of kaolin and an overall absence of ironstone crusts.

The sandstone at Newnes is soft and breaks readily with relatively little energy to disaggregate into kaolin, silica sand and fine silica. Pecover 1986, describes the Banks Wall Sandstone as gently dipping in an easterly direction and generally comprising:

"...50 to 80% quartz and 5 to 30% clay with a small percentage of lithic fragments" and "... contains approximately 20% of clay and silt sized –75µm material which is composed primarily of kaolinitic clays and a small proportion of fine silica, mica, and iron oxide."

There are claystone horizons within the sandstone that occur as thin discontinuous lenticular bodies. The sandstones are generally massive, display cross bedding and can contain coarse quartz pebbles.

Some areas of the deposit contain prime white kaolin while in other areas the kaolin is slightly off white.

3.3 Geological Exploration

Extensive exploration has been conducted to determine the location and extent of the kaolin reserves. Exploration mine development planning and market research undertaken to date over the tenement area has spanned a 6 year period from 1996 to 2000. As part of the exploration works topographic contour mapping (on a 2 m interval) was produced on an orthophoto base, generated from scanned stereographic pairs of aerial photographs. The topographic database was developed by Geo-Spectrum (Australia) Pty Limited, following an aerial survey carried out for the project.

Reverse circulation drilling in the area comprised 54 drill holes to depths of up to 30 m, spaced over 4.5 km of prepared drill access tracks. The results allowed for the clear delineation of areas of pale coloured kaolinitic sandstone, suitable for the extraction of kaolin. An auger drilling program, using both a four inch and a nine

inch diameter drill, was carried out within the area targeted by the previous drilling program in the north western part of the lease.

Bulk samples of the friable kaolinitic sandstone over a range of depths were taken and disaggregated to separate the kaolin from the sand. Bulk separation equipment designed and built at Macquarie University was used to fractionate specific size fractions. The kaolinite fraction (<10 µm) was mineralogically tested by X-ray diffraction techniques and quantitative size analyses using a Sedigraph particle size analyser.

Full interpretation and facies modelling of the drill hole data was carried out and this formed the basis of the mining plan formulated by MineConsult in 1999 and included in this report as **Figures 3.1 to 3.11**.

3.3.1 Product Quality and Reserve Quantities

The sandstone material to be extracted and primary crushed at the site is all of a relatively high quality with commercial value, either as kaolin or as high quality sand. In discussions with major end users, the Company has identified that the 12% silt fraction can be marketed as feedstock for silica flour production and an additive for concrete products. Any remaining unsaleable material can be used as construction fill.

The quality of the friable sandstone can be subdivided into 2 categories, based on the processing required to obtain clean products.

These are:

- ❑ ***premium grade friable sandstone*** consisting of light coloured sandstone with very low iron content; and
- ❑ ***standard grade friable sandstone*** consisting of coloured sandstone with a small percentage of iron.

Estimates from the geological modelling indicate that the total volume of material proposed for extraction is 23.7 Mt, of which 18 Mt (in situ) is premium grade friable sandstone and 5.7 Mt (in situ) is standard grade material.

The products obtained from the friable sandstone following processing include kaolin and high quality sands. The 'kaolin fraction' is defined for this project as comprising clay admixed with a small proportion of very fine silica minerals, sized at <10 µm. An estimated 2.02 Mt of this product will be extracted over the 21 year life of the project.

The remaining 21.71 Mt comprises high grade construction sands and various speciality sand and gravel products.

Table 3.1 – Estimated Production Figures Over the Life of the Mine (tonnes)

	Total Production *	Average Annual Production	Maximum Annual Production
Kaolin	2,022,432 (8.52%)	96,306	119,000
Construction Sand	19,566,793 (82.43%)	931,752	1,154,000
Specialty Sand	2,148,240 (9.05%)	102,297	127,000
Total Production	23,737,466	1,130,356	1,400,000

3.4 Pit Planning

The conceptual designs of the pit, stockpiles and roads are described in the following sections.

3.4.1 Design of the Open Pit

Detail design work is underway for prepared for:

- ☐ extraction of the friable sandstone resource;
- ☐ internal haul roads and drainage systems;
- ☐ primary crushing and materials handling on site; and
- ☐ construction and operation of conveyor and rail loading systems to move the material off site to the processing area.

Planning has been computer generated by MineConsult using state-of-the-art Gemcom software. It was based on current aerial survey data obtained by Geospectrum and geological information. Extraction planning and scheduling was reviewed by Don Reed and Associates (DRA) in consultation with the owners of the proposed operation.

Plans have been prepared to show pit development over 21 years and these stages are shown in **Figure 3.2** to **Figure 3.8**. These intervals have been chosen to demonstrate the status and impacts of the development at various stages of extraction and rehabilitation.

The open pit development stages may be summarised as follows and each stage is illustrated in **Figure 3.2** to **Figure 3.7**:

- Stage 1:** Before any substantial worked faces are established, removal of vegetation, erection of infrastructure, pit depth of RL 1020.
- Stage 2:** Four (4) benches would be formed with elevations of RL 1053, RL 1044, RL 1035 and RL 1020 respectively.
- Stage 3:** Further bench established, five (5) benches with elevations of RL 1053, RL 1044, RL 1035, RL 1026, and RL 1020.
- Stage 4:** Pit widened significantly with three (3) large benches of RL 1008, RL 999 and RL 993; and four small benches of RL 1017, RL 1026, RL 1035, RL 1044 and RL 1053 respectively.

Stage 5: Pit is doubled in size with seven (7) benches of RL 993, RL 999, RL 1008, RL 1017, RL 1026, RL 1035 and RL 1044 respectively.

Stage 6: Pit increased in depth and extended further south, one (1) main bench forming base of pit RL 993.

Principle planning criteria have been adopted to ensure:

- ☐ long term viability of the development (ie. planning that allows operational and cost efficient pit operations);
- ☐ maximum yield of kaolin from the friable sandstone extracted at any location;
- ☐ that environmental planning issues raised by statutory authorities and project consultants are addressed to minimise impacts from the proposed operations; and
- ☐ that the post operational landform lends itself to site rehabilitation in a manner that guarantees the long term environmental and aesthetic integrity of the site.

Of particular importance throughout the planning process has been the need to find the most appropriate compromise between:

- ☐ accessing high grade friable sandstone early in the extraction process;
- ☐ minimising water, noise and visual impacts generated by the project and the potential for negative impacts on the adjacent National Park/World Heritage Area.

Mine planning has made provision for:

- ☐ optimising friable sandstone extraction;
- ☐ minimising the area of disturbance;
- ☐ progressing extraction from the north to the south to mitigate the impacts of the project on Newnes Junction residents to the south;
- ☐ constructing a large sump during the pre-extraction phase to capture run-off from disturbed areas and prevent any uncontrolled discharge into the adjacent Blue Mountains National Park;
- ☐ providing adequate buffers between the proposed open pit development and the Blue Mountains National Park to the east;
- ☐ construction of internal drainage within the pit to ensure zero discharge from the disturbed area runoff catchment in conditions of up to a 1 in 50 year storm event;
- ☐ diverting clean water around disturbed areas to ensure that water collected within the pit is minimised;
- ☐ designing site batters to minimise erosion;
- ☐ progressively rehabilitating disturbed areas.

3.4.2 Site Development

It is proposed that the site will contain a pit from which the friable sandstone will be extracted via ripping and pushing with a dozer. Pushed up material will be front end

loaded into trucks prior to being transported to the primary crushing facility, and subsequently conveyed to a covered stockpile. Crushed sandstone will be conveyed to a surge bin adjacent to the railway line and loaded into trains for transportation to an off-site processing facility.

Crushing and materials handling plant and infrastructure, including the grizzly, crusher, covered stockpile and maintenance facilities etc, will be located along the northern portion of the site.

Construction

Prior to the commencement of extractive operations the site will require preparation and installation and erection of operational equipment and infrastructure. Construction operations will be required for the site access road, internal haul and service roads, erection of materials handling, servicing, maintenance and administration facilities, excavation and installation for grizzly and crusher, and erection of conveyor systems.

The construction works will be performed in two (2) stages with total estimated duration of not more than six (6) months (26 weeks). A summary of the construction stages and typical plant and equipment are presented below.

Construction Stage	Description of Activities	Typical Plant & Equipment
Stage 1 (4-13 weeks)	- Access road - Internal roads - Excavation for crushing facility - Preparation for siting of buildings - Compaction of building sites - Preparation of footings for conveyor	- Dozers - Excavator - Front End Loader - Haul Trucks - Tree Mulcher - Truck Mounted Auger - Vibratory Roller - Water Cart
Stage 2 (4-13 weeks)	- Building erection & fitout - Installation of stationary plant & equipment - Erection of conveyor systems - Commissioning of plant & equipment	- Crane - Concrete Trucks - Welders - Compressors - Generators - General Hand Tools

Operation

NKPL has undertaken conceptual designs of the pit, open stockpile areas, covered stockpiles, conveyer routes and internal roads. A key feature of the open pit development will be the requirement for selective extraction of premium grade and standard grade, friable sandstones. For this reason, the pit will be developed with shallow benches typically 3m high. The basic stages are as follows:

Pre Extraction Stage – Stripping and stockpiling of the topsoil overburden by dozer will avoid compaction of the soil and subsequent loss of structure. Topsoil will be stockpiled in low (2m high), but long piles for later rehabilitation works. Stage preparation works will occur prior to the commencement of each extraction stage.

Friable Sandstone Extraction - The selective winning of friable sandstone will be achieved by ripping and/or excavating the friable sandstone prior to pushing ripped sandstone up for loading. It is proposed to develop the pit in a north to south direction from the top to the bottom of the hillside.

Ripped Sandstone Transportation - The extracted sandstone will be front end loaded into haul trucks and transported to the crusher, from which the crushed sandstone will be conveyed to a covered stockpile.

Train Loading - Stockpiled, crushed sandstone will be fed from the covered stockpile onto the conveyer for transfer to the surge bin located at the train loading facility. The material will then be transported by rail to an off-site processing facility yet to be determined.

Vegetation Management

The proposed open pit development area is covered with eucalyptus woodland vegetation. There are currently exploration tracks crossing the area, some of which will be used for continued site access.

Existing vegetation within the designated pit areas will be progressively removed before extraction starts in specific development areas. The clearing schedule will be roughly in accord with the extraction schedule shown on **Figures 3.2 to 3.8**. Wherever possible, cleared vegetation will be transported directly to rehabilitation areas for respreading.

In the event that there are no rehabilitation areas available at the time, cleared vegetation will be windrowed for future mulching and spreading as part of site rehabilitation activities. If necessary, excess vegetation may be burnt with appropriate approvals from Council.

All clearing and revegetation works will be done in consultation with the relevant authorities and DLWC in particular. Seed collection of species on site will be undertaken as part of the rehabilitation program and the seeds used to propagate plants that will be used in the rehabilitation works.

Topsoil Handling and Storage

The topsoil on site mainly consists of a very shallow (<0.30m) cover of poor quality, sandy loam over most of the proposed kaolin mining area.

Topsoil will be stripped (by bulldozer, hydraulic excavator or FEL) and either used immediately in rehabilitation works or stored for future rehabilitation works. Wherever possible, overburden will be stripped, transported, dumped and respread in one operation. This will be done in accordance with preferred DLWC policy in order to sustain as much of the biological content of the soil as possible.

Topsoil removed from the areas initially disturbed, ie. the infrastructure and stockpile areas, will be stored in topsoil stockpiles located within the final pit limits that will be cleared for this purpose. These areas will have silt fences constructed downslope to

contain sediment movement. The topsoil stockpiles will be approximately 2 m high and will have batters no steeper than 1:3 (V:H).

The topsoil stockpiles will be seeded with grasses as soon as construction has been finalised (subject to suitable weather conditions) to stabilise the soil. This topsoil will be used in the initial landscaping works to be carried out on the berms of the pit benches.

Soil and Water Management

An Erosion and Sediment Control Plan will be prepared as part of detailed design for the project. The plan will detail works to be undertaken prior to any surface disturbance such as the clearing of vegetation and subsequent stripping of overburden. Such work will include:

- ☐ construction of sedimentation dams on all significant drainage lines exiting the site to ensure that sediment does not leave the site during the early stages of construction;
- ☐ use of hay bales or sand bag check dams in roadside drains and minor watercourses to retard runoff flow and trap sediments; and
- ☐ erection of silt stop fencing downslope of all disturbed, externally draining areas.

All sediment traps will be regularly maintained to ensure effective control of runoff from disturbed areas.

After initial protection works have been installed a sump will be constructed in the base of the pit to collect stormwater at a low point in the pit, and prevent sediment-laden water from leaving the site. This sump will be constructed to ensure that the 1 in 50 year storm event will be contained within the open pit development area, protecting the waterways of the adjacent Blue Mountains National Park and World Heritage Area. For the remainder of the pit development, all erosion and sediment controls within the mine will discharge into the main open pit sump. Water will not be discharged from the site unless it meets discharge requirements specified by the relevant authorities.

The proposed system will provide significant protection against sediment movement into adjacent watercourses in the Blue Mountains National Park. Further information on erosion control systems is provided in the discussion on water management and erosion control.

3.5 Extraction Method and On Site Handling

Extraction will proceed in a north to south direction from top to bottom to minimise noise and dust impacts on local residents. Additional depth will be obtained as pit development moves southward, helping to shield residences from the development. Extraction of premium and standard grade sandstone will involve the following activities:

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- ❑ **topsoil removal and storage:** stripping and/or placement of the topsoil using a small dozer. This will avoid compaction of the soil and subsequent loss of structure. If topsoil cannot be used immediately in rehabilitation works, it will be stockpiled in low (approximately 2 m high) piles for later use in progressive rehabilitation;
 - ❑ **friable sandstone extraction:** extraction will be achieved by dozer ripping and pushing into heaps for front end loading to haul trucks;
 - ❑ **materials handling:** once ripped, pushed and loaded friable sandstone will be trucked to the crusher station before being conveyed to stockpiles and/or the rail loader.

Due to the fact that downstream processing will be conducted offsite, large stockpiles of the material will not be necessary at Newnes Junction. Temporary stockpiles will be necessary to store crushed sandstone prior to transfer for rail transportation. As far as is practicable, these will be located in-pit, on working benches.

The following details regarding the extraction and handling of the crushed sandstone have been provided by Roger Smith and Associates.

Figure 3.9 and **Figure 3.10** show the conceptual flow and layout of the materials handling, stockpiling and train loading system proposed for the operation.

3.5.1 Extraction

Mine planning is based on a gradual increase over the initial ten years of pit operation until full production is reached in approximately year 11. Friable sandstone will be extracted by ripping with a bulldozer, prior to loading onto haul trucks and transporting it up a ramp to the crusher station (see **Figure 3.10**).

3.5.2 Crushing

Crushed sandstone will be delivered to the crusher station by 50 t dump trucks and discharged through a grizzly screen to a surge bin below the dump point.

The grizzly will be horizontal and minus 200 mm material will pass through, leaving a small amount of plus 200 mm on the grizzly. The grizzly will be a hydraulically operated, tipping, SimbaGrid type that allows oversize to be tipped off to the side as and when necessary. The small amount of oversize expected would be periodically backloaded onto a returning truck and taken back to the pit to be laid out, run over by the dozer and crushed to below 200 mm. It is anticipated that trucks coming off the dump station would turn left around the end of the Stacking Conveyor, run west along the northern boundary of the lease, then turn left again to pass under the stacking conveyor return down the ramp into the pit.

A light duty Apron Feeder will be located under the Surge Bin to ensure a steady controlled feed to the rest of the system. The Apron Feeder will discharge into a roll type crusher/sizer that performs both the initial crushing operation and also sizes the sandstone for reliable subsequent/ stacker/ reclaimer/ train loading operations. The

friable sandstone will crush easily and the crusher/sizer will operate on an open circuit.

3.5.3 Stockpiling Conveyor

Crushed sandstone will fall onto a transfer conveyor and then be transferred to the stockpiling conveyor. The capacity of the stockpiling conveyor system will be 680 t per hr.

Crushed sandstone will include damp clayey material that is difficult to handle if it becomes wet. While the equipment has been carefully selected to take account of the nature of the sandstone and the handling characteristics of the crushed product, it is essential that the raw feed be protected from the rain from this point on. For this reason, the dump point, all conveyors and the product stockpile will be covered. These covers will also reduce the dust generated by the operation.

The stockpiling conveyor will elevate and then run horizontally along a gantry over the top of the stockpile area. A tripper will be incorporated into this system and operate over the full length of the stockpile. The tripper will move automatically when the stockpile reaches the required height and controls will be designed to allow the tripper to operate from either end. By this means, a single stockpile system will stack premium grade sandstone one end and standard grade sandstone the other end, thus avoiding duplication of the facilities.

3.5.4 Main Stockpile

The capacity of the main crushed sandstone stockpile will include 6,000 t of premium grade sandstone and 6,000 t of standard grade sandstone. This will be equivalent to the volume required by two unit trains for each grade of material.

The stockpile area will be excavated out of the slope of the hill and partially concealed from view. The base of the stockpile will be bedrock and no concrete pad will be required. The material excavated during the construction of the stockpile area consists of friable sandstone that will be fed back into the system.

A 45° pitched, environmental green, colourbond roof will be erected to cover the entire, main stockpile area. Vertical columns down the length of the stockpile will support the overhead tripper gantry, as well as supporting the A-frame roof support system. This will keep the crushed sandstone dry and reduce the visual impact of the light coloured stockpiled material.

A 3 m deep trench will be excavated down the centre of the stockpile to house the reclaim tunnel under the stockpile. This trench will continue down the length of the stockpile with a slight negative slope so that the whole reclaim tunnel will be self-draining.

3.5.5 Stockpile Reclaim System

The capacity of the reclaim system will be 4,000 t per hour, to match the loading rate of the train loader.

A series of wide throat reclaimers will be located in the roof of the reclaim tunnel under the stockpile. Preliminary estimates suggest that a total of ten units would be required, five for premium grade sandstone and five for standard grade sandstone. Each set of reclaimers will operate independently and interlocks will prevent both sets running at the same time, preventing contamination of the different graded material.

3.5.6 Reclaim Conveyor

As the existing topography on the lease is lower than the rail loop and is sloping away from the rail line, it will be necessary to cut the stockpile area into the hillside and provide a ramp for the conveyor up to the lease boundary. The ramp will involve a 5 m wide bulldozer cut with the surrounding area being left untouched for visual screening. Spoil from the excavation of the reclaim conveyor will consist of friable sandstone and will be fed back into the system.

The reclaim conveyor will run through the reclaim tunnel, up the ramp and then continue on to intersect the rail loop adjacent to the existing Clarence Coal Loading facility. In order to intersect the rail line at the required point, it will be necessary to angle the whole conveyor and stockpile system at about 5° to the line of the northern lease boundary. In consideration of the size and location of this conveyor, it will be designed to drive on the return side of the belt or on the tail pulley.

All conveyor gantry structures will be painted environmental green to reduce their visual impact.

3.6 Transportation

Transportation of crushed sandstone from site is possible either by rail or by road since facilities for both exist in the vicinity of the proposed development. There is an existing rail loop associated with Clarence Colliery, which is used to transport coal to Port Kembla. Currently the facility is under-utilised and can easily accommodate the proposed maximum production rate at the Newnes Junction Pit as well as Clarence Colliery. Road transportation of the material is also a possibility, however, the additional resulting traffic on the Bells Line of Road would be undesirable. It is considered that rail transport of the run-of-mine material to an off site plant located in the outer suburbs of Sydney is the best and most environmentally responsible option.

For these reasons, it is proposed to rail the crushed sandstone to the processing site in Sydney.

In view of the size of the unit trains and the required loading rate it is impractical to provide bins on the rail loop large enough to load a full 3,000 t unit train. Consequently, the reclaim system and conveyor will be designed to match the loading rate and the train loading bin will operate as a small surge bin. The design capacity is 680 t, giving about a 7.5 minutes residence time. This will be adequate to handle any fluctuations in the reclaim system.

Since it is impractical to consider sharing the existing train loader with Clarence Colliery, a separate, purpose designed train loader located adjacent to the existing coal loader will be constructed.

It is intended to use similar rail wagons to those commonly used for coal and it will be necessary to provide a simple, mechanically operated, automatic cover over the loading port to keep the crushed sandstone dry during transit. The loading system is anticipated to be a continuous, automatic, flood loading system similar to that commonly used in the Coal industry throughout Australia. The Clarence Colliery Rail Loop is a Class “A” system and a unit train holds 3,000 t. In order to fit in with the Clarence Colliery operations, it will be necessary to load a unit train in less than 55 minutes to avoid excessive penalty rates. At 4,000 tonnes per hour loading rate, the Newnes Junction Friable Sandstone system will be designed to load a unit train in 45 minutes.

To transport the maximum anticipated production of 1.4 Mtpa on a 50 week/year basis will require 9 unit trains per week. This is similar to the existing number of coal trains per week. Stockpile capacities will allow up to a maximum of 2 trains per day for 2 days. Clarence Colliery will have priority over the use of the loop. They also may, on occasions, load 3 trains in one day however, this is only 3 hours out of a day and still allows adequate time for the proponent to load 2 trains on the same day.

The operation of the reclaim system, the train loading conveyor and the train loader will all be interlocked, automatic and controlled from the train loader control cabin by the operator.

3.7 Processing of Crushed Sandstone

The establishment and operation of the proposed processing plant will be covered under a separate EIS once site selection and negotiations have been finalised. While approval for the processing area is not being sought in connection with this EIS, conceptual information regarding the processing of the primary crushed sandstone is provided in **Appendix C**.

In summary, the downstream processing area will be located close to rail transport to enable the crushed sandstone, raw feed to be brought to site by rail from Newnes Junction. In addition, the processing site will require a reasonable land area, considerable quantities of water, power and proximity to road transport routes.

Given the above criteria, it is considered environmentally responsible and financially more viable to locate the processing plant in an industrial area on the outskirts of Sydney. NKPL is investigating available sites that meet the necessary criteria for secondary, tertiary and quaternary processing, product stockpiling and dispatch. NKPL is at various stages of negotiation with the owners / lessees of each of the sites and a final decision regarding the processing site should be able to be made in the relatively near future.

It is anticipated that a separate development approval will be sought for a processing and distribution site located adjacent to rail facilities in the Greater Sydney Area.

Timing of this application will be subject to negotiation of satisfactory commercial terms and any conditions imposed on the Newnes Junction development.

3.8 Plant and Infrastructure

Plant and infrastructure required to support the project will be minimal, given that all the friable sandstone mined at the site will be transported off site for processing. Plant and infrastructural requirements at Newnes Junction will include:

- ☐ a 75 tonne feed hopper, scalping grizzly and rolls crusher;
- ☐ materials handling equipment (conveyors, drives, feeders, transfers);
- ☐ a single train loading bin;
- ☐ a small equipment parking area;
- ☐ a transportable office block;
- ☐ toilet facilities;
- ☐ power;
- ☐ a potable water supply (to be tanked in as required); and
- ☐ an equipment servicing area which will be located within pit limits as far as is practical.

3.8.1 Plant and Equipment

Mobile plant used to win, load and cart friable sandstone from the proposed mine will typically consist of:

- ☐ 1 to 2 x Cat D11 bulldozer (or equivalent depending on production);
- ☐ 1 x Cat 988 front end loader (or equivalent);
- ☐ 3 x Cat 773 dump trucks (or equivalent).

The preferred method of winning and transporting friable sandstone will be using dozers to rip and push the material into piles with a loader feeding dump trucks to transport sandstone from the pit to the crusher plant located at the north-eastern corner of the site. (Alternatively, scrapers could be used to both extract and transport the material while an hydraulic excavator could be used instead of the dozer to directly load dump trucks. The scrapers and hydraulic excavators will be optional and if used would replace the bulldozer, loader and/or dump trucks). Since the extraction of the friable sandstone will likely be undertaken by a contractor, the final equipment list will be subject to competitive tender. For the purposes of this EIS, and in particular the noise impact assessment, the highest noise generating equipment has been assumed. During the early years of the operation, noise data will be collected and if noise exceedences are found to occur, operational alternatives will be considered and implemented.

The major components of the on-site processing facilities will include:

- ☐ crusher station/trommel screen;
- ☐ stockpile conveyor;
- ☐ product stockpiles;
- ☐ train loader conveyor; and

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- ☐ train loading bin.

3.8.2 Road Design

The location of the main haul roads and ramps into the Newnes pit are shown in **Figures 3.2 to Figure 3.8**. Roads will have a minimum width of 20 m, including the travelling surface and drainage provisions. Ramp gradients will be no greater than 10% that will allow their use during wet weather. Ramps will have a minimum internal radius of 20 m.

3.8.3 Sewage Treatment Facilities

It is proposed to install a package treatment plant that uses biological processes to treat the sewage.

Effluent from such package aerobic treatment plants contains less polluting organic material and significantly less bacteria than septic tank effluent. Effluent quality requirements for such plants are:

- ☐ Biochemical oxygen demand (BOD₅) 20 mg/L;
- ☐ Suspended solids (SS) 30 mg/L; and
- ☐ Faecal coliforms (FC) 30 per 100 ml.

An example of such a unit would be the Envirocycle system. These units are circular with five annular segments in series and two centre compartments. The annular segments comprise two primary sedimentation sections and three aeration sections. The centre compartments comprise one clarifier and one disinfection tank. Sludge from the clarifier is returned to the first primary sedimentation tank. Aeration is achieved by a diffused air system and disinfection by chlorine.

Treated effluent will be used to irrigate landscaped and other revegetated areas. Spray irrigation areas will be licensed by the EPA in accordance with their requirements.

3.8.4 Power

The plant will require in the order of 2.5 megawatts of power, which will be provided from the grid. Diesel generators will be used initially and will then be retained on site as a backup power source for use in emergency. The diesel to run these generators will be sourced from two 10,000 L above ground diesel storage tanks that will be fully bunded. These power sources will provide for all requirements at the Newnes site including domestic needs, extraction requirements and conveyor drive requirements.

3.8.5 Fuels and Lubricants

Fuel will be stored in above ground diesel tanks within a bunded area on an impermeable hardstand. Diesel will be pumped directly from delivery tanks into an above ground storage tank located to the north of the site. The bund will be sufficiently large to contain 110% of the volume of the largest tank within the bund in accordance with AS 1940. Hose couplings will be located within the bund wall and

there will be no pipework constructed through the wall. The bund will contain any spillage and prevent associated soil and groundwater contamination. A small mobile tank will be used to refuel the mine equipment.

Lubricants will also be stored in a designated bunded area with a concrete base. Oil will be delivered to the site in drums that will be unloaded and laid on their sides (to prevent the ingress of water) in the bunded area. When required, oil drums will be placed on a lube and workshop truck and oil will be transferred to equipment using portable pumps.

Inspections of the tanks and the bunded areas will be carried out regularly and fuel supplied will be reconciled with fuel stored to ensure that leakage is not occurring.

Waste oil will be stored for periodic collection and recycling by a local waste contractor. In the event of a spillage, the oils will be contained within the bunded area and pumped to drums for recycling. Residual oil will be absorbed using an appropriate material, and disposed of appropriately. Any spills occurring outside the bunded areas will be cleaned up by excavation of the material and appropriate disposal.

3.9 Water Consumption Requirements

The Newnes operation will require water for the following activities:

- ☐ domestic water supplies (potable);
- ☐ dust suppression within the open pit and hardstand areas (non potable);
- ☐ dust suppression on access roads (non potable); and
- ☐ fire fighting (non-potable).

No water will be required for processing purposes since ripped and primary crushed rock will be processed off site.

Potable Water

Demand for potable water has been estimated at 20 L/person/day. With an estimated maximum workforce of up to 10 people (including truck delivery fleet), potable water demand will be approximately 200 L per day.

Potable water for drinking and staff amenities will be stored in an above ground tank (up to 5,000 L) located adjacent to the main office and amenities area. Rain water from roofs of on site buildings will be harvested with the shortfall being supplemented as required by water trucked to site by a small tanker.

Non-Potable Water

Raw water will be sourced from the in pit sump and if necessary will be supplemented from tankered supplies.

The vast majority of the site's water demand will be for dust suppression in pit. Stockpiles will be covered to minimise dust since water cannot be sprayed on the ore.

Dust suppression in the mining area and on the access road network will be achieved through the use of a water truck, which will spray water as required to minimise dust generation. The water tanker used will hold approximately 25,000 L of water and will be used as required to suppress dust on the site. During dry weather, it is estimated the tanker may be used for up to 4 hours per day, and will need filling about twice per day.

Water requirements for dust suppression for the site are anticipated to be in the order of 50,000 L/day, depending on weather conditions.

3.10 Project Schedule and Hours of Operation

3.10.1 Project Schedule

It is anticipated that the proposed extractive operation could be in commercial production within 26 weeks of development consent being granted. Exact scheduling of the development will however, depend upon the time of receipt of development approval and necessary licences and permits, availability of suitable equipment and contractors for the initial clearing, construction activities and mine operation.

Another key factor in determining the commencement of the operations will be finalising the approvals for the processing site in the Greater Sydney region.

3.10.2 Construction

Construction activities will commence following development approval and the identification and development of a suitable processing site. Construction activities at the site are expected to last for approximately 26 weeks however will be contingent on circumstances during the construction period. A detailed engineering design will be undertaken once development consent has been granted. This work will take into account any requirements in the conditions of consent applying to the project.

Contractors will be engaged to carry out the majority of construction activities and will be drawn primarily from the local area. The construction workforce will comprise a combination of skilled, semi-skilled and unskilled labour. There will be a small component of specialist contract labour as well as staff from the proponent's or associated companies who may have to be brought into the area.

Since most of the construction contractors will be locally based, it will not be necessary to establish construction camps on site.

3.10.3 Operation

Production schedules have been calculated on the basis of 10 hours per day, 5½ days per week, 50 weeks per annum, with approximately 400 tonnes per hour being extracted, loaded, transported, crushed, conveyed and stockpiled.

Normal hours of operation for development and operational activities will be as follows:

- ☐ ***Pit development*** will occur in daylight hours only, nominally 7.00 am to 6:00 pm Monday to Saturday;
- ☐ ***in-pit extraction*** will occur during daylight hours (ie. Monday to Saturday between 7.00 am to 6.00 pm);
- ☐ while the majority of ***train loading dispatch*** will occur during daylight hours wherever possible, 6 days per week, the operation will need to be available 24 hours a day, 7 days a week to provide flexibility for transportation requirements. Twenty four hour dispatch is necessary to optimise the available loading times given that the rail loop is owned by Clarence Colliery, which has priority on the loop, and that rail loading times will be determined by the rail authorities. Loading activities would occur on average for 1-2 hours per day but may occur for up to 3 hours a day depending on rail authorities schedules; and
- ☐ ***plant maintenance*** - where possible, preventative maintenance will be undertaken during normal pit operational hours. In the event that this is not possible, maintenance will occur after hours with limited overtime. Breakdown maintenance may be required up to 24 hours per day during stoppages, as per normal industry practice.

3.11 Workforce

3.11.1 Construction

During the construction period a significant number of contractors will need to be employed on site. These will include company representatives, project management, supervisors, engineers, surveyors, earthworks and other contractors (electrical, civil, mechanical etc) landscapers and so on.

3.11.2 Operation

The number of people employed at the Newnes Junction operation on a day to day basis is anticipated to fluctuate between 6 and 10, depending on production. The single shift workforce will typically require up to 8 people, including:

- ☐ 1 x pit manager;
- ☐ 1 to 2 x bulldozer operators;
- ☐ 1 x loader operator;
- ☐ 3 x dump truck drivers; and
- ☐ 1 support staff / train loader.

The proposed development will provide long term job security for the workforce once it becomes established and as production increases, further employment opportunities may become available. Outside contractors may also be employed to assist with

clearing and stripping operations, the establishment of site drainage, sediment catchment, water reticulation and rehabilitation systems.

The Newnes Junction operation will also provide direct and/or indirect employment to a number of external suppliers, service providers, contractors and consultants. These may include:

- ☐ major consumable suppliers (fuel, wear parts, tyres etc);
- ☐ parts suppliers (mobile and fixed plant);
- ☐ service contractors (electricians, plumbers, mechanics, fitters etc);
- ☐ mining and civil engineers;
- ☐ environmental contractors and consultants;
- ☐ geologists, surveyors, mine planners; and
- ☐ office suppliers, printers etc.

3.12 Rehabilitation

3.12.1 Rehabilitation Objectives

Temporary and permanent rehabilitation strategies have been developed for the site, with the primary aim being to maximise surface stability during the construction phase and to establish the final landform so that impacts on the adjacent National Park and World Heritage are minimal.

A rehabilitation strategy has been developed which incorporates temporary and permanent structures to maximise surface stability during construction works and rapidly establish final batters and benches. The objectives of the rehabilitation strategy are to:

- ☐ minimise the environmental impact of the expanding operation during development and operational phases, ensuring that protection of water quality and erosion control works are key priorities, and that progressive rehabilitation is completed as soon as possible;
- ☐ ensure that site drainage and sedimentation structures remain stable and functional under extreme rainfall events;
- ☐ ensure that vegetative matter and topsoil is made available for site rehabilitation as required;
- ☐ guarantee that the resource is extracted and the site rehabilitated in a manner that will ensure the quality of surface runoff and groundwater infiltration at all times; and
- ☐ produce a final “walk away” landform which is geotechnically stable and blends aesthetically into the surrounding landforms, yet as far as possible does not limit possible future land uses.

3.12.2 Infrastructure Areas

Rehabilitation works will be conducted on all exposed batters associated with access roads, stockpile areas and water management structures. These works will be conducted as soon as possible after construction, to stabilise surfaces, prevent erosion and protect water quality.

Surface preparation prior to rehabilitation works will generally include:

- ❑ dozer ripping of worked out areas in advance of topsoiling, seeding and sowing operations to increase moisture infiltration and improve and prolong the available moisture for establishing vegetation. Ripping will also reduce surface runoff and subsequent erosion hazards whilst promoting tree root penetration. These works will be carried out in consultation with an experienced geotechnical engineer in order to avoid any potential slope instability;
- ❑ application of fertilisers and gypsum where required to improve the structure of the material, to avoid surface sealing and to encourage early root development. Any such applications will be done in consultation with DLWC. Fertiliser rates may be reduced in order to avoid nutrient rich runoff leaving the site.

Where applicable and given the small areas to be rehabilitated at any one time, rehabilitation works may include a spray application of straw mulch material to exposed slopes. The mulch would consist of a mixture of straw, bitumen, fertiliser and seed mix. The primary purpose of this application is to provide immediate surface soil stability to minimise erosion potential while at the same time sowing grass seed and fertiliser.

An appropriate grass seed mix will be used, based on recommendations made by the Department of Land and Water Conservation. The mix will consist of a mixture of fast growing, short-lived species; slower growing, hardier grass species; and nitrogen fixing legumes. An example of the type of grass seed mix for different growing seasons is provided in **Table 3.2**.

Table 3.2 - Generalised Seed and Fertiliser Applications

Season	Species	Rate kg/ha	Fertiliser*	Rate kg/ha	Sowing
Autumn sowing/ low bulk pasture	Kangaroo Valley Rye	10	11-34-11 or 15-30-0	400	Early March to early May
	Highlands Bent	5			
	Rose Clover	5			
	Red Clover	5			
Autumn sowing/ high bulk pasture	Cereal Rye	10	11-34-11 or 15-30-0	400	Early March to early May
	Kangaroo Valley Rye	5			
	Phalaris (Sirosa)	5			
	Highlands Bent	5			
	Seaton Park Sub Clover	5			
	Red Clover	5			
	Lucerne	5			
Summer sowing/ low bulk pasture	Couch	5	11-34-11	400	Late Dec to late Feb
	Haifa White Clover	5			
	Red Clover	5			

Table 3.2 - Generalised Seed and Fertiliser Applications

Season	Species	Rate kg/ha	Fertiliser*	Rate kg/ha	Sowing
Summer sowing/ high bulk pasture	Japanese Millet	1			
	Paspalum	3			Late
	Couch	5	11-34-11	400	Dec to late
	Rhodes Grass	15	15-30-0		Feb
	Kikuyu	5			

* The mixtures in the fertiliser column refer to the percentage by weight of P₂O₅, N, and K₂O in the recommended fertiliser types. Commercial fertilisers are available which contain these proportions of major nutrients (Source: Hannon 1984).

The hay-mulching present in the spray mixture promotes slow runoff velocities, reducing scour potential. However, even with such a surface sealing, runoff from larger storm events will have the potential to erode steeper unconsolidated slopes. The erosion potential will reduce once vegetation is established.

The fertiliser application is likely to be either “Starter 15” or “Grower 11” at a rate of 400 kg/ha. Gypsum may also be applied to improve the soil structure and water infiltration, however this will be determined in consultation with the DLWC prior to revegetation works. Fertiliser rates may be reduced to 125 kg/ha in areas closer to the National Park boundary in order to avoid nutrient release. Once the areas have been sown they will be regularly maintained to maximise germination and sustained growth. Should it be necessary, areas will be reseeded. Once the final revegetation works are complete and self-regenerating native vegetation communities are established, maintenance requirements will be substantially reduced.

The above seed mix will be used in selected areas away from the National Park boundary. Although exposed slopes are not planned between the pit and the National Park, should revegetation works be necessary, only native species will be used. This will also avoid the potential for non-native grasses entering the National Park. The 50 m buffer between the mine pit and the park boundary will not be disturbed.

3.12.3 Open Cut

A unique and critical component of the operation will be the early and progressive rehabilitation of disturbed areas around the open cut. The nature of the friable sandstone requires relatively shallow ripping and selective extraction from horizontal benches to optimise grade separation. Consequently, the pit will be developed with very shallow benches. The general rehabilitation concept for the pit walls is shown in **Figures 3.12 to 3.14**. Rehabilitation of the site will occur progressively around the peripheries of the site, not within the open pit itself, which must be left open for continuing and contamination free extractive operations.

The nominal bench height within the pit will be 3 m high. A 2 m berm will be created on each bench during the extraction of the bench below it. This method of extraction will allow for the 2 m berm to be revegetated as the bench is extracted, enabling progressive rehabilitation of the mine walls. In normal hardrock quarries, the bench heights are usually some 5 times higher, rendering rehabilitation work difficult and impossible to commence until the later stages and/or completion of extraction.

Once the edges of the first bench have been taken, a 2 m wide area around the perimeter of the excavated area can be rehabilitated adjacent to the 3m pit wall, while extraction continues on this and the next bench.

The rehabilitation will occur progressively and will involve:

- ☐ surface preparation of the area by ripping;
- ☐ placement of at least 10 cm of topsoil on a 2 m wide area of the bench around the edge of the pit; and
- ☐ planting of native shrubs and trees on the topsoiled bench. It is proposed to undertake some tree planting in the early stages of the project. These rehabilitated areas will assist in minimising the visual impacts of the mining activities from the adjacent National Park. By the time open pit operations have reached an advanced stage, these rehabilitated areas will be well established and these terraces will form part of the final landform.

The areas to be rehabilitated can be prepared, topsoiled and revegetated using the un-mined working bench for access. Extraction of the next bench will cease at the edge of the rehabilitated berm and then continue down into the next bench. The site topography will allow for continued access to all benches.

The rehabilitation plan results in a large number of small benches being formed, each with a rehabilitated berm. The benches will be formed rapidly, enabling progressive rehabilitation. The final bench will be shaped in the form of a lake, which will be allowed to fill with surface water and pit seepage. This will provide the potential for passive recreational activities at the end of extraction at the site.

3.12.4 Final Land Use

The principal objective of the rehabilitation plan is to form a stable landform that will pose no long-term environmental hazard to the adjacent Blue Mountains National Park and World Heritage Area.

When determining the appropriate final land use for the site, a number of other factors need to be taken in account, namely:

- ☐ compatibility with surrounding land uses;
- ☐ existing ecological values;
- ☐ physical constraints;
- ☐ visual implications and landscape compatibility;
- ☐ soil availability or suitability of alternative top dressing materials;
- ☐ existing land capability for the site and surrounding areas, and
- ☐ requirements of state and local authorities and community organisations.

Since the area currently supports open eucalyptus forest, it is appropriate that the final vegetation of the site be similar. The topography of the final land use will consist of a large number of small benches formed in an amphitheatre shape, each with a rehabilitated berm. The final bench will be shaped in the form of a lake that will be

allowed to fill with surface water and pit seepage. This will provide for a stable landform that will not have a negative impact on the adjacent National Park.

NKPL are mindful of the importance of keeping final land use options open in light of the significant changes that can occur over a 21 year period. During the course of the mining and rehabilitation works, further opportunities may be identified which could influence the final use of the land. This may result from input from local organisations or government agencies.

The final void will be secured in a manner acceptable to the Department of Mineral Resources. A preliminary final rehabilitation plan is shown on **Figure 3.8**. To achieve this landform, rehabilitation works will occur as soon as practical at the edge of the current working bench.

In order to minimise the visual impacts of the site from views of pit faces from Bald Trig within the Newnes State Forest and elevated vantage points within the Blue Mountains National Park, it is not proposed to leave the excavated pit walls as one face. As outlined above, the resultant pit wall will be progressively rehabilitated to create numerous benches or terraces down the slope, each of which will be vegetated by native species obtained from the area. This revegetation program will limit the visual impact of the project from elevated vantage points during all stages of pit development.

Areas requiring long term stability will be seeded with a mixture of native tree and shrub species in the initial sowing. In addition, seedlings will be planted on the berms in accordance with the requirements of the DLWC. Advice will be sought from the DLWC for an appropriate species list to be included in the sowing mix and seedling planting.

In most areas the final rehabilitation works will be a natural progression and continuation of the initial rehabilitation works. Until such time as extraction has ceased, rehabilitation will occur around the edges of the pit, and will not involve the pit floor. This means that rehabilitation will be limited to bunded berms and vegetation works located around the roadways and infrastructure area.

Following cessation of extraction, it is proposed to permit the floor of the pit to flood, thus creating a water body. The land surrounding the water body at the base of the pit will be revegetated with native species. Once revegetation works are established, the lake could serve as valuable water storage for local wildlife.

Once operations have been completed, all buildings, infrastructure and stockpiles will be removed from the pit and processing areas leaving them to be shaped and ripped where necessary, for topsoiling. It is anticipated that only minor regrading will be required for these areas. It is proposed that the main haul road will remain for use in the ongoing management of the site rehabilitation and for fire fighting purposes.

Revegetation works will be monitored in order to fine tune rehabilitation methodologies and ensure that a suitable vegetation community is established in the open pit area.

3.13 Energy Statement

The principal source of energy to be used in the mine will be electricity. Diesel generators will be used initially and will be retained as a back up system for emergency power only. The company recognises the need to conserve energy in all areas of its operation and is committed to using the most energy efficient processes at its disposal both from environmental and commercial perspectives. At this stage, however, it is not possible to accurately define the total energy use given that at least some of the initial development activities will likely be undertaken on a contract basis.

All mobile plant to be employed at the site (with the possible exception of a petrol powered 4WD vehicle) will operate on diesel. Estimated average annual diesel consumption will be in the order of 511,000 L at peak production, although initially it will be considerably less than this. Two fully bunded 10,000 L above ground diesel storage tanks are proposed for the site. This represents over three weeks usage, but is likely be replenished on a fortnightly basis.

3.14 Sydney Processing Plant (not subject to this application)

A conceptual kaolin separation and beneficiation plant has been designed by Roger Smith and Associates (RSA) for construction in one of several sites under investigation in the Greater Sydney Area. The site will occupy up to 8 ha within in an area serviced by rail.

Crushed friable sandstone from the Newnes Junction Open Pit operation will be transported to the site by rail where it will be fully processed into a range of industrial minerals and construction sand, as shown on **Figure 3.15**. The refined products will be transported to markets by road and or rail from an onsite distribution centre.

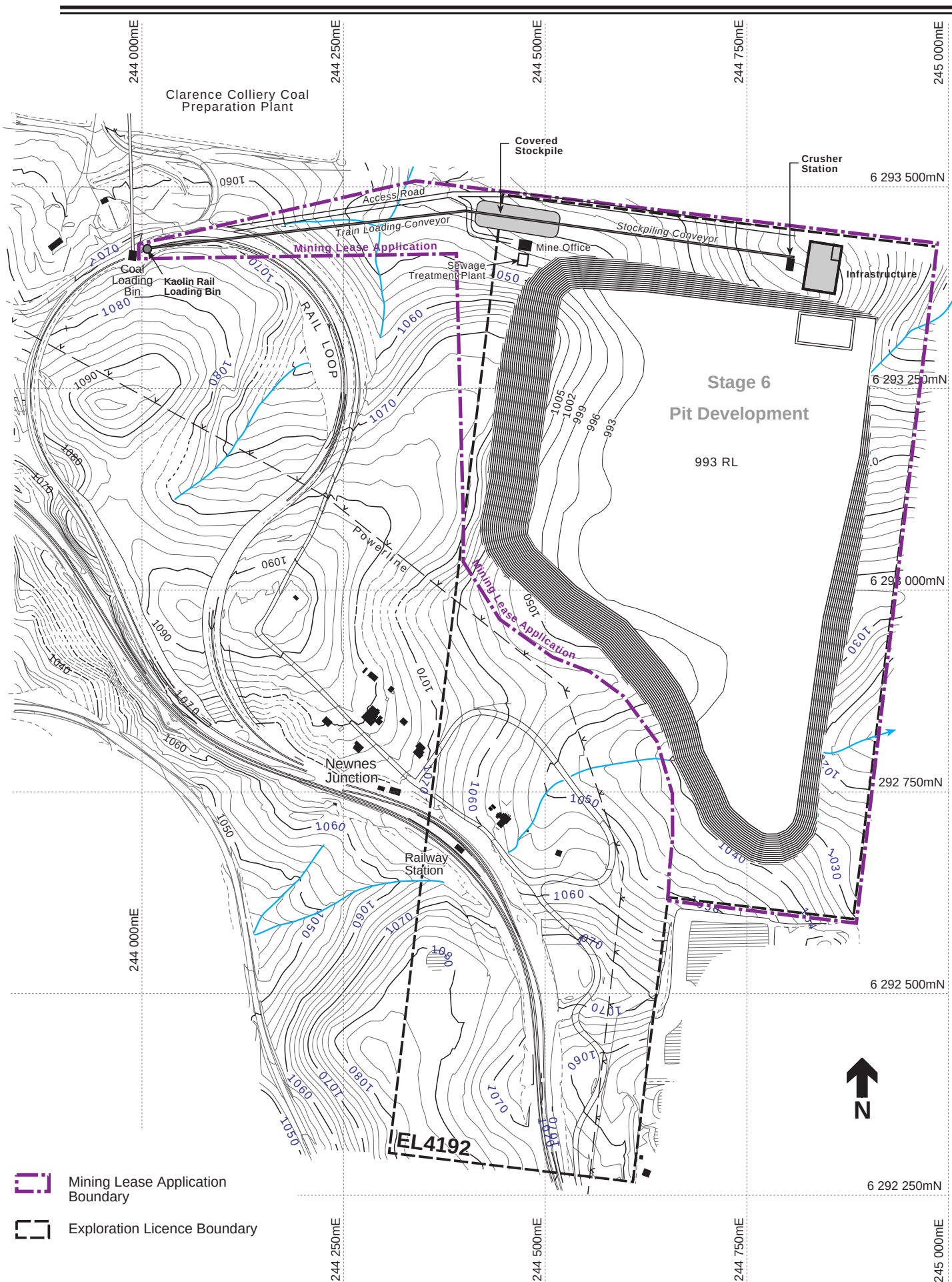
The processing plant will consist of a rail unloading facility with a raw product stockpile area attached to a reclaim conveyor.

The plant is designed as a single process, dual strand system catering for both premium and standard grade of friable sandstone and will be capable of processing up to 1.4 Mtpa of raw material.

The washplant through attrition cells and hydrocyclone sizers will recover silica silt and produce a clean washed sand less than 5mm in diameter. Kaolin clay products will pass through thickening tanks, magnetic separators and final dewatering will take place in a continuous dual belt filter press. The plant is current best practice technology and is a controlled process completely enclosed in a building.

Further refinement of the kaolin output from the filter presses will comprise calcination or part calcination, milling and bagging for final distribution. Washwater will be continually recycled through the plant and make up water will be provided from industrial water from local council wastewater treatment plant or alternatively through on site water storage dams depending on the final choice of processing plant sites.

The kaolin separation plant will require 15 full time employees. Rail unloading will proceed 24 hours per day however, the washplant and kaolin beneficiation plant will only operate initially during daylight hours but will progressively build up to a 24 hour operation when production levels are at their peak of 1.4 Mtpa.



0 100 200 300 400metres

FIGURE 3.1
Newnes Kaolin - Pit Infrastructure Layout

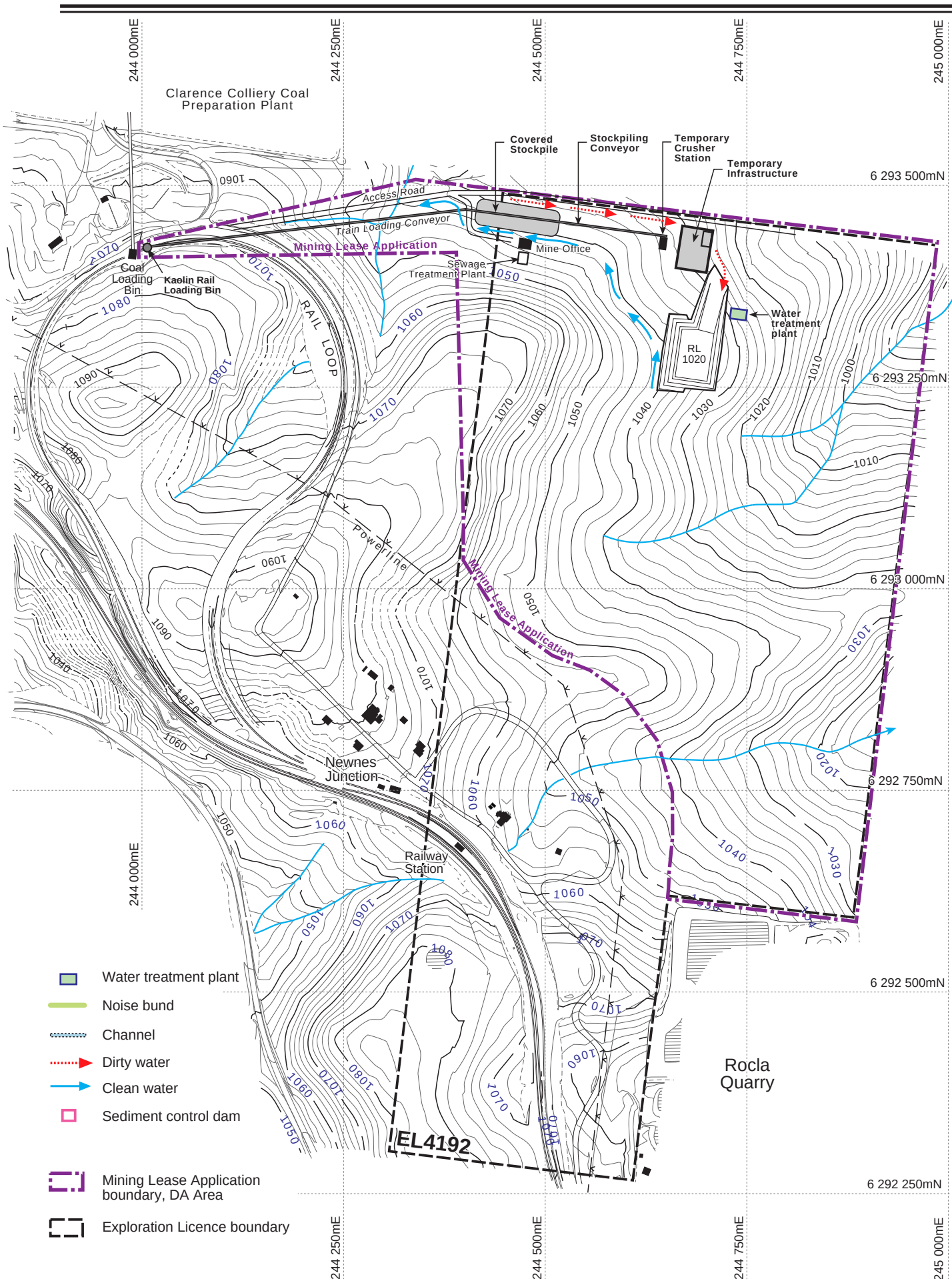
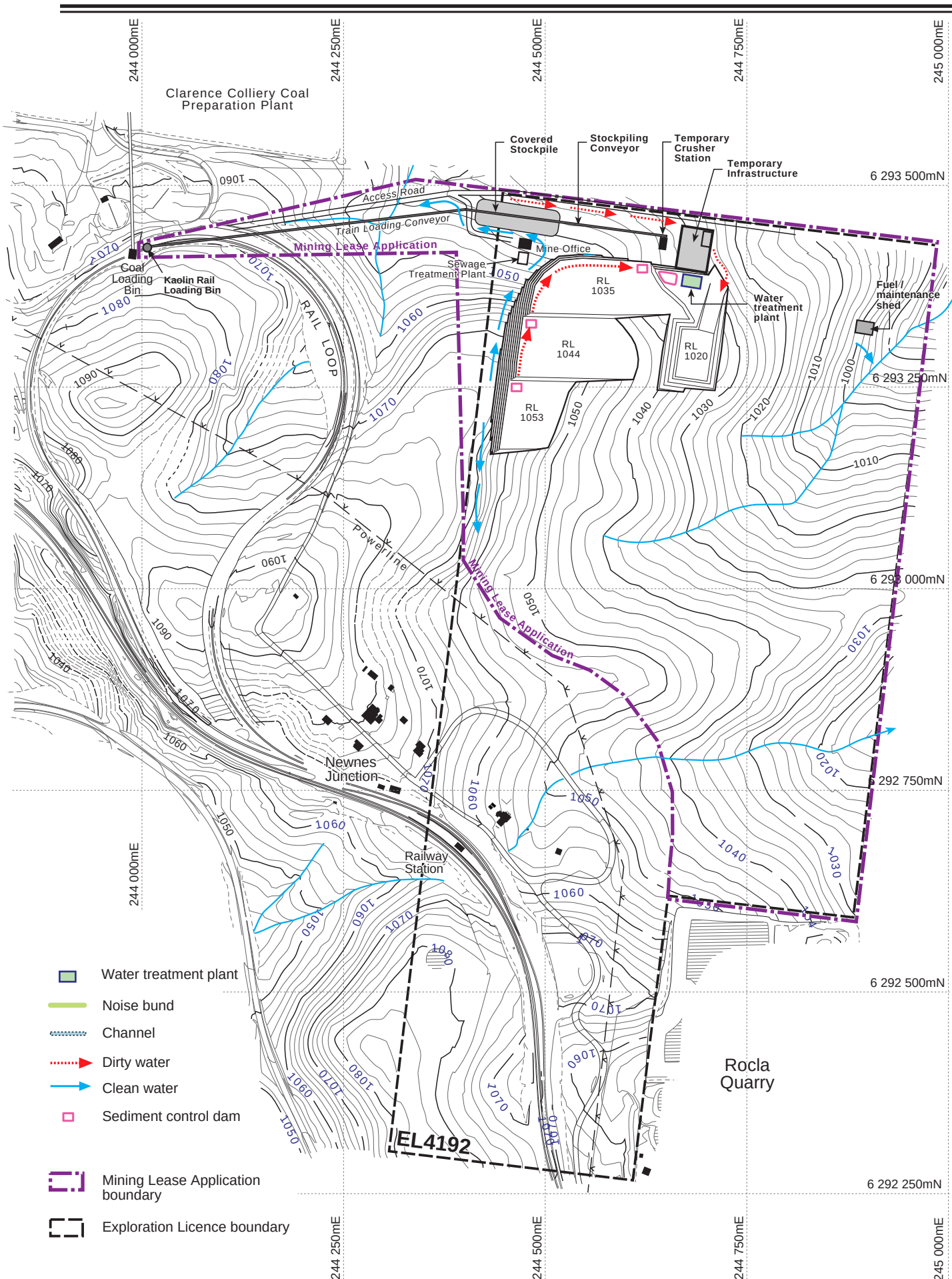


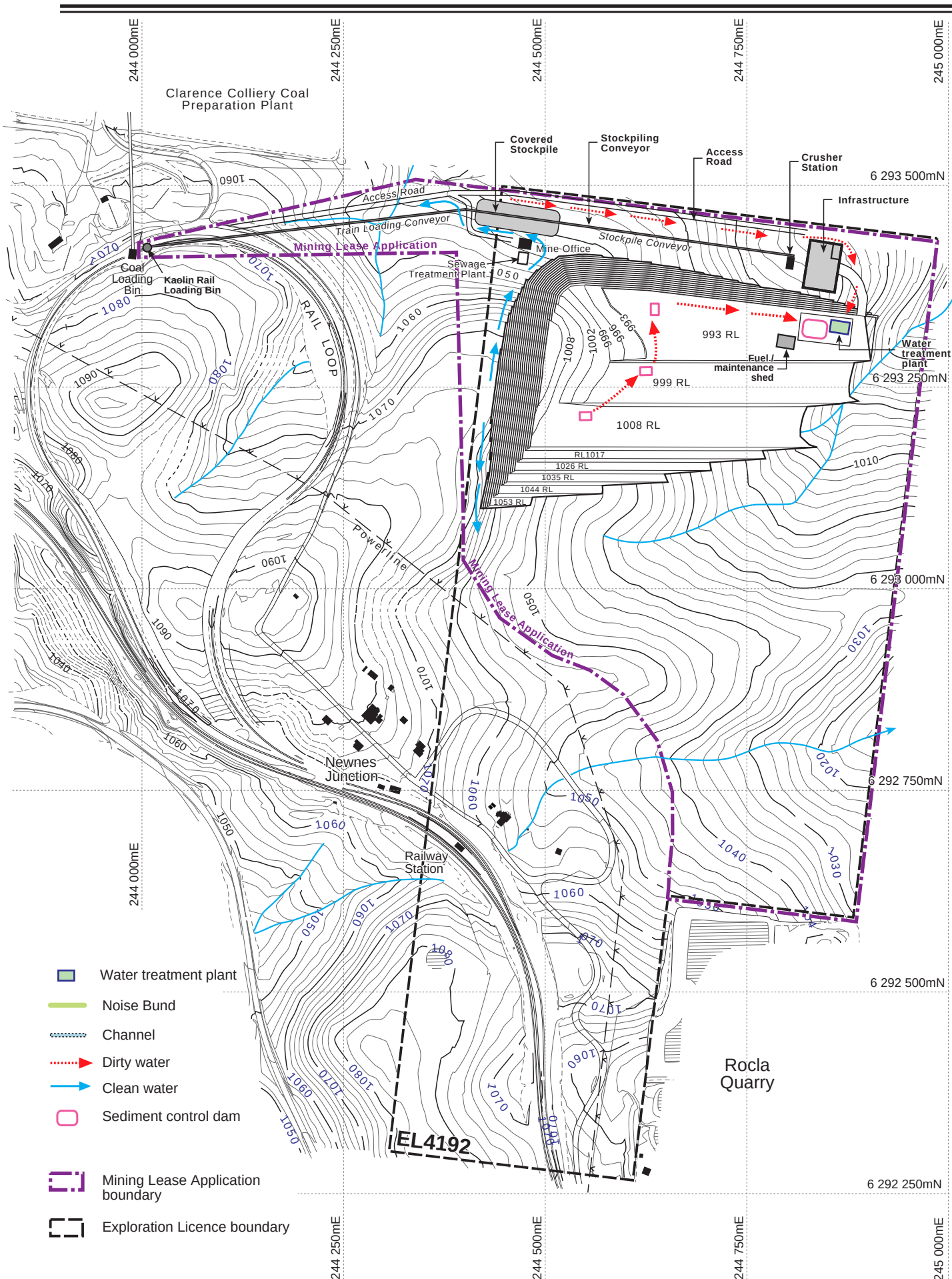
FIGURE 3.2
Mine Development - Stage 1



0 100 200 300 400metres



FIGURE 3.3
Mine Development - Stage 2



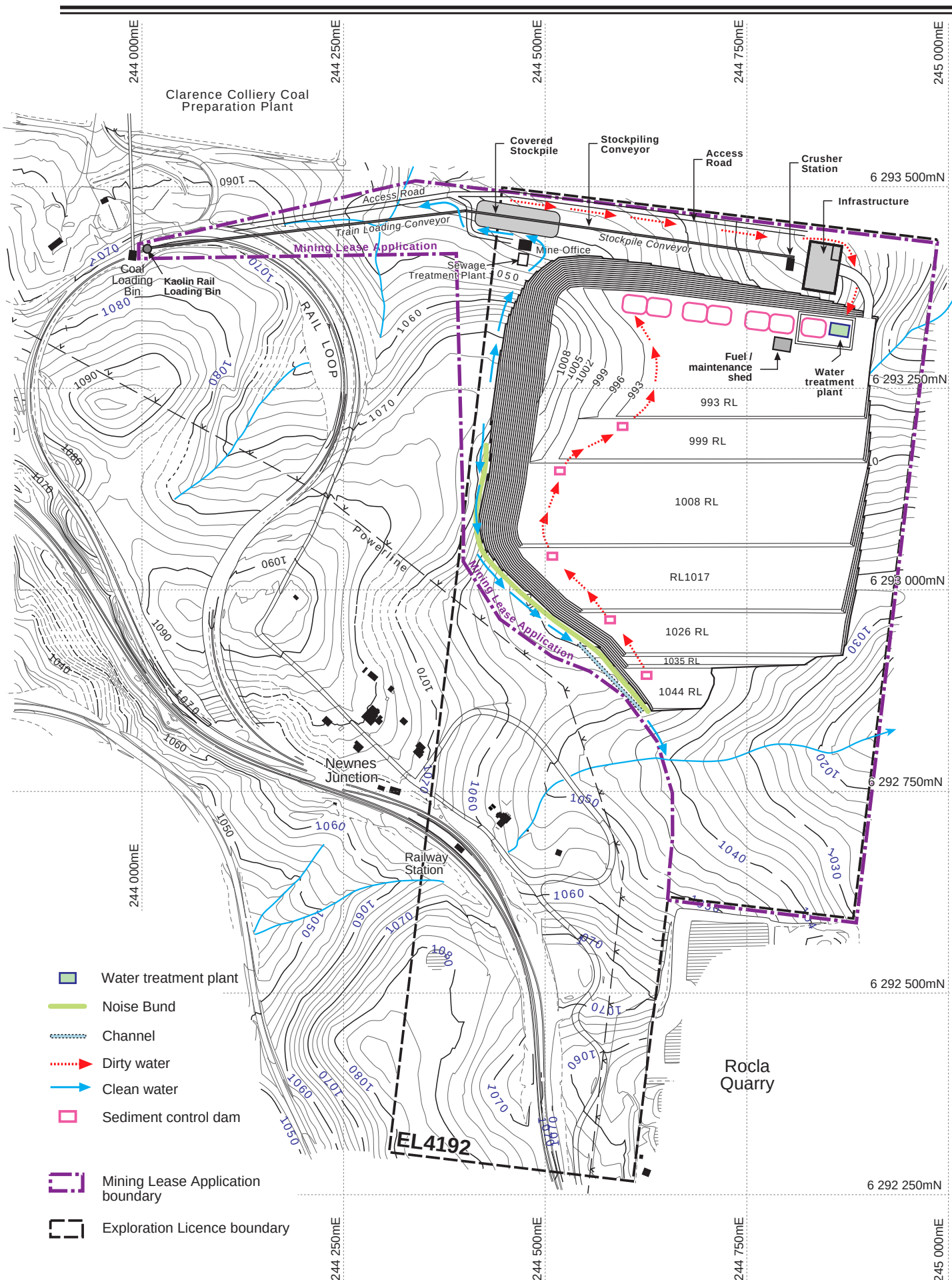


FIGURE 3.6
Mine Development - Stage 5

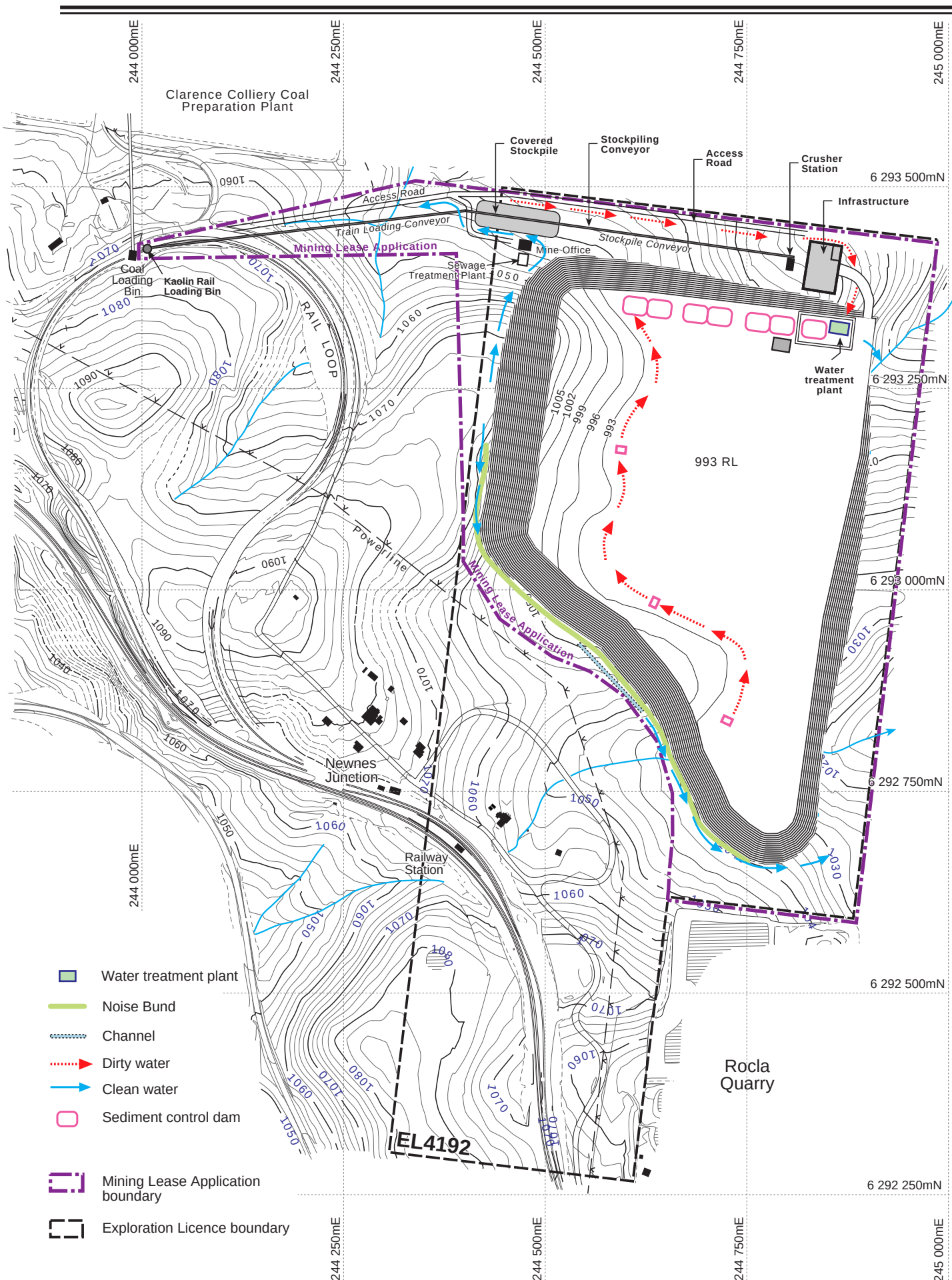


FIGURE 3.7
Mine Development - Stage 6

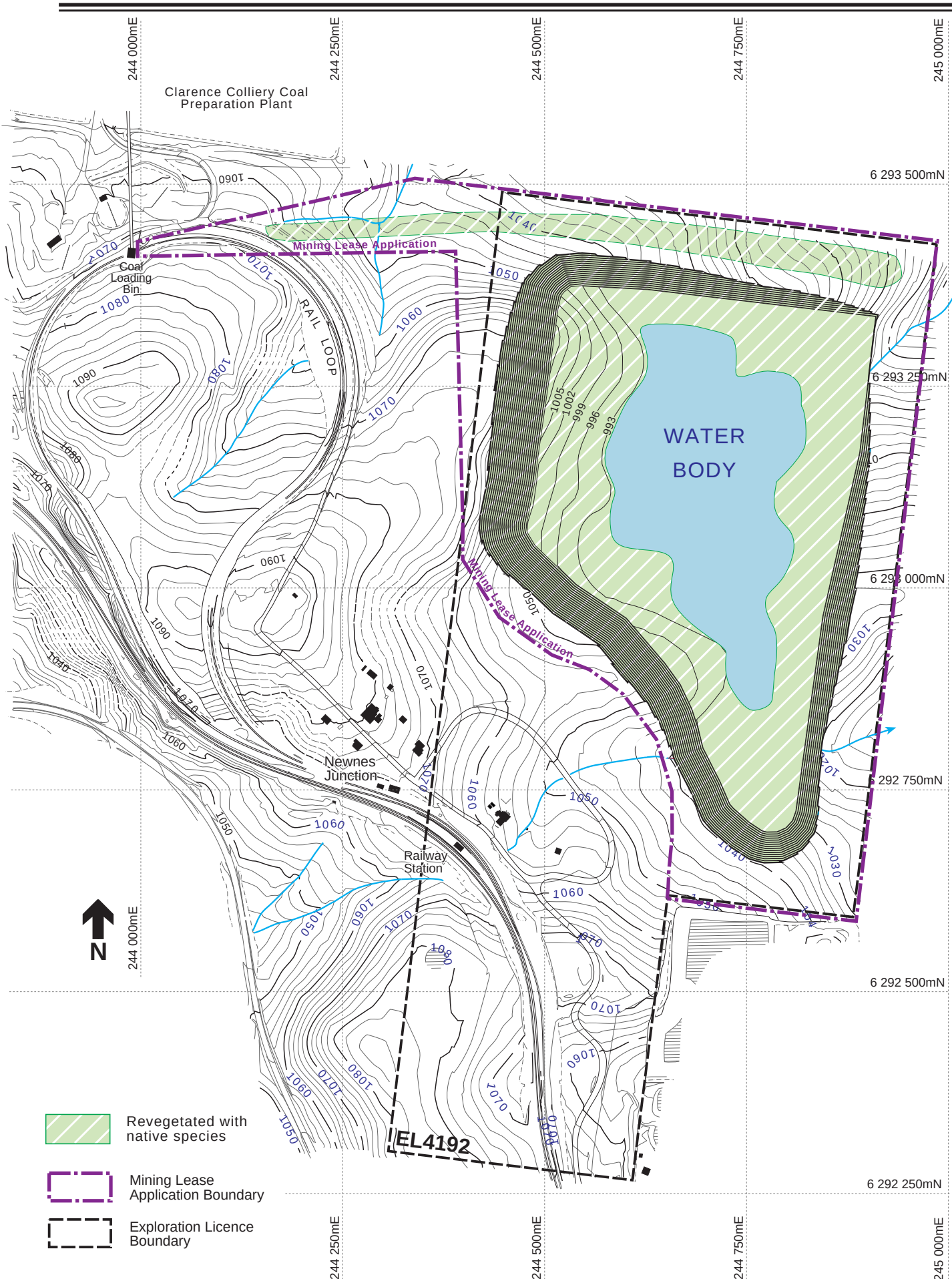


FIGURE 3.8
Newnes Kaolin - Final Rehabilitation Plan

Plan showing
stockpile, conveyor
and infrastructure

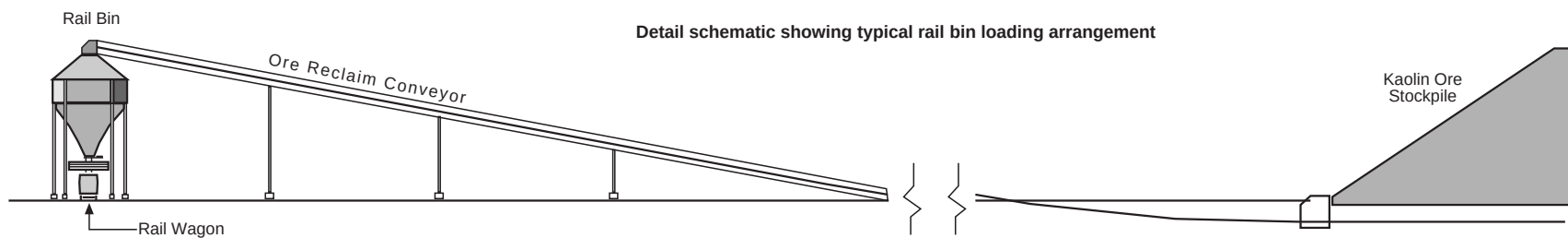
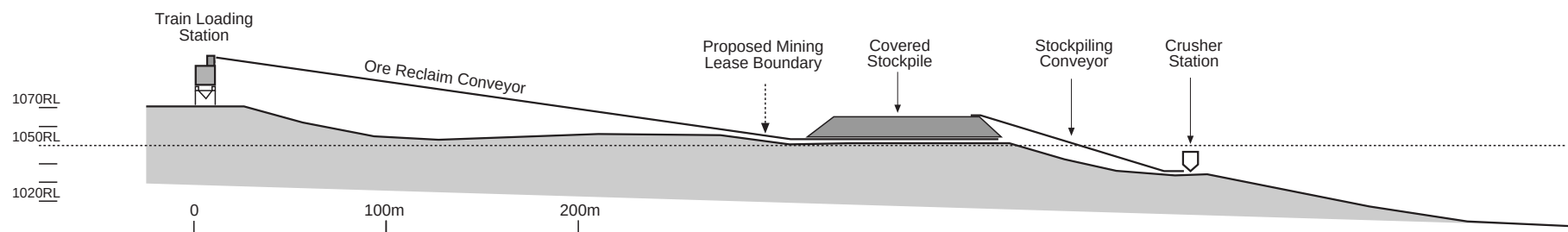
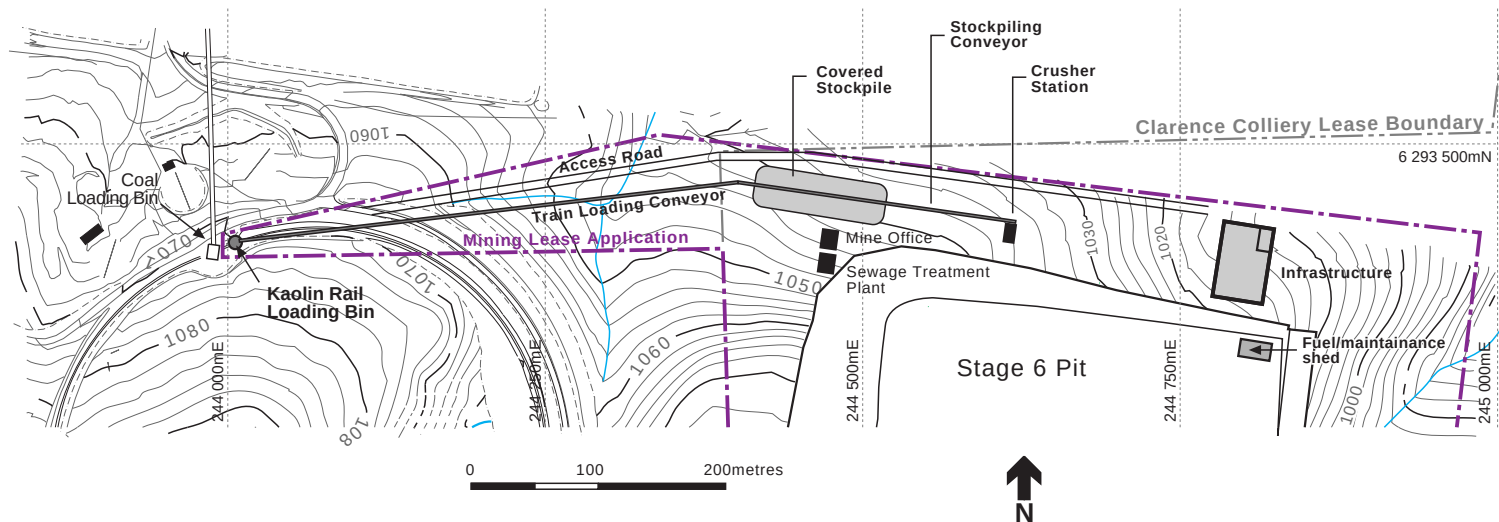


FIGURE 3.9
Newnes Kaolin
Stockpiling and Trainloading System

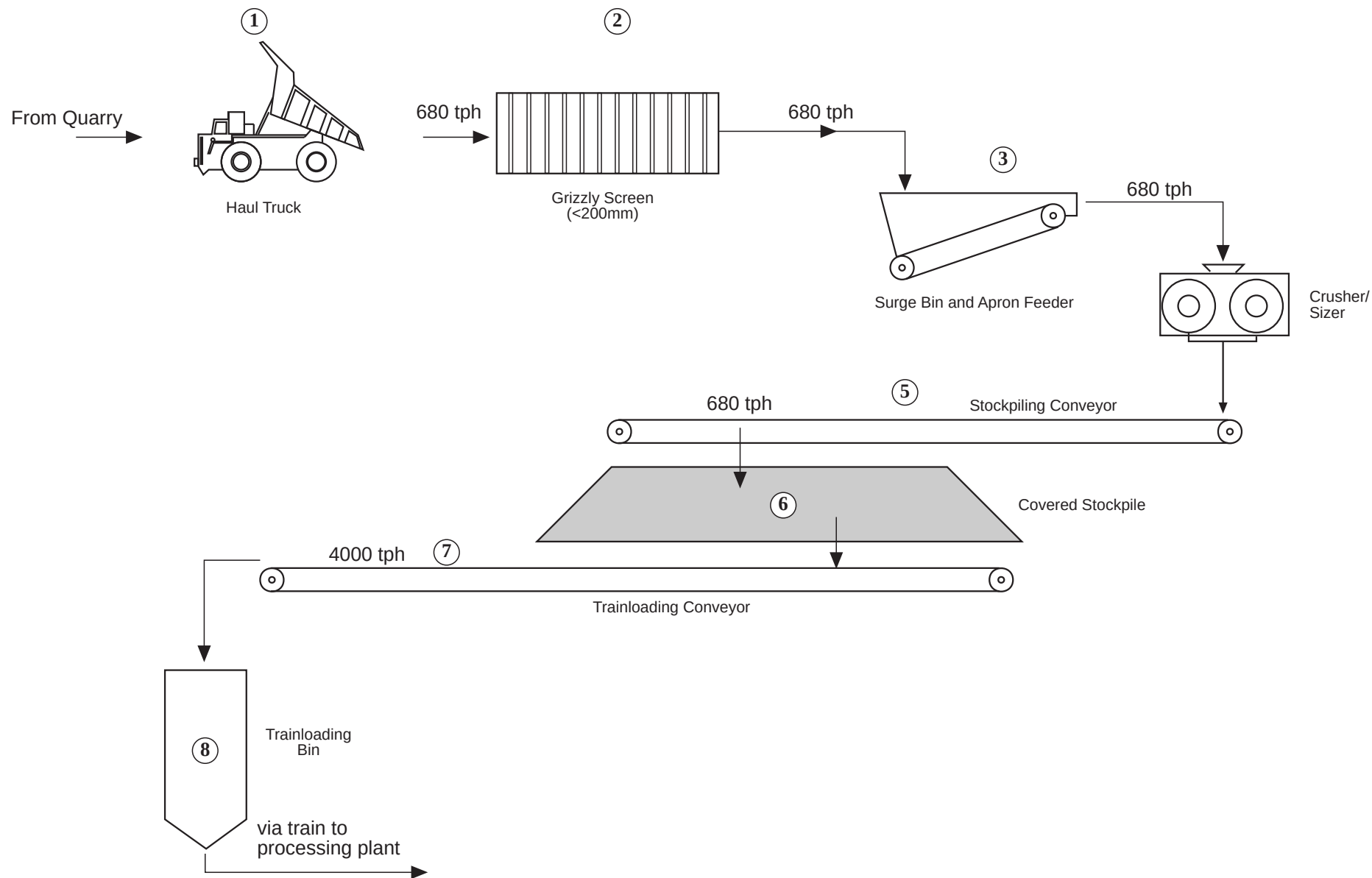


FIGURE 3.10
Materials Handling - Conceptual Flowsheet

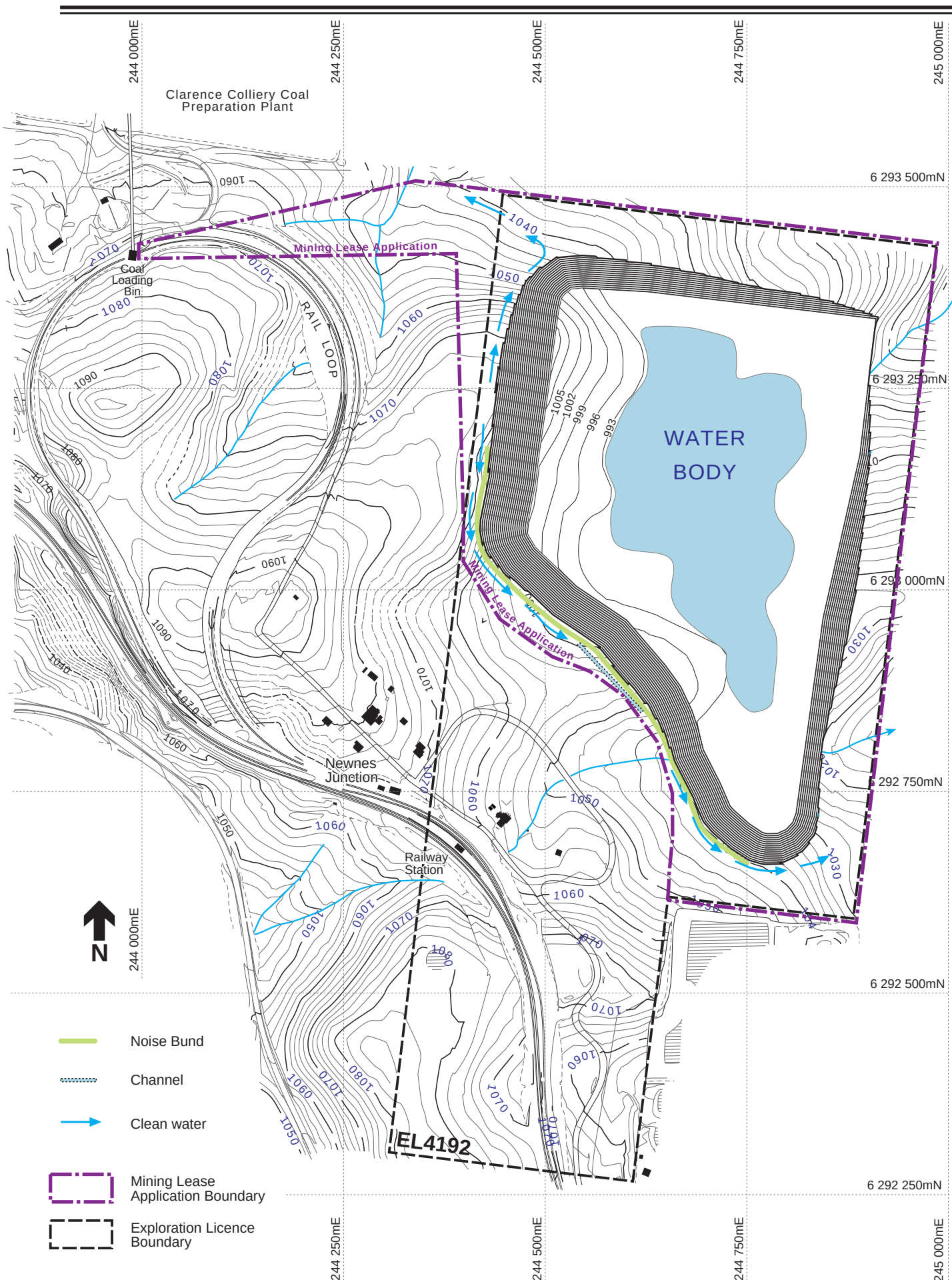


FIGURE 3.11
Final Surface Water Management

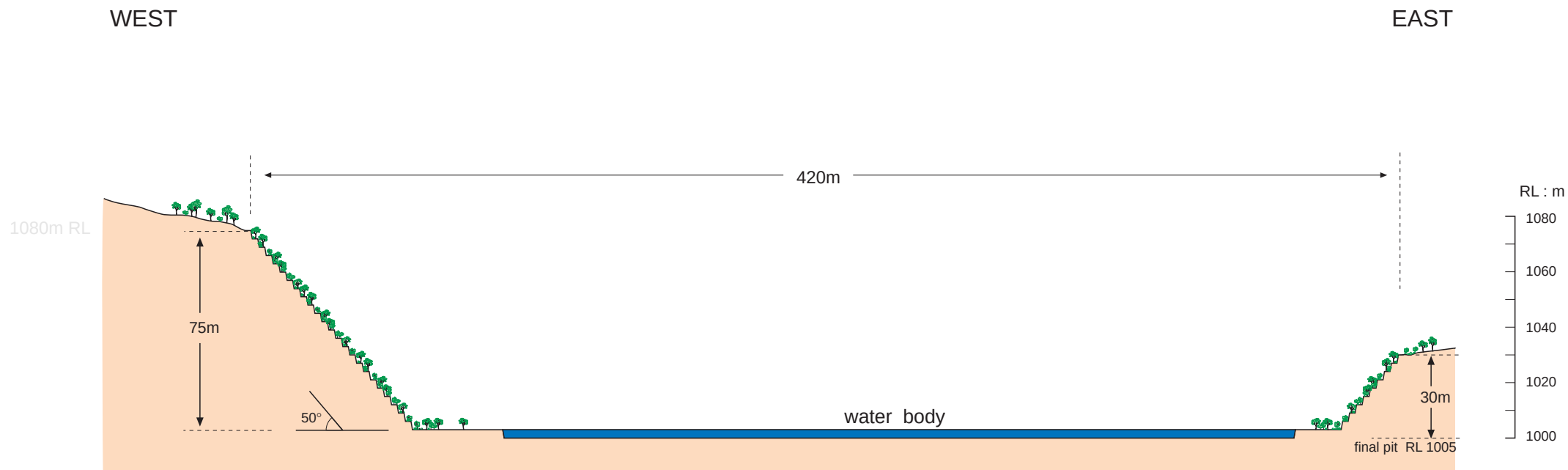
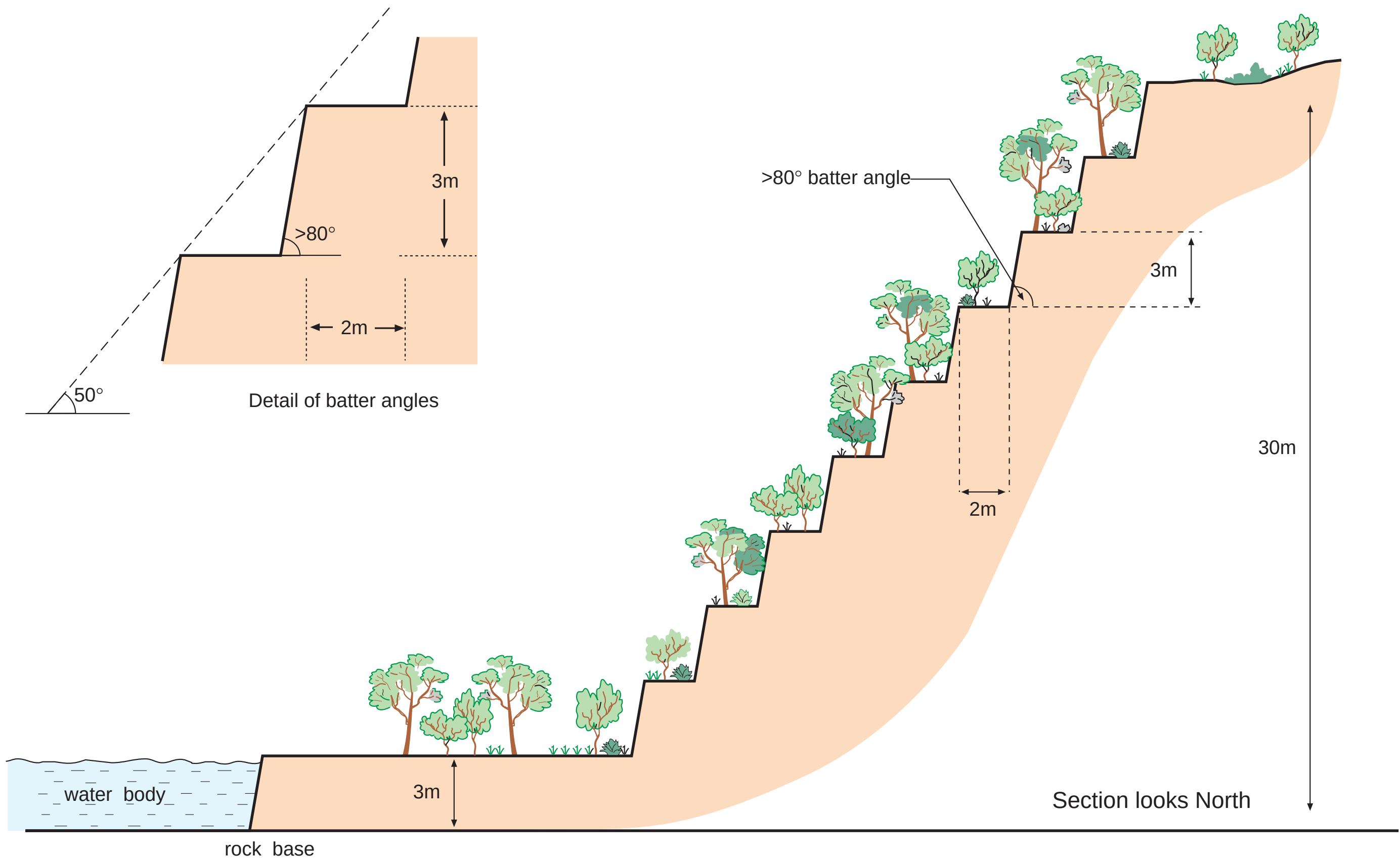
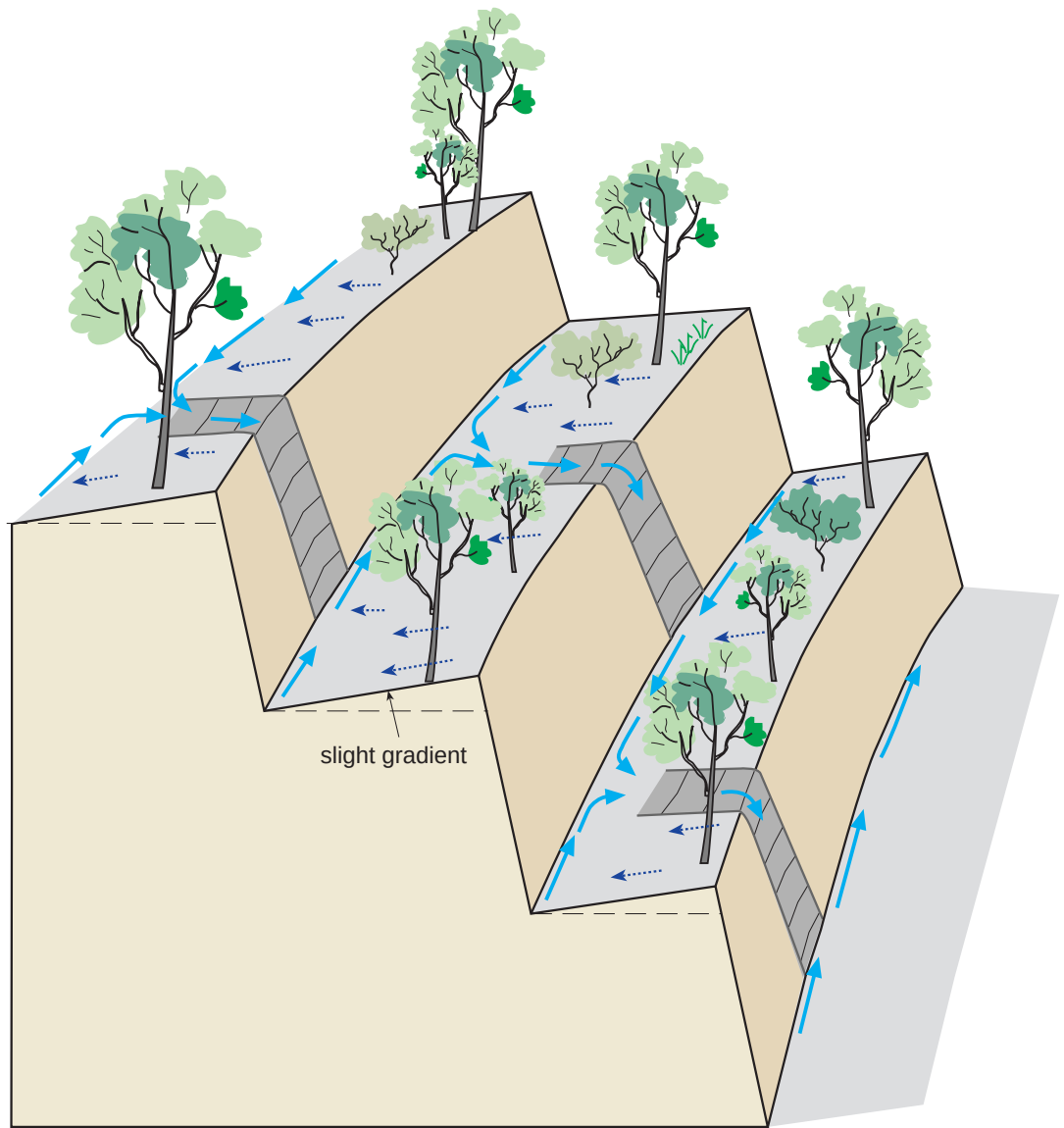


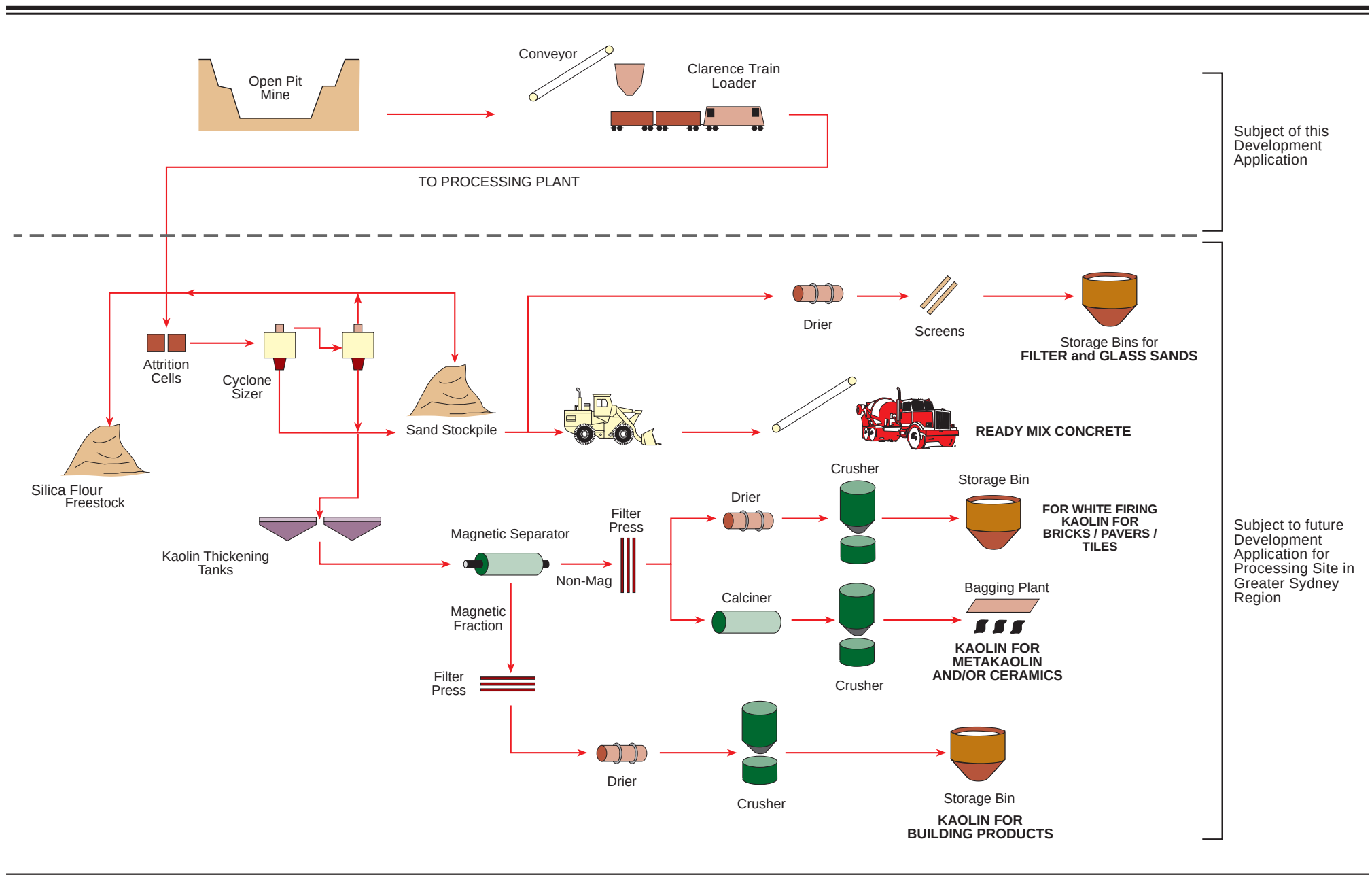
FIGURE 3.12
Cross Section - Revegetation of Benches



0 2 4 6 8 10 metres

FIGURE 3.13
Cross Section - Revegetation of Benches - Detail





Source : Newnes Kaolin Pty Ltd, March 2002

FIGURE 3.15
Sand and Kaolin Processing Flow Chart

4. Project Justification and Alternatives

This section provides the justification for the project as well as assessing the feasible open pit layout and processing alternatives. A key consideration in the justification of the project is the economic role that the extraction of the friable sandstone will have in the local and regional economy and the benefits that will result in industry.

4.1 Introduction to Project Justification

Justification of the proposed development is considered under a number of headings within this report. The principal justifications for the project are considered to be:

- ☐ the size, extractability and regional significance of the friable sandstone resource;
- ☐ the need to optimise the State's resources and to develop a valuable resource that is recognised by the NSW Department of Mineral Resources;
- ☐ the relative lack of iron concentrations and induration compared to alternative friable sandstone deposits on the Newnes Plateau (Pecover 1986);
- ☐ the range, quality and 'fully graded' characteristics of the quartz sand products able to be produced and marketed;
- ☐ the high quality of diagenetic kaolin present in the sandstone as matrix;
- ☐ the location of the resource away from densely populated areas and adjacent to established sand quarries and the Clarence Coal Colliery;
- ☐ the fact that the site is able to be developed, operated and rehabilitated in an environmentally and commercially sustainable manner;
- ☐ the proximity to the existing rail siding providing a direct rail link to off-site processing locations and Sydney Metropolitan area markets and eliminating the need to road haul product off-site with associated transportation impacts;
- ☐ the quality and range of industrial minerals and premium quality construction sands able to be derived from downstream processing of the friable sandstone;
- ☐ the current and growing regional demand for the full range of industrial mineral and construction material products able to be produced;
- ☐ the finite and diminishing availability of alternative sources of premium quality, industrial and (fully graded) construction sands, within the Sydney Region;
- ☐ the non-availability of any substantial quantities of equivalent quality **kaolin** within the Sydney Region.

The project is considered further justified by opportunities to:

-
-
- ☐ optimise the friable sandstone resource by separation, processing and/or beneficiation of individual mineral components, with little or no waste product generated; and
 - ☐ minimise environmental and social impact by adopting rail transport and off-site processing options, with limited, if any, requirement for settling ponds and tailings disposal.

Alternatives to the proposal need to be considered from the perspective of both the applicant and the industrial minerals and construction materials industries. The alternatives considered within this report relate to:

- ☐ planning alternatives considered by NKPL; and
- ☐ alternative sources of supply for local and regional markets of sand and kaolin in the long and short term.

Alternatives with respect to secondary , tertiary and quaternary processing of the crushed sandstone will be considered under a separate EIS.

4.2 Regional Significance

The regional significance of the resource has been established by

- ☐ the volume and nature of the friable sandstone resource and the quality of constituent quartz and kaolin mineralogy relative to alternative sites on the Newnes Plateau and within the Sydney Basin in general;
- ☐ the suitability of the site for open pit development, sandstone extraction, primary processing and stockpiling in terms of site topography and accessibility, sandstone friability and homogeneity, reserves, and available space;
- ☐ the location of the site in proximity to rail and markets for downstream processing and sales;
- ☐ the long term demand for kaolin and high quality industrial and construction sand products from Sydney, regional, interstate and (potentially) overseas markets;
- ☐ the finite nature of major, existing alternative sources of supply (as discussed in Section 4.8.2).

The first two issues are discussed in Section 3 of this EIS and the later issues are discussed below.

4.3 Resource Location

The friable sandstone resource containing kaolin and high quality quartz sands at Newnes junction is a geologically unique resource that cannot be replenished.

Reconnaissance geological exploration for friable sandstone resource areas within the Newnes Plateau was carried out by the NSW Department of Mineral Resources (Pecover, 1986).

Detailed interpretation of reverse circulation drill logs by NKPL focussed on the calculation of an “iron factor” based on the recorded density of ferricrete bands (ironstone); on a scale of zero, equals homogenous friable sandstone (devoid of ironstone bands) to 100 which equates to continuous ironstone. Range of the “iron factor” over the Newnes Plateau is from 0 to 40, refer **Figure 4.1**.

Ironstone banding within a friable sandstone resource is an impediment to traditional ripping and dozing open cut mining methods employed on the Newnes Plateau, and in addition, incurs increased processing costs. Furthermore, the multiple stillstands of the water table which have given rise to the ironstone bands reflect a less aggressive chemical weathering regime. Kaolin diagenetically formed under these conditions is usually not of high grade which limits its applications as an industrial mineral.

Traditional construction sand resources within the Sydney Basin are generally devoid of ironstone (Whitehouse and Roy, 2000). On the Newnes Plateau, with the exception of the southern part of the Clarence Sand and Gravel Pit (Boral), all sand extraction pits have an ironfactor of zero. From a total of 80 drill holes within EL 4192 (Newnes Junction) ironstone banding was a rare phenomenon and when encountered, bands were less than 5 cm in thickness.

Although there are no officially designated areas for sand extraction of the Newnes Plateau, Pecover (1986) has expressed the view that extraction of sand within pine forestry land on the plateau could lessen the environmental impact.

Furthermore, pine plantations according to Pecover (1986) would provide effective screening for such operations thereby reducing noise, dust and visual impact. Pines could be re-established over re-contoured areas following cessation of sand extraction.

Based upon these assumptions, potential extraction areas for the Newnes Plateau have been identified by Pecover (1986) and it should be stressed that geological modelling through exploration and quality analysis has played no role in the definition of these areas. **Figure 4.1** shows the location of these areas on the Newnes Plateau and the iron factors of these areas. A subsequent report (Department of Planning, 1996) on “Management strategy for mining of sand within the Newnes Plateau” contains a map of the area showing the same areas defined by Pecover (Sites 1-6) as “sites of highest prospectivity”.

The iron factor obtained from these areas range from 15 to 40 with an average of 33. According to the results of diagenetic modelling carried out by NKPL on the Newnes Plateau, the zone of highest prospectivity is represented by the areas of past and current friable sandstone exploration where ironstone banding is almost entirely absent with an iron factor close to zero.

Within this narrow zone of high prospectivity, there is an apparent diagenetic trend (**Figure 4.2**) whereby the iron content of the kaolin matrix decreases in a south easterly direction from 3.95% to 1.78% (raw clay) and from 1.54% to 0.66% (beneficiated clay). Concomitant with this decrease, there is an increase in brightness of the kaolin from 50.5% to 71% (raw clay) and 81% to 95% (beneficiated clay); (Kmentoni 1984, a, b, c; 1985).

Increased brightness combined with a lower iron concentration are desirable parameters of the kaolin which enhance its uses as an industrial mineral.

According to the results of diagenetic modelling carried out by NKPL, the Newnes Junction friable sandstone resource located on EL 4192 is ideally situated on the south eastern extreme of this diagenetic trend of chemical weathering. The absence of shale and claystone bands (acting as aquicludes) have reinforced the aggressive leaching conditions which has generated the high grade resource at this locality.

Premium quality kaolin and quartz sands are materials in high demand from regional manufacturing and construction market sectors. The key issues to end users are product quality and delivered cost. Product quality will result from the quality of the resource itself and the degree of downstream processing required.

Industrial mineral and construction sand markets are highly sensitive to transportation costs. Resources must therefore be located as near as possible to consumer markets and/or have transportation arrangements that permit transportation of the product in an economically viable manner. Given the extent of processing required and the fact that the bulk of excavated material needs to be transported to Sydney (as either raw feed or processed product), the decision has been made to rail all of the crushed sandstone to Sydney for processing and subsequent sales distribution.

The proposed development site is located immediately adjacent to an existing rail loop used by Clarence Colliery for coal transportation. It is sited between two existing industrial developments – Clarence Colliery pit top to the north west and Rocla Quarry to the south. The site is also adjacent to the Blue Mountains National Park to the east. The nearest residences are located in the village of Newnes Junction, a small community adjacent to the railway. It is therefore located away from densely populated areas and is not highly visible from frequently visited vantage points.

The proposal involves transporting the vast majority of the crushed sandstone to Sydney for downstream processing and sales distribution. The decision to transport all of the crushed sandstone to Sydney by rail, will assure far better utilisation of the existing Clarence rail loop and eliminate the need for high truck volumes and impacts on local and regional roads.

4.4 Production and Sales

The Company is planning a staged entry into the market, with a progressive volume increase of mining until the target goal of around 1.4 Mtpa is reached. Capital investment in processing and product beneficiation plant in the Sydney area will be

linked to market demand for the individual sand and kaolin products to be produced. Initial investment will be for plant capable of processing crushed sandstone to produce:

- ☐ building material, ceramic clays (white firing clays), and metakaolin (cement pozzolan);
- ☐ construction sand (quartz sand);
- ☐ pea gravels (landscaping);
- ☐ filter sand (quartz sand);
- ☐ silica flour; and
- ☐ glass sand (flint grade).

Sales forecasts of refined products at maximum production of 1.4 Mtpa of friable sandstone, based on market research is shown on **Figure 4.3**.

Plant design will be modular in order to allow additional processing and beneficiation plant to be installed as higher value product quality is proven and markets penetrated / captured. Whilst the project will be ‘construction sand driven’ in its initial stages, it will become increasingly ‘kaolin revenue driven’ once existing reserves are exhausted and kaolin markets are consolidated.

4.4.1 Marketable Products

End products can readily be classified into two major groupings: kaolin products and silica sand products. The silica products can be sub-divided into industrial mineral sands (glass sand, filtration sand etc) and construction sands (concrete sands etc).

The potential success of the Newnes Junction Project lies in the wide diversity of marketable products that can be separated and refined from the friable, chemically weathered sandstone to be extracted at Newnes junction. Considered on a ‘per tonne’ basis, the most valuable component of the sandstone will ultimately be the kaolin.

Although kaolin is one of the most valuable industrial minerals contained in the friable sandstone ore, the deposit is best considered to be a multi commodity deposit wherein each of the refined components contributes to the economic success of the mining project.

One of the keys to the long term commercial viability of the proposed project will the planning, management and attaining of stock balance between the production and sale of the various sand and kaolin products. This is why the production and sale of all products will be to a large extent dictated by sales of construction sand in the initial years of the project. Market analysis and financial modelling demonstrate that the project has the potential to become ‘kaolin revenue driven’ in about its fifth year of operation.

Extraction of the kaolin by wet processing of the crushed sandstone involves several phases of attrition, washing and separation. As a result, the quartz sand particles are imparted with a high degree of purity that enhances their suitability for a whole range of industrial silica products, including glass sand and high purity silica flour.

Testing of the kaolin has proven the suitability of the mineral for use as a principle raw material in the manufacture of refractories and ceramic products. In addition, high gradient magnetic separation and calcination of the kaolin provide strong indications that the calcined kaolin will be able to be marketed as an extender for titanium dioxide and used as an opacifier in paints and paper. The proponent is currently exploring the concept of producing ‘metakaolin’ for use as a concrete additive able to significantly enhance performance characteristics of cement-based mortars, concretes and related products. If successful, the concept presents the company with an exciting possibility to produce and market a new product.

The range of kaolin products listed in **Table 4.1** shows its use for bricks and pavers at the lower end of the value scale through to ceramic and refractory kaolins, metakaolin and paper and mineral fillers at the upper end.

It is envisaged that during the start up phase of production, marketing will focus upon those products with proven markets and/or those that require the minimum amount of processing. As metallurgical test work advances and markets are determined, the higher value products will be produced by bringing on line the more advanced processing techniques required to refine these products.

4.5 Marketable Kaolin Products

Kaolin is a near-white clay, predominantly composed of the mineral kaolinite. For many modern industrial applications kaolin must be extensively refined and processed from its original state to obtain important commercial characteristics. After refining and beneficiation, kaolin ranks as one of the most valuable of the industrial clays.

Kaolin is used in two main areas, these being:

- ☐ the heavy clay industry; and
- ☐ so called ‘other applications’.

The heavy clay industry makes use of clays that are not beneficiated and may incorporate substantial quantities of fine silica, in this case –10 micron material. So called ‘heavy clays’ are used as a raw material in the manufacture of a range of important building materials such as clay bricks, pavers, roof tiles and earthenware pipes as well as ceramic whiteware and tiles etc.

Whilst some heavy clay values are relatively low, they escalate substantially in the Sydney Metropolitan regions for good quality white firing and ceramic quality clays, such as that will be available from the Newnes Junction resource. Good quality, white firing clays used in the Sydney brick making industry are currently ‘imported’ (at considerable transport cost) from locations such as Windellama, south east of Goulburn.

Table 4.1 – Marketable Products

Mineral	Grouping	Product
Kaolin	Building Materials	- Bricks / pavers (cream to white firing)
		- Bricks / pavers non-cream to white firing)

Table 4.1 – Marketable Products

Table 4.1 Marketable Products			
Mineral	Grouping	Product	
		- Plaster board	
		- Whiteware, tiles, glazes	
	Ceramics / Refractories	- Pottery, insulators	
		- Refractory “grog”	
	Cement Pozzolan	- “Metakaolin” (Strength enhancer for concrete)	
	Calcined Kaolin	- Paper coaters	
		- Paper fillers (opacifiers)	
		- Paint and plastics fillers	
		- Adhesive fillers	
	Silica	Building and Construction Sand	- Ready mix concrete sand
			- Concrete tiles, pipes, bricks and pavers
			- Prefabricated concrete products
- Asphalt			
- Fibre cement			
- Bricklaying sands			
- Pipe laying sands			
Specialty and Industrial Sand		- Silica Flour (for fibreglass, rubber, ceramics, abrasives, glaze & paint fillers)	
		- Fine silica sand (for cements, abrasives, chemicals)	
		- Glass sand (flint grade)	
		- Sand blasting media	
		- Filter sands	
		- Oil and gas drilling sand	
		- Bedding sand	
Landscaping and Recreational Product		- Fill	
		- Home hardware / garden	
		- Landscaping / horticultural	
		- Golf bunker sand	
		- Soil blends	

Kaolins that are used for so-called ‘other applications’ are generally of a higher grade and often require beneficiation. These kaolins are used in a wide range of product areas including high quality ceramics, refractories, mineral fillers and paper manufacture. Prices obtained for such kaolin are generally far higher than for heavy clays. Refined / beneficiated kaolin products are used for paper filling and coating as well as in the manufacture of paints, plastics, adhesives and auto exhaust emission catalytic converters. It is also used as an ink pigment; rubber reinforcing agent; raw material for porcelain, dinnerware, and enamels and as a catalyst base for petroleum cracking.

4.5.1 Building Materials

Kaolin of various types is widely used in ceramics and for house bricks and pavers. Kaolin is also used in the manufacture of plasterboard and wallboard.

White firing kaolin is highly sought after in Sydney by manufacturers of house bricks, pavers and roof tiles. The major manufacturers of bricks in Sydney, including Boral, Austral Bricks, PGH / CSR and Norbrick currently import a white firing kaolin clay from the Goulburn-Marulan area, to blend with lighter firing clays and shales to produce a lighter coloured product. Discussions with each of the major manufacturers has confirmed that availability of the Newnes Junction kaolin from a processing plant located in the greater Sydney area will allow the proponent (NKPL) to compete favourably with kaolin currently being trucked in from the Goulburn-Marulan area.

Austral Bricks have recently commissioned a new tile plant in Sydney for the production of outdoor decorative tiles and pavers, which feature an 'alabaster' light cream coloured variety. NKPL anticipates that the product, which is composed of 40% kaolin raw materials, will provide another excellent outlet for the kaolin produced from the friable sandstones.

4.5.2 Ceramics/Refractories

Refractory clays are those that are able to keep their shape and properties at high temperatures. As resistance to heat is the most essential property, the end products must fulfil rigid specifications. PCE (Pyrometric Core Equivalent) is a technical measurement of the property. The Newnes Junction kaolin has a PCE in the range of 30 to 33 confirming its potential as refractory kaolin. In addition, the low alkali and extremely low iron contents of the Newnes Junction clay are favourable for refractory kaolin production. Since the closure of Australia's sole producer of refractory clay (Merrygoen in NSW), Australia imports all of its 10,000 tpa needs.

Kaolin of various types is also widely used in ceramics such as pottery, sanitaryware, insulators, house tiles etc. Discussion with a number of major ceramic producers and/or kaolin suppliers confirms that much of the existing kaolin supply comes from Albury Fields in the south of NSW. Discussions also indicate that the Newnes Junction kaolin should be in a strong competitive position because of its inherent mineral qualities and location.

4.5.3 Cement Pozzolan

High Reactivity Metakaolin is a manufactured mineral admixture made from kaolin clay. It significantly enhances many performance characteristics of cement-based mortars, concretes and related products. When used as a 5-15% replacement for cement, metakaolin can result in increased strength, reduced permeability and greater durability. Metakaolin has been shown to outperform the more traditional concrete admixtures such as silica fume and fly ash from coal fuelled power stations. Metakaolin is currently not produced in Australia.

Australia produces 10,000 tpa of silica fume as a byproduct of silicon metal production. Forty per cent (40%) of this is required for the production of refractory

materials while the remaining 6,000 tonnes is used as a cement pozzolan. Expressions of interest have already been shown by major Australian cement producers to further evaluate the advantages of using High Reactivity Metakaolin (HRM) in their products. Average price per tonne of Australian (Simcoa, WA) silica fume is \$500/tonne bulker bagged. Imported HRM from the UK is costed at \$850/tonne.

The prospect of becoming a long term supplier of metakaolin in Sydney at a competitive price is one of NKPL's long term aims and part of its marketing strategy to increase the base selling price of its kaolin products. NKPL intends to fully investigate and pursue this market potential via extensive laboratory research and ongoing discussions with all major cement manufacturers.

4.5.4 Calcined Kaolin in the Paper Industry

Calcining involves upgrading the natural hydrous kaolin by heating to high temperatures. Calcining removes the water of hydration of the basic particle, changes the natural particle shape and makes the kaolin whiter and brighter.

Calcined kaolin is well established in the industry as the most significant high bulking extender pigment for the paper industry. It has opacifying properties second only to titanium dioxide.

Calcined kaolin is the most widely used extender of titanium dioxide in paper applications and is the least expensive and therefore the predominant mineral used. In application, the kaolin is used as a coating in paper manufacture to improve opacity and brightness and to control absorption of inks into the paper during the printing process.

Preliminary testing of the Newnes kaolin by the Department of Mineral Resources has shown that although the calcined kaolin (following magnetic beneficiation) meets the brightness specification it only does so at calcination temperatures in excess of 1050°C (Kmentoni, 1984). The economic viability of this project is not dependant on the successful production of calcined kaolin. Further technical evaluation will be carried out once the project commences.

4.5.5 Calcined Kaolin in the Paint Industry

Mineral products are added to compounds to improve certain performance characteristics. The main reason for using them is to reduce the cost of the end product. The inclusion of a filler such as kaolin, generally costs a fraction of other materials used in paints and plastics such as expensive pigments, polymeric resins, pulps or rubbers.

Kaolin is used in paint, providing high covering power as well as desirable flow and suspension properties, viscosity and corrosion and weathering resistance. It is used in the increasingly popular water-based paints where coarse grades provide a matt finish and finer grades a gloss finish.

Plastic resins generally have some kind of filler added to them and kaolin is a suitable material for such use due to its dispersibility, low abrasive characteristics and flow properties. It is also widely used as a filler in adhesives and sealants.

4.6 Marketable Sand Products

The great bulk of materials produced during the initial processing of the friable sandstone will be sub rounded, fully graded, quartz sands. Dependant on impurities present, the degree of processing undertaken, and final product specifications, these sands will be suitable for a range of uses ranging from high grade industrial sands to premium quality construction sands, and landscaping sands and 'pea' gravels. Good quality industrial sands will be available at a relatively early stage of product development.

4.6.1 Construction Sands

Construction sands incorporate an extensive range of coarse, medium and fine graded products as well as blended and fully graded sands. In general, these sands require less processing than specialty and industrial sands and will dominate the Company's sand sales in the early years of operation. Premium quality construction sands such as those derived from the Newnes Junction resource are used in substantial volumes for the manufacture of:

- ❑ **Ready Mixed Concrete** – Supply of sand to this market segment is generally subject to rigorous laboratory testing to ensure it meets stringent quality assurance requirements. The sand needs to be strong, durable, sound, chemically inert, suitably shaped, neutrally coloured, free of deleterious materials and fully graded.
- ❑ **Concrete Products** – Sand specifications are often similar to those for ready mixed concrete sands in terms of mechanical properties and chemical inertness. Differences in specifications principally relate to sand gradings, which differ according to individual product requirements.
- ❑ **Fibre Cement** – Manufacturer specifications call for clean fine quartz sand (ex Kurnell or equivalent) which is subsequently ground to finer grades prior to manufacture of fibro, Hardiflex and similar products.

Other markets for Newnes Junction quality sand include asphalt manufacture, general building and plumbing applications, landscaping applications and bagged 'hardware' sands. Lesser value markets include sale of the product as bedding and/or filling sand. The great bulk of the sand will however be sold at the 'top end' of the construction sand market, that is, to the manufacturers of ready mixed concrete and concrete products. The latter include pre stressed concrete panels and beams, concrete culverts, sleepers, masonry bricks, blocks, pavers, tiles, pipes, and so on.

4.6.2 Specialty and Industrial Sands

Many industrial mineral products use industrial sands as raw materials. These include:

- ❑ ***Silica Flour*** – Silica flour is used by companies that manufacture fiber-reinforced cement products, ceramic tiles and sanitaryware (eg. toilets).
- ❑ ***Fine Silica Sand*** – Fine Silica Sand has a wide range of uses including abrasive cleaners, acid proof cements, adhesives, carpet backing, epoxy concrete, foundries, grouting compounds, miscellaneous chemicals, paints, paper impregnation, polyester resins, polymers, putties, toothpastes and cleaners, glazes and frits, mould washes, paints, plastics, refractories, rubber products and sealants. Letters of interest have already been received for the export of this product to Asia and US markets.
- ❑ ***Glass Sand*** – Glass sand is the major component of glass. Two sands are commonly used in glass melting, a white low iron oxide sand for flint glass and a higher iron oxide amber sand for coloured glass and most flat (window) glass. Although amber sand has a higher oxide content, both products are required to have specified and consistent chemical composition and particle size distribution. It is technically feasible to produce both flint and amber glass sands from the friable sandstones at Newnes Junction.
- ❑ ***Filter and Drainage Sand*** – These sands are generally coarser and more single sized sands to enhance porosity. Industrial filtration media consists of washed and graded quartzose gravel and sand for the removal of particulate matter and bacteria from municipal and industrial water supply systems. These sands are currently understood to be sourced from Brisbane.

4.6.3 Landscaping and Recreational Sands

Sand is used in the upkeep of sporting facilities such as golf courses, cricket grounds, racecourses and football grounds. It is anticipated that the Newnes Junction deposit will be able to supply a range of quality sands to individual specifications.

4.7 Kaolin and Sand Markets

The company is planning a staged entry into sand and kaolin markets, with progressive volumes and quality of product being produced until the target goal of around 119,000 tpa of kaolin and 1.281 Mtpa of sand is reached.

Specialist consultants were employed to undertake research into the potential markets for the various products capable of being produced with the ore mined from Newnes Junction.

4.8 Overall Market Analysis

4.8.1 Kaolin Markets

The Department of Mineral Resources Laboratories has carried out investigations (Kmetoni, 1984) on the kaolin fraction of the material to be mined (obtained from adjacent sites). Analyses conducted included chemical tests, mineralogical analyses, particle size, firing characteristics and refractoriness. The analysis concluded that the kaolin clay was at least suitable for whiteware ceramics and that with beneficiation would grade up to more expensive high quality micronised kaolin products used for industrial purposes such as high brightness fillers.

Worldwide, around 40 million tonnes of kaolin is produced annually, of which 24 million tonnes is consumed by the paper industry. Kaolin is mined and processed in many countries and is one of the industrial minerals of sufficient value to be widely exported throughout the industrialized world. Currently, major exporting nations include the United States, England, Brazil and Indonesia. Key importing nations include China.

It appears that there are ample market opportunities for Newnes Junction Kaolin products in NSW and around the world, with numerous export markets existing in Asia and New Zealand, depending on the consistency of final products produced.

The market supply and demand for within industries using kaolin products is described in the following sections.

House Bricks and Pavers

Kaolin of various types is widely used in ceramics and these markets offer some reasonable scope for Newnes Junction Kaolin products. Both the white kaolin from the "premium" ore and the off-white kaolin from the "standard" ore are suitable for these products.

Plaster / Wallboard

This sector represents a possibly very good target market for Newnes clay, as there are several very large users including La Farge, CSR and James Hardies, all of which take thousands of tonnes of reasonably high priced clay and take delivery in bulk tankers. It is suggested if a clay suitable to these companies can be produced it would be a very good base load of higher value clays. The feed would also be useful as Metakaolin and potentially grog products of very attractive value, without the need to transport from the Albury district.

Ceramics / Refractories

The availability of high grade and very high grade refractory clays at competitive costs is one of the long range problems faced by the refractories industry. Molochite®, the tradename for the calcined refractory grog, is produced by Imerys in the United Kingdom and also in China. The Newnes Junction refractory kaolin

products could replace imports from both these countries. Consequently, there may be markets for materials produced by NLPL.

Metakaolin

The use of kaolin materials as a pozzolanic admixture in the manufacture of concrete may generate significant markets for Newnes products, replacing the less effective traditional pozzollans of fly ash and silica fume.

4.8.2 Sand Markets

Principle markets for sands include:

☐ ***construction sand***

- ready mixed concrete
- concrete tiles
- concrete pipes
- concrete bricks & pavers
- prefabricated concrete products
- other concrete products
- fibre cement
- asphalt paving
- mortar ('brickies sand')
- bedding
- fill
- plaster, render and grout
- filter and drainage
- sport facilities (tennis courts etc)
- landscaping, horticulture and nursery propagation
- general building and construction (via resellers, hardware outlets, direct sales etc).

☐ ***industrial sand***

- glass
- ceramics
- abrasives
- cleaners
- foundries.

☐ ***soil blends***

- containing up to 50% natural sands but sold ex-pit as soils.

Construction Sand

Demand for construction sands from Sydney Metropolitan area markets averaged 5.8 mtpa during the five year period 1995/96 to 1999/00, peaking at 6.73 million tonnes in 1999 / 2000. It is estimated that more than 57% of this was supplied to just two market segments – the manufacturers of ready mixed concrete (49.4%) and concrete products (7.7%). Based on historical data, total demand is projected to

increase at an average 1% per annum to reach 6.85 mtpa during the five year period leading up to 2019/20.

The technical advantage built in to the washed friable sandstone produced from Newnes Junction is that it is a fully graded sand and does not require any blending of either a coarse component or a fine component sand for usage in ready mix concrete. Indicative grading curves for washed construction sand supplying the Greater Sydney Area compiled by Pienmunne and Whitehouse (2001), refer **Figure 4.4**, clearly highlights the close conformity of the Newnes Junction grading curve with the grading envelope most widely accepted by industry (Don Reed and Associates, 2000).

The bulk of sand consumed by ready mixed concrete manufacturers comprised coarse river sand blended with fine dune sand, sourced from Penrith Lakes and Kurnell respectively.

In the 1999/2000 financial year, more than 19% of the natural sand consumed by Sydney's construction industry had to be imported from outside the region. Thus, the industry had to import more than 1 Mt of 'natural' sands, despite the substantial growth in the availability of alternatives, including so called manufactured sands (hard rock crusher dust), recycled concrete and brick sands, slag and crushed sandstone.

Based on current projections and assumptions, Sydney Metropolitan area markets will experience shortages of construction sands of approximately:

- ❑ 38% (2.4 mtpa) during the period 2005/06 to 2009/10;
- ❑ 74% (4.9 mtpa) during the period 2010/11 to 2014/15; and
- ❑ 86% (5.95 mtpa) during the period 2015/16 to 2019/20.

The main cause of the shortages will be the cessation of sand extraction at Kurnell in about 2005/06 and at Penrith Lakes in about 2010/12. The exhaustion of quarriable reserves at these two locations will decrease Sydney production of construction sands by about 1 mtpa, and 2.8 mtpa respectively.

If reserves of both coarse and fine sand are to be exhausted during the period 2005/06 to 2010/11 within the Sydney metropolitan region, then it can be readily argued that all future studies should be concentrated on identifying the best possible sources of naturally occurring, fully graded sands in proximity to Sydney markets.

The DMR and others, have identified the Newnes Plateau and Penrose/Wingello area in the Southern Highlands as the two principle, long term sources of fully graded, premium quality construction sands for supply into Sydney Metropolitan markets. The full strategic value of these resources will be realised once reserves of coarse and fine sand at Penrith and fine sand at Kurnell are exhausted, in 5 to 10 years.

DMR reports authored by Spackman (1992) and Lishmund, Oakes & Patterson (1995) refer to Pecover's 1986 report that concludes (inter alia):

'The Sydney region currently faces a shortage of fine, medium and coarse graded construction sands. The shortage of sand is expected to become critical by the

end of this century as existing sources are depleted.... The high quality and immense size of the sand resources of the Newnes Plateau could lead to development of the area as the major source of supply to the Sydney region into the next century.'

The site controlled and geologically explored by Newnes Kaolin Pty Ltd (NKPL) is understood to contain at least 23.7 million tonnes within the proposed Mining Lease, of fully graded premium quality sand product. From the considerable data base of technical information available, it can be confidently forecast that fully graded sand product will be at least the equivalent of any existing blended sand product, in terms of sand quality.

Long term sales opportunities for the sale of NKPL sand can be forecast in excess of 1 Mtpa as a part replacement for forecast shortages of 2.4 Mtpa after 2005/06, to 5.95 Mtpa by 2019/20. Newnes Junction sand will be in demand on the basis of its long term availability, quality (particularly grading) and delivered price into Sydney markets.

The commercial viability of the project hinges on a number of factors unique to the NKPL site. These include:

- ☐ massive, long term reserves located in relative proximity to Sydney markets;
- ☐ the pending exhaustion of extractable sand resources in the Sydney metropolitan area;
- ☐ the high quality of the sand, particularly in relation to grading and shape;
- ☐ costs economies attached to high volume extraction, processing and sales;
- ☐ long term, rail transport economies;
- ☐ the optimisation of product yields from sand extracted that will result from the processing and sale of industrial sands and matrix clays.

The combined effect of these and other environmental and operational factors, should be to ensure the long term viability of proposed extraction of friable sandstone at the NKPL site.

Industrial Sands

Silica Flour Production

Australia produced almost 3 Mt of silica flour in 2000 versus 1.928 Mt in 1993, with export destinations including Japan, South Korea, Papua New Guinea, the Philippines, Taiwan, and the U.S. Queensland produced 2.829 Mt of silica in 1994/95 versus 2.494 Mt in 1993/94; Western Australia produced 742,000 t of silica flour from more than 6 operations in 1995/96; New South Wales produced 611,000 t of silica in 1993/94; and South Australia produced about 133,000 t in 1995/96.

Current production of ground silica flour in Australia is 40 to 43,000 tpa, even though installed production capacity is at least 168,000 tpa. This production excludes the very large tonnages of silica that are ground captively by companies that manufacture fiber-reinforced cement products, ceramic tile bodies (eg Johnson Tiles), and sanitaryware bodies (eg Caroma). Reportedly, such silica is being wet ground and

delivered directly into the manufacturing process. When the in-house supply is interrupted occasionally, due to equipment repairs for example, these companies purchase silica flour in large volumes, on very short notice, and at prices considerably in excess of their own wet milling costs.

Of the total tonnage of silica flour sold in Australia, 45% is delivered in bulk tanker trucks (with ACI Fibreglass being the largest customer), 15% is delivered in 1 tonne bulk bags, and 30% is delivered in 25kg paper bags. The use of 40kg bags has been outlawed by labour unions. Exports are mostly made in bulk bags.

Glass Sand

Apart from a few “cottage industry” operations the NSW glass industry is currently understood to comprise seven plants. In terms of glass tonnage, the most significant of these plants is ACI Glass Packaging Australia (ACI-GPA) at Penrith, and Bradford Insulation at Ingleburn. Together the two plants account for in excess of 80% of the total glass sand demand.

Currently the demand for glass sand is met by two groups; PB White Minerals Pty Ltd (PBWM) and Unimin Australia (formerly ACI) from resources in the Port Stephens area.

Two sands are commonly used in glass making, a white low iron oxide sand for flint glass and a higher iron oxide amber sand for coloured glass and flat glass. A flint grade glass sand is normally required to have an iron oxide content of $\leq 0.03\%$ whilst an amber glass may call for an Fe_2O_3 content of 0.15%.

Stitt and Morris (1973) and Stitt (1974) have demonstrated that it is possible to produce a flint grade glass sand from the Kable Sands (Pioneer) friable sandstone resource on the Newnes Plateau by a process involving grinding, sizing, high pulp density attritioning and froth flotation.

However, given the low iron content (averaging 0.028 % from washed drillhole samples) of the premium grade friable sandstone at Newnes Junction, NKPL proposes to selectively mine and stockpile the resource into premium and standard grades of sand.

The processing plant design by Roger Smith and Associates (1999, 2001) incorporates a single process, dual strand system for co-processing both grades of sand.

Grading of the washed premium sand would be carried out by a series of parallel hydrocyclones followed by drying and storage in bins.

Chemical analyses of the premium grade drillhole samples from Newnes Junction (EL 4192) shows conformity with the industry requirements for the flint grade glass sand, and highlight the economic and environmental advantages of bypassing the beneficiating process outlined by Stitt (1974).

Long term production of silica sand for flint glass manufacture in the Sydney region may ultimately depend on the availability of friable sandstone deposits. The Newnes Junction resource is located adjacent to rail transport for delivery to a processing plant in the Greater Sydney Area. The proven chemistry of the premium grade sand makes the Newnes Junction resource an excellent candidate for future supplies of flint grade glass sand for Sydney markets.

4.9 Summary of Project Justification

A large part of the justification for developing the Newnes Junction Kaolin resource relates to the regional significance of the resource and growing regional demand for the products. These factors in turn relate to the:

- ☐ size and quality of the resource;
- ☐ proximity to the Sydney and regional markets;
- ☐ quality and range of specified kaolin and sand products to be produced;
- ☐ substantial markets available for high quality kaolin products;
- ☐ growing regional demand for blended and classified sand products; and
- ☐ diminishing supply of quality sand product within regional markets, particularly near Sydney.

The project represents a significant advancement in resource utilisation, product beneficiation and value adding when compared to conventional friable sandstone quarries supplying product into Sydney markets. The project is considered further justified by resource optimisation and impact minimisation, the latter primarily resulting from decisions taken in relation to rail transport and off-site processing.

4.10 Alternatives Considered

There is a range of development alternatives that can be considered. Project planning in its current form has been developed over a number of years and has evolved after detailed evaluation of a number of significant variations. Initial planning commenced prior to the granting of EL 4192. More detailed investigations commenced following the results of the initial exploration phase which proved the value of the resource.

Over recent years there has been a range of detailed planning and investigations including:

- ☐ 'mine' planning;
- ☐ engineering design;
- ☐ process design;
- ☐ market analysis and detailed feasibility studies;
- ☐ environmental investigations.

It is believed that the resultant proposal provides an optimum balance between resource optimisation, operational and commercial requirements, and environmental management.

Key decisions made which formulated the current proposal include the transport of all raw material to a processing site in the Greater Sydney Region, location of the operation adjacent to a rail loop with easy loading facilities, providing a buffer between the operation and the adjoining Blue Mountains National Park, the development of a unique terraced landform allowing early rehabilitation, and the commencement of extraction at the furthest point away from residences in Newnes Junction.

The project has also incorporated a range of mitigation measures covering air, water and noise emissions as a result of the environmental investigations. These mitigation measures have been incorporated into the design of the project as detailed in the EIS. The following is a summary of the principal alternatives considered in relation to the proposed development.

4.10.1 Alternative Development Sites on the Newnes Plateau

The Newnes Plateau has been identified by both the Department of Mineral Resources and the then Department of Planning as containing regionally significant sand resources. The report produced by the Department of Planning in 1990, entitled “Newnes Plateau, Management Strategy for Winning of Sand”, identified a number of constraints, planning provisions and development opportunities. The main constraints included the:

- ☐ sensitive nature of the catchment and environmental systems in adjacent land;
- ☐ surface and groundwater implications;
- ☐ impacts on the six dwellings in the village of Newnes Junction;
- ☐ constraints on road transport;
- ☐ tourism issues; and,
- ☐ interaction with other developments including coal mining, public infrastructure and forestry activities.

Given the particular nature of this proposal and the decision to transport all raw feed to Sydney for processing, the requirement to be located near rail loading facilities becomes paramount. It would not be feasible to transport up to 1.4 million tpa to Sydney by road. Indeed, the Plan of Management for extraction within the Newnes Plateau indicates that it may be a condition of any future consent that the material be moved to Sydney by rail rather than road. Also, the capital cost of developing new rail infrastructure away from the main Western Rail Line, particularly through the Newnes Plateau area is not considered feasible.

Although there are other sand resources located on the Newnes Plateau, the quality varies and the knowledge of the mineralogy of the clay content is not proven. Iron content is a limiting factor as is the type of clays present within the sand. The exploration and extensive testing of the resource within EL 4192 has demonstrated that the clay content is pure kaolin and can be successfully separated, which together with the resultant high quality sand component, creates an economically feasible project.

Based on a study of the quality of kaolin at three sites on the plateau, EL 4192 should be capable of yielding close to the highest quality kaolin of the area (Stitt & Associates, 2001). Stitt & Associates (2001) demonstrated that EL4192 is ideally situated on the eastern edge of the Newnes Plateau from the point of kaolin quality. A comparison of the data from the Rocla pit (on the south eastern corner of EL4192) with the two other operational sand pits on the Newnes Plateau shows that following:

- ❑ the average Fe_2O_3 content decreases from north to south (3.67% to 1.58%);
- ❑ kaolin brightness improves significantly from north to south.

Both these parameters have a major influence on the marketability of the refined kaolin products.

Extensive drilling within EL4192 has clearly shown that the development of ironstone bands over the area proposed for mining is negligible. This is in sharp contrast to the thick ironstone bands encountered in drill holes over the Newnes Plateau (Pecover, 1986).

The Plan of Management for extraction within the Newnes Plateau also identifies that extraction within the Wollangambe River catchment would be subject to significant constraints, in particular, strict controls that would apply to runoff. By not processing the material on site, the use of process water is significantly reduced and water management on site is reduced to the catchment and control of disturbed area runoff. Water inflows within the pit will be used for dust suppression only and will not need to be stored for processing. This simplifies the water management and pollution control systems for the proposed open pit development. .

It is considered that the location of the proposed development site provides the best balance between resource quality, transport requirements and control of environmental impacts, for the project.

4.10.2 Open Pit Design and Planning

Plans for the staged development of the proposed open pit development have evolved over time in response to assessment of individual environmental impacts. Such changes have at all times been assessed and finalised with regard to resource optimisation and best (industry) practice requirements. The pit limits are constrained by the need to provide a buffer between the operation and the National Park, the location of the nearest residences and the rail loop, as well as maintaining of an access way between the National Park and residences.

The pit stages have been developed to ensure that noise and dust impacts on Newnes Junction are minimised, particularly in the early years so that future noise bunding and shielding can be developed for later stages. The pit development has also been staged around the location of drainage lines which cross the site. This will minimise water inflow across disturbed pit areas whilst still allowing for later clean water diversion works.

4.10.3 No Development Option

The no development option involves not extracting the resource. This option would effectively sterilise a resource of 'state significance' whose development will provide an operationally, commercially and environmentally viable solution to construction sand shortages projected from Sydney Metropolitan area markets from approximately 2005 / 2006. The extraction and subsequent sale of the kaolin and industrial sand products will also address regional shortages of essential industrial mineral commodities, whilst at the same time assuring the commercial viability of the project.

The resource and its location are geologically and geographically unique. Principle constraints to the development of sand extraction and processing operations are costs and economic viability. Despite the fact that industrial and construction sands are essential commodities, their value is often relatively low. This particular resource has specific characteristics that make it extremely valuable. The in situ material is effectively construction sand, however, the matrix clay content is dominantly kaolin (rather than a mixture of clays commonly present in other sand resources) and the quartz grains are of high and relatively uncontaminated quality. The separation of the kaolin yields high quality silica sand that can be used not only the construction industry but also for industrial silica sand applications.

Not to develop this project would remove the opportunity to exploit the only known large scale kaolin/sand deposit located immediately adjacent to an existing rail infrastructure. As a consequence, any other large scale kaolin/sand deposit would need to rely on road transport.

The mine plan was chosen on the basis of its limited environmental impact and ability to maximise kaolin yield.

4.10.4 Equipment Alternatives

There is a range of equipment alternatives available, some of which may still be used in the future. The impact assessment has been based on dozer ripping, front-end loaders feeding in pit haul trucks leading to the crushing, screening and stockpile area. The mobile plant investigated is typical for this type of open cut extraction, however, it should be noted that this work is likely to be undertaken by contractor and the equipment fleet may alter.

Alternatives considered could include scrapers that would replace the dozers and haul trucks or an excavator that would replace the front-end loader and dozers. Any variation to the equipment used in the operation would need to be assessed for noise output to ensure that the modelling undertaken as part of this EIS remains valid.

4.10.5 Preferred Option

The plan presented within this EIS represents the preferred mine plan. The plan provides a balance between the proponent's objectives, market expectations and environmental constraints and opportunities.

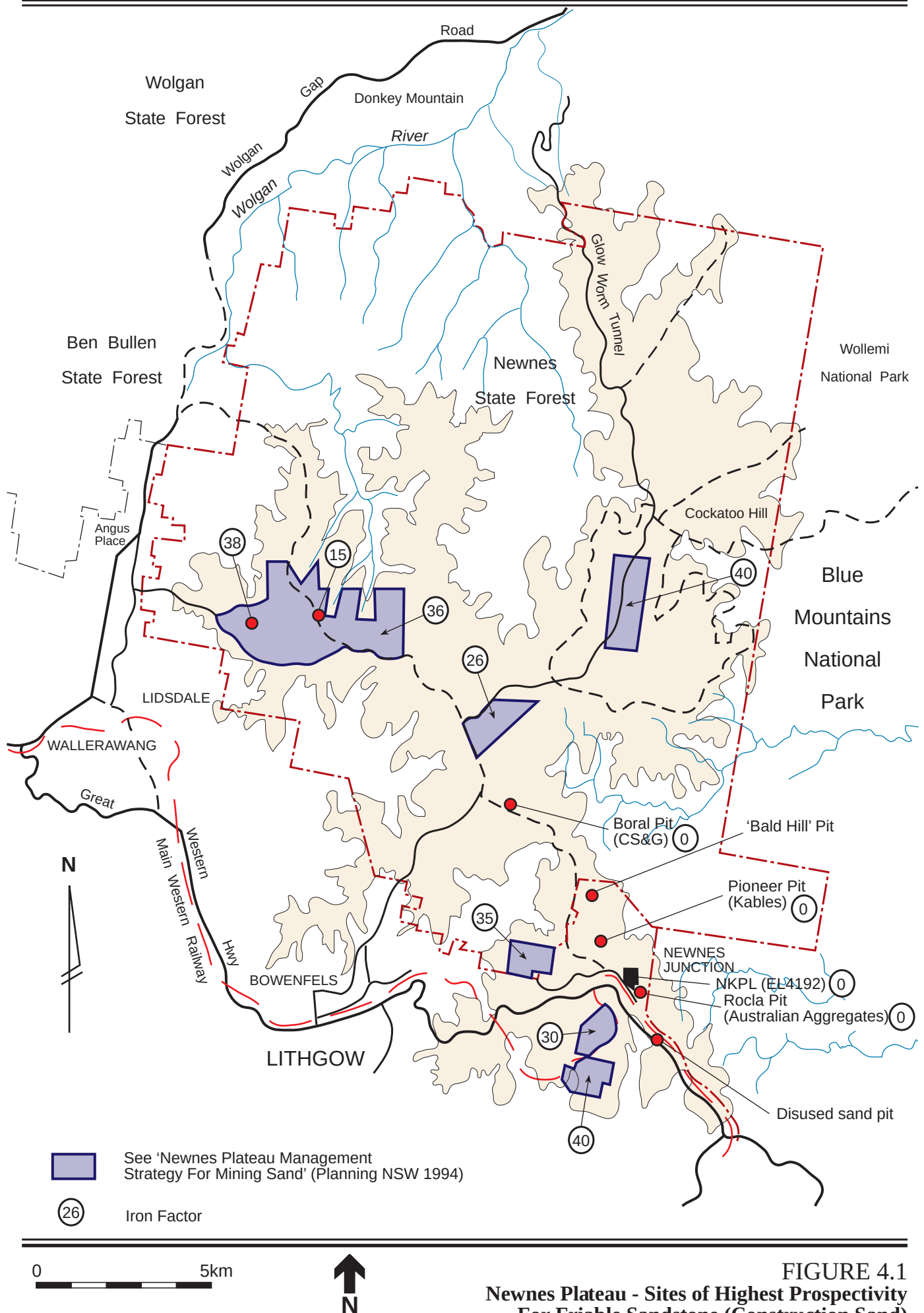
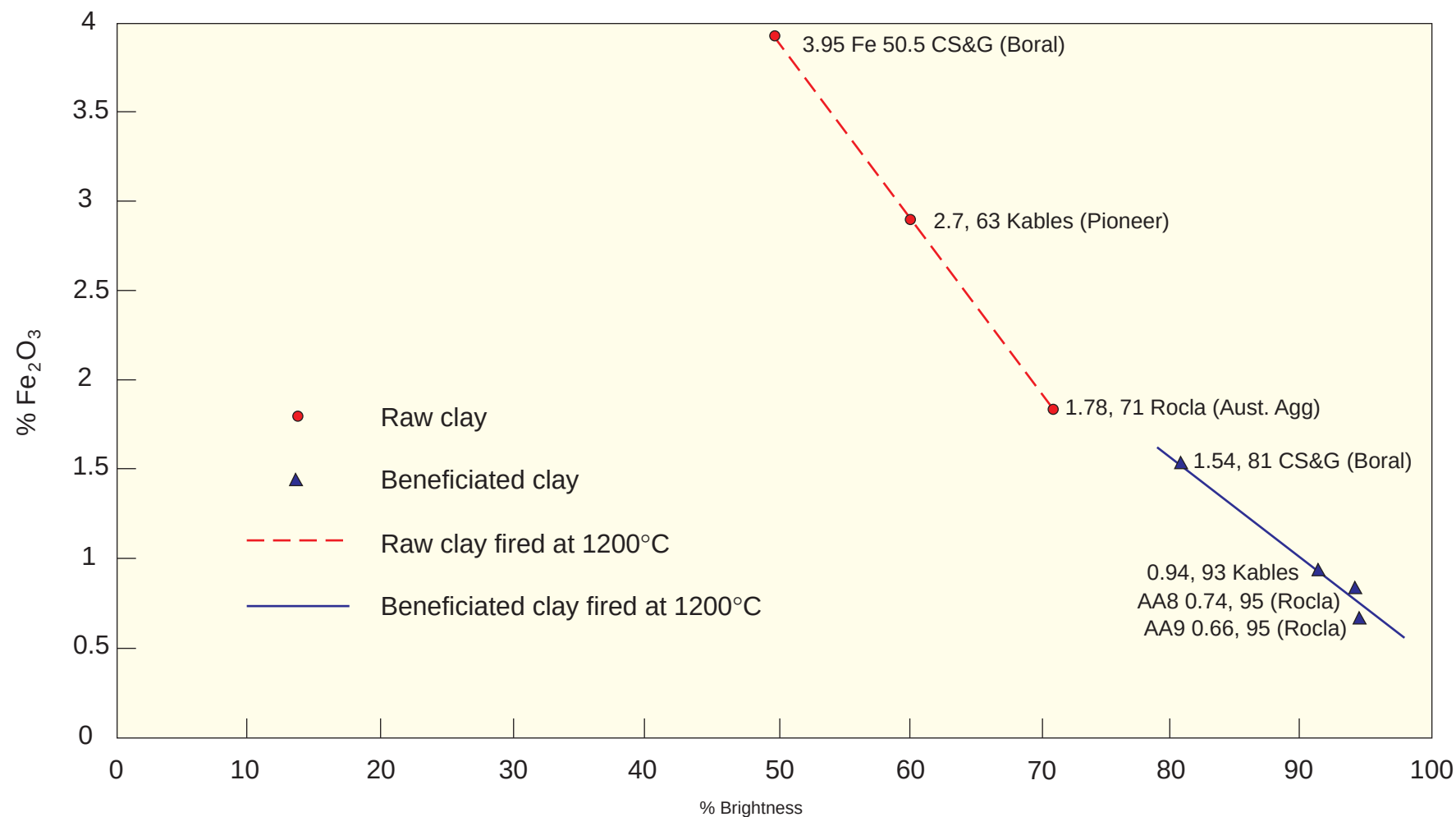
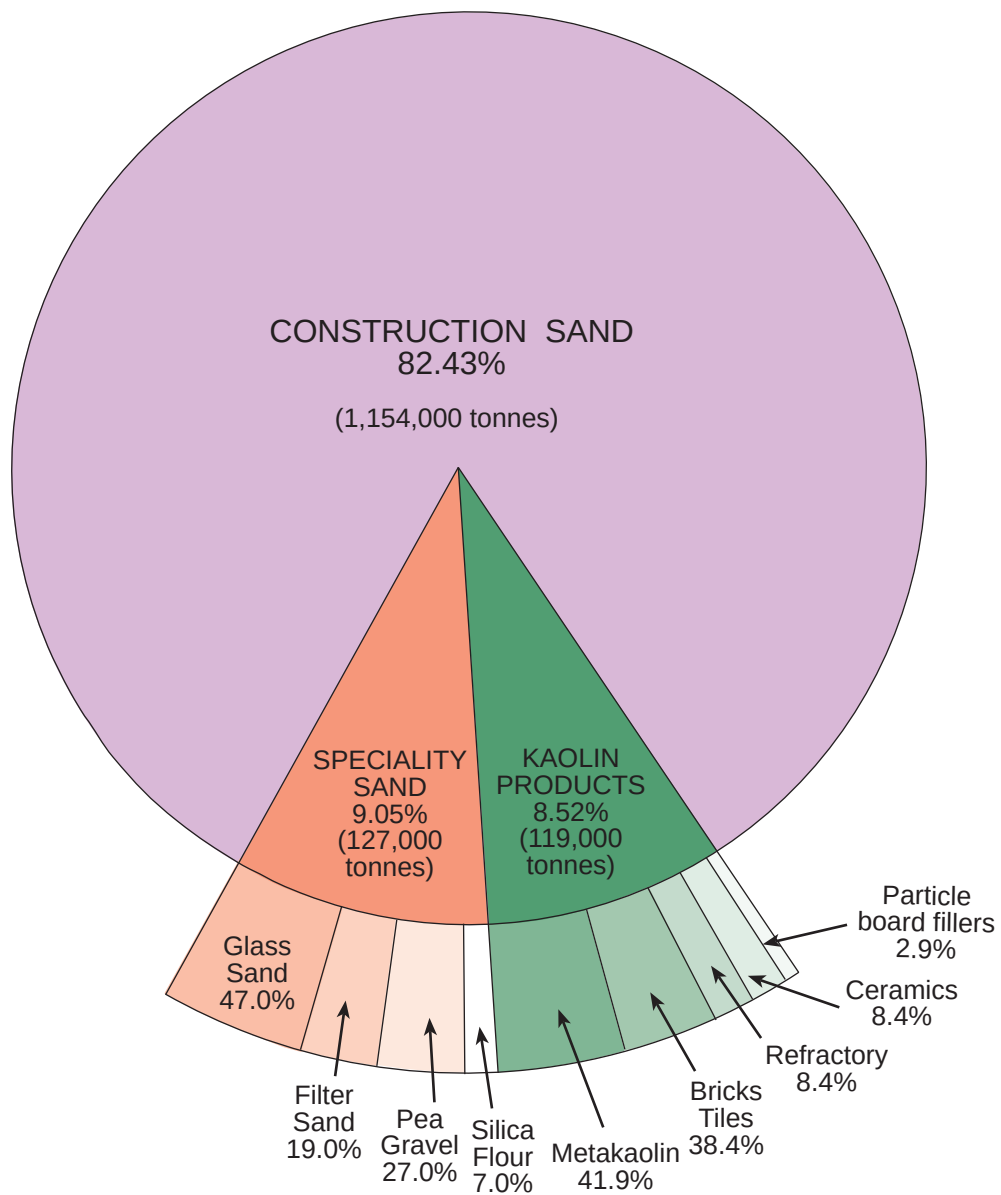


FIGURE 4.1
Newnes Plateau - Sites of Highest Prospectivity
For Friable Sandstone (Construction Sand)



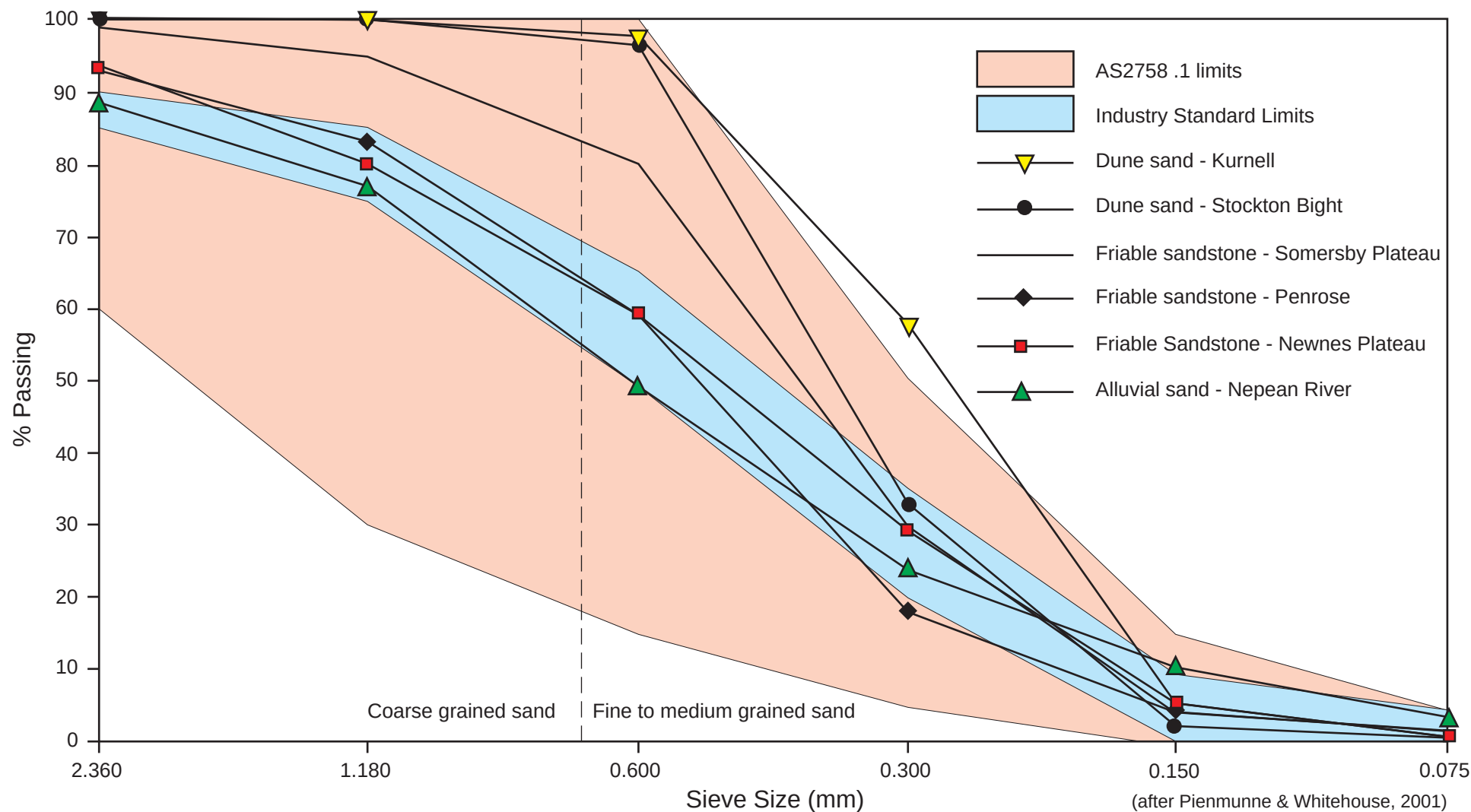
Plot of Average $\% \text{Fe}_2\text{O}_3$ Against Average $\% \text{Brightness}$ for Three Newnes Plateau Pits - Both Raw and Beneficiated Kaolin, Calcined at 1200°C .

FIGURE 4.2
Average $\% \text{Brightness}$ Raw and Beneficiated Kaolin



**Sales Forecast of Refined Products at Maximum
Production of 1.4 Mtpa of Friable Sandstone.**

**FIGURE 4.3
Sales Forecast of Refined Products**



**INDICATIVE GRADING CURVES FOR WASHED CONSTRUCTION SAND
SUPPLYING GREATER SYDNEY AREA**

**FIGURE 4.4
Grading Curves for Washed Construction Sand**

5. Land Use and Environmental Effects

This section describes the existing environment and surrounding planning controls, land uses, biophysical and cultural environment and provides an assessment of the anticipated impacts on these systems.

5.1 Land Use of Proposed Mine Site and District

The land use on which the proposed mine site is situated is vacant Crown land, vegetated with eucalyptus woodland and used primarily by the local residents to access the adjacent Blue Mountains National Park. The site has little agricultural potential having very shallow, infertile soils.

The land use of neighboring land includes:

- ❑ **coal mining activities** - industrial usage of the land to the north and east by Centennial Coal Company for its reject emplacement areas, pit top facilities and the rail loading loop associated with Clarence Colliery.
- ❑ **sand quarrying activities** - the Rocla Sand Quarry is located immediately to the south of the proposed mine site. Kables Sands is also located in the vicinity, some 2 km to the north-west of the Clarence Colliery and Boral used to operate a sand quarry on the plateau nearby.
- ❑ **recreational and environmental protection** - the adjacent Blue Mountains National Park to the east is used for protection of local flora and fauna and for recreational activities. It has recently been listed as part of the Greater Blue Mountains World Heritage Area, which covers seven national parks (Blue Mountains, Wollemi, Yengo, Gardens of Stone, Kanangra-Boyd, Nattai and Thirlmere Lakes) in the Greater Blue Mountains district. The area has been listed as World Heritage on the basis of eucalypt biodiversity, wilderness and cultural values of the Greater Blue Mountains area.

The Wollemi Wilderness is located approximately 600 m to the north-east of the site. This site is the largest declared wilderness area in the state, covering an area of 361,000 ha (NPWS information as at June 2000).

Local areas of particular recreational interest include Gooches Crater, a picturesque area visited by local bushwalking groups. The Zig Zag Railway is located some 5.5 km to the west of the site.

- ❑ **residential usage** - residential land use occurs in Newnes Junction village, located immediately to the south west of the site. The village consists of about six dwellings, five of which are permanently occupied and one of which is used as 'weekender'. There is potential for other dwellings to be constructed in the village at some time in the future.

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- ❑ **transportation routes** - the Main Western Railway line and the Bells Line of Road are both located to the south of the site, and are two of the major east-west transportation arteries for the state.
 - ❑ **forestry activities** – State Forests own extensive areas of the land to the north and west of the site.

5.1.1 Land Use Implications

The proposed development would be confined to a Mining Lease largely within EL 4192 and would involve no immediate requirement for property acquisition or adjustments within the lease area. A key feature of the project is that it is remotely located with a limited number of private residences nearby. With the proposed safeguards, the actual impacts of the quarry on the land use will be minimised, particularly during the earlier phases of the operation.

Newnes Junction Village

The closest residences are located in Newnes Junction village, to the south of the proposed mining area. A buffer zone of 200 m between the mining lease and the closest residential dwellings will be maintained to limit the impact of the operation on these dwellings. These houses will have no direct views of the operation and land use in the area will remain residential.

Impacts on the village will be associated with construction traffic since the access from the site to the Bells Line of Road will be the same as that from the village to the Bells Line of Road. Mine traffic will turn off before reaching the village so impacts will be minimised. During the operation of the facility heavy vehicles will be limited since ore will be transported by road. Consequently, transportation impacts on local residences will be limited.

Dust impacts are anticipated to be minimal. During the later stages of mining the stringent noise criteria associated with the operation may not be able to be met and consequently impacts on local residences will occur. NKPL are prepared to purchase noise affected residences in Newnes Junction in the later stages of mining, or make alternative arrangements in consultation with residents.

Current access to the Blue Mountains National Park is gained through the project area to the north of the Rocla sand quarry. This access will be maintained as part of the project development to enable local residents to continue to access the national park located to the north of the village. This access will be fenced to ensure that the safety of residents is maintained.

The development may have a negative affect on property values of Newnes Junction however, this effect would not extend to other residential areas not directly affected by the development such as Clarence Village. The actual effect is difficult to predict as buyers have differing requirements, based on a range of influences. It is not anticipated that prices will be significantly affected. However, to mitigate against loss of property value within Newnes Junction, the proponent is prepared to purchase affected residences for a negotiated value which assumes the kaolin mine was not

operational. The price would include relocation costs, however, should residences take up the offer but not wish to move from the area, they would also be welcome to continue to reside in Newnes Junction for a nominal rent.

Following the completion of mining activities in the area, the local residents in the area may use the site as a recreational resource. The use of the site will not preclude the use of Newnes Village as residential land.

Blue Mountains National Park

A buffer zone between the mining operation and the Blue Mountains National Park will be maintained and recreational activities in the Blue Mountains National Park will not be significantly affected.

Impacts will be limited to visual impacts from elevated vantage points in the National Park, however these are not easily accessible. The site can be viewed from the unformed track leading to Gooches Crater but not from the Crater formation itself. Other operations are currently visible from this track including Clarence Colliery Pit Top and fan installation, Kable and Rocla Quarries, access roads and railway formations. The buffer between the site and the adjacent park will provide intervening topography and vegetation that will assist in the screening the site from less elevated locations below the site but within the National Park.

Following the completion of mining, the site will be revegetated and visual impacts will be minimised. The site will have a different topography that may be evident from elevated vantage points within the National Park however, since it will be revegetated it will blend in with the surrounding native vegetation on the Clarence Colliery lease and the adjacent Blue Mountains National Park.

Industrial Activities in the Area

Industrial activities in the area will not be impacted detrimentally by the proposed development. No significant impacts on the local road networks will occur since the vast majority of transport from the site will be via rail.

The proposed mine will share the existing rail loop currently owned by Centennial Coal, however, Centennial will retain priority use of this rail loop and its operations will therefore not be impacted by the proposed operation.

Forestry Activities

The proposed activity will have no impact on forestry activities in the area. Existing activities will be able to continue without any alteration.

5.1.2 Future Land Use

Following the completion of mining in this area, and rehabilitation of the landscape, the future land capability of the site will be similar to that of the current site although the topography will be substantially different. The final land use will be determined in consultation with relevant community and authority bodies closer to mine closure

however, the site will be progressively rehabilitated and the final landform is likely to consist of a benched basin with a water body located at the base of the basin. Native vegetation to be progressively re-established on the benches will be capable of supporting native fauna.

Ultimately, the land could be used for recreational purposes or left as vacant vegetated land for conservation purposes. Other potential land uses could include using the water body as a wetland.

5.2 Topography

The proposed kaolin mine is located on the southwestern edge of the Newnes Plateau. The Newnes Plateau is the largest plateau in the Blue Mountains and one of the highest areas within the Sydney Basin. The surface of the plateau is gently to moderately inclined and covered mostly by particularly friable sandstones of the Narrabeen Group. The area is typically rugged with numerous cliffs that are nearly vertical in relief with deep gullies and elevated ridge tops. The elevation of the area ranges between ASL 900 m and 1,200 m. While pagoda rock formations are present on the edges of the Newnes Plateau, no such rock formations occur in the proposed development area.

The proposed site is located within the headwaters of the Wollangambe River, and the railway line to the west of the site is located at or near the catchment boundary. The proposed kaolin mine is located on an east facing hill slope draining into the Blue Mountains National Park.

At its centre, the proposed site has an elevation of about 1030 m ASL. Along the eastern boundary, the eastern corner of the site has an elevation of about 1000 m within a minor drainage gully that crosses the north eastern corner of the block. The topography rises further south to about 1040 m, and then falls away again to about 1020 m within an easterly drainage gully. Average elevation along the western boundary is uniform at about 1040 m.

The site of the proposed mine is crossed by two narrow ephemeral creek lines, draining southwest to northeast into the Wollangambe River (as shown in **Figure 5.1**). To the east of the site, the land falls away into the Wollangambe River within the Blue Mountains National Park. The catchment areas of these two ephemeral creeks are about 30 ha (northern drainage line) and 16 ha (southern drainage line). The northern drainage line flows into the Wollangambe River some 400 m from the site boundary and the southern drainage line flows into another tributary of the Wollangambe River before joining the river about 1.5 km from the site.

The two small ridges that cross the site are also oriented southwest to northeast, rising to the southwest.

5.2.1 Impacts of the Project on Topography

During the course of the proposed mining project, an open void will be progressively created within the landscape as mining proceeds from bench to bench as shown in the

mine plan figures. This void will drain into a low sump area within the central area of the void to prevent sediment-laden water from entering the adjacent Blue Mountains National Park and World Heritage Area.

At completion of mining the topography in the area will contain the final extent of this open cut void, some 450 m wide and 400 m long at its western edge and 650 m long at its eastern edge. The western side of the void will be some 50 m deep while the eastern edge will be 30 m deep. The void walls will be terraced, consisting of small, stepped sandstone benches some 3 m high resulting in an average slope of a approximately 50°. These benches will be vegetated with native species and will be separated by near vertical sandstone slopes. The void will drain into the centre, and it is proposed to create a wetland in this central area with native species from area.

5.3 Land Capability

The land capability of an area can be classified as either urban or rural land capability. The urban land capability of an area refers to its ability to support a particular intensity of urban development without serious erosion and sedimentation problems occurring both during construction and over the longer term. The rural capability of an area refers to the ability of the land to sustain regular agricultural and pastoral production without permanent damage.

The Department of Land and Water Conservation (DLWC) has classified the land in this area according to its capability for agricultural use. The classification depends on a number of factors including slope and soil fertility. Eight capability classes are identified and a brief description of each of these is provided below.

Class I	Suitable for a wide variety of uses, with the highest potential for agriculture.
Class II	High potential for agricultural use, but with increasing limitation.
Class III	Generally fair to good agricultural land.
Class IV	Not generally suitable for cultivating on a regular basis; comprises the better classes of grazing land.
Class V	Not suitable for cultivation; production generally lower than for grazing land in Class IV.
Class VI	Comprises the least productive grazing land.
Class VII	Generally comprises areas of steep slopes with shallow soils; clearing of timber not recommended.
Class VIII	Land unusable for agricultural or pastoral purposes; preservation of the natural vegetation recommended.

Class VI land is found on side slopes with shallow soils, rocky outcrops and water logging. This land class could be suitable for grazing purposes although some of the land would not be very productive. Class VII and VIII land occurs on the steeper slopes in the area.

Under the DLWC's classification, the area affected by the development falls within the classification class VI. This land is therefore unsuitable for cultivation and has limited grazing capacity.

5.3.1 Land Capability Impacts

The proposed mining activities will not have a significant impact on land capability in the area. No impacts will occur on adjacent lands and the only impacts will be associated with the area immediately impacted by the mining operation.

The area contains a valuable state resource and the proposed development will involve extracting this resource prior to returning the area to native vegetation.

Following completion of mining, the area surrounding the open cut void will be rehabilitated and returned to native vegetation. The land capability of this area will not alter from current land capability although the area of the open cut void will be altered in terms of topography. The land is currently not suited for grazing or agriculture and is best vegetated. It is not proposed to use this area for grazing or other agricultural purposes after mining. Rather, the mined area will be rehabilitated with native species and will have a similar land capability to the current area.

5.4 Soils

5.4.1 Regional Soil Landscapes

A number of soil landscapes exist within the region, varying with the location of the soils within the topography and the location of the site in relation to geology and climate. The soils found within each of the regional landscapes that area found within the Newnes Plateau are described below. In addition, two other soil landscapes occur within the region and these are discussed in the next section dealing specifically with the site soil landscapes.

Newnes Plateau Soil Landscape – The Newnes Plateau soil landscape is common in the area, occurring on level to gently undulating wide crests and ridges on plateau surfaces of Triassic Sandstone. The local relief is up to 20 m and slopes are generally less than 10%. It occurs in areas where the elevation is usually greater than 1,000 m and infrequent rock outcrops are found in the landscape. The vegetation of this soil landscape consists of partially cleared low open-forest and woodland, as well as pine plantations.

The soils of this soil landscape are shallow (less than 50 cm) Sands and Lithosols which occur on crests associated with rock outcrops, or moderately deep (50 - 150 cm) Earthy Sands which occur on gently inclined sideslopes. Leached Sands are found near drainage depressions. Where shale / ironstone lenses are found there are moderately deep (>50 cm) Yellow Earths, while deep (>200 cm) Earthy Sands are found on deeply weathered friable sandstones. Minor sheet erosion and track erosion are common in these soils, and the soils are also particularly susceptible to erosion after bushfire or logging.

Mount Sinai Soil Landscape – This soil landscape occurs on narrow, rocky undulating crests and steep sideslopes with many rocky benches and pagoda rock formations within the Narrabeen Group Sandstones. The local relief is up to 130 m with slopes generally exceeding 30% and elevation from 900 - 1180 m. Rock outcrops are abundant, and open heath vegetation is often present in protected valleys.

The soils within this soil landscape are very shallow (up to 30 cm) stony sands, Lithosols on crests and sideslopes with rocky benches and shallow (<100 cm), Earthy Sands and occasional Yellow Earths on insides of benches and in deeply weathered joint lines of the Narrabeen Group sandstones. Shallow Earthy Sands exist in narrow incised valleys. The soils are extremely susceptible to water and wind erosion.

Warragamba Soil Landscape - This soil type is present in deeply incised valleys in the Narrabeen Group sandstones with minor cliffs. Local relief is from 80 - 130 m, slopes > 35% and elevation above 700 m. It supports uncleared tall open forest.

The soils are shallow to deep (50 - 150 cm) Lithosols on crests and ridges with Brown Earths and Red Podzolic Soils on upper slopes and Yellow Podzolic soils on the lower slopes. The soils have an extreme water hazard.

Deanes Creek Soil Landscape – this occurs predominantly on the central Newnes Plateau along linear drainage lines, including tributaries of Farmers Creek. It occurs in narrow, gently inclined elongated swamps with a local relief to 30 m and slopes from 0 - 5% at an elevation above 1000m.

The soils are moderately deep (<130 cm) waterlogged Humic Gleys and Grey Earths near and along the drainage lines, while moderately deep (30 - 100 cm) Peaty Sands and Earthy Sands occur on the swamp margins. These soils have permanently high water tables and are subject to period or permanent waterlogging.

5.4.2 Mine Site Soil Landscapes

Within the proposed mining lease area, two soil landscapes occur, the Medlow Bath and Wollangambe Soil Landscapes. The Medlow Bath soil landscape is found across the majority of the site on the higher and flatter slopes, while the Wollangambe Soil Landscape occurs on steeper slopes towards the eastern edge of EL4192.

Medlow Bath Soil Landscape - This soil type is common in the area and occurs extensively on both the Newnes Plateau and Blue Mountains Plateau. This landscape occurs on narrow crests and moderately inclined sideslopes formed on the Narrabeen Group sandstones. The landscape has a local relief of 20-50 m and slopes of 10-20%. It occurs at elevations generally greater than 850 m. It is characterised by localised rock outcrops and supports partially cleared open-forest and open-woodland.

Occasionally associated with rock outcrops, the soils on the crests are generally shallow (<40 cm) organic rich sands overlying either bedrock or well drained earthy sands (<80 cm deep). On the sideslopes there tends to be moderately deep (less than 100 cm) Yellow Earths and Earth Sands. Associated with the rock outcrops are shallow (less than 60 cm) Lithosols / Siliceous Sands. The soils are susceptible to erosion when the ground cover is disturbed.

Wollangambe Soil Landscape – this landscape consists of rounded convex crests and moderately to steeply inclined sideslopes on Narrabeen Group sandstones. Local relief is up to 100 m and slopes are usually <35%. The elevation is generally greater than 600 m and localised rock outcrops are common, including broken scarps and small rock ledges and cliffs.

On the crests soils are shallow (<30 cm) Siliceous Sands / Lithosols, Earthy Sands and Yellow Earths. On sideslopes soils are moderately deep (<100 cm) Earthy Sands, Yellow Earths and Red Earths. Shallow Siliceous Sands / Lithosol occur on small rock ledges and low broken scarps with a severe water erosion hazard.

The soils within EL4192 are very sandy, shallow and well drained, supporting open woodland vegetation. The sub-strata across the site is predominantly weathered, medium grained, cream to white sandstone. A characteristic of the Triassic Bank Wall Sandstone is that it forms a thin hardened surface crust, rarely exceeding a few millimetres, which mantles a friable, crumbly sandstone with an a clay matrix of kaolin. There are no outcrops of sandstone visible in the proposed mine area.

The site has few available soil resources, making the resources that are present very valuable for the rehabilitation of the site. Soils derived from the friable sandstone are low fertility sandy soils with a moderate to extreme erosion hazard. They consist of sandy yellow loams with a brown to yellowish sub soil, with often no distinct differentiation between topsoil and underlying weathered sandstone.

5.4.3 Potential Impacts and Impact Mitigation Strategies

The sandy soils on site are susceptible to erosion when the ground cover is disturbed. The active mining area will expose subsoils, sand and friable sandstone that will pose an erosion risk if left unprotected over significant periods of time.

A potential risk associated with the site is that of erosion of the final walls following mining. Left unprotected, erosion of the sand and clay material can result in gullyng of the highwalls and sediment build up in the quarry pollution control ponds.

In order to protect the site from erosion, the rehabilitation works will be undertaken on each successive bench as they are created. The drainage system, as outlined in Section 3, has been designed to contain a 1 in 50 year, 72 hour storm event. This will be achieved with the construction of in-pit sumps and controlled discharge to the National Park of clean water that meets quality requirements.

A range of erosion and sedimentation controls will also be provided in the pit to minimise sediment-laden runoff from disturbed areas. To limit the risk of soil erosion and sediment loads in the waters, only the minimum area required for each successive mining area will be cleared and stripped of topsoil at any one time. This will reduce the area exposed at any one time and makes best use of the existing natural vegetation cover in preventing erosion and protecting water quality.

The proposed system will provide protection against uncontrolled runoff containing sediments from entering the waters of the Wollangambe and the Blue Mountains National Park.

As the mine proceeds, topsoil will be stripped and stockpiled from successive areas and stored prior to use in the rehabilitation activities. The useable component of the available topsoil ranges from the top 10 cm or more within or near drainage lines to less than 5 cm over the remaining area. The topsoil represents a highly valuable resource, containing weed free soil and seeds of species found on site, in addition to nutrients and organic matter that will assist in the revegetation of the area.

Topsoil will be stripped and placed topsoil stockpiles in areas adjacent to the initial mining areas. Topsoil stockpiles will be less than 2 m high with side slopes of 3:1 (H:V) and they will be of variable length. This will reduce the occurrence of anaerobic conditions that can occur in larger stockpiles. Should topsoil need to be stored for greater than 12 months, a cover crop will be sown to stabilise the surface as well as maintain biological activity within the soil.

When the outer edge of a bench is ready for rehabilitation, topsoil will be recovered from the stockpiles and placed on the 2 m strip that has been prepared for revegetation.

Only topsoil that has been derived from the site area will be used in the rehabilitation program. This will ensure that exotic weed species are not brought on to site in any other topsoil material, preventing the potential for weed infestation in the adjacent National Park due to the mining activities.

With an estimated 38,000 m³ being generated, it is not anticipated that there will be a shortfall in topsoil as is usually the case in mining operations. This is because the final landuse of the site includes the creation of a water body or possibly a wetland at the base of the pit.

Native vegetation communities will then be established on the rehabilitation areas. As it becomes established, the vegetation will protect the soil resources of the pit edges and encourage infiltration of rain water and assist in the settlement of sediment.

The benched terraces will be developed to discharge water in a controlled fashion to the next bench. This will prevent gully erosion on the rehabilitated areas and sedimentation of runoff occurring. The terraced walls will have slopes equal to or greater than 80° to minimise the amount of rainfall on them and the erosion risk over the long term.

5.5 Visual Implications

The visual assessment was carried out on the basis of fieldwork and the study of the stereoscopic aerial photographs. Recommended amelioration treatments have been proposed to minimise the visual impacts associated with the works.

5.5.1 Visual Catchment

The visual catchment of the proposed mine site extends around the site to varying distances as shown on **Figure 5.2**. The best views of the site that are readily accessed are available from Bald Trig, located in the Newnes State Forest, some 2 km to the

north-west of the site. This site is the highest point in the area and has views of the National Park, Clarence Colliery, Kables Sands and the Rocla Quarry.

Views from the east are limited, since the area is covered by National Park with few permanent, formed tracks that would allow public access to gain views of the site. The site can be viewed from short sections of the unformed track leading to Gooches Crater, a feature known to bushwalkers, but cannot be seen from the feature itself. Views of Clarence Colliery pit top, the two existing quarries, access roads and railway infrastructure are also visible from this location.

Clear views of the kaolin mine would be available from rock pagodas located immediately opposite the site and on the edge of the National Park. Access to the top of these pagodas is extremely difficult and requires rock-climbing equipment. From this site, clear views of other industrial and residential activities on the western side of the National Park are available.

The site will be visible from residents at Newnes Junction, particularly on the northern side of the road. Although the quarry benches will not be visible in the early stages of the development, the removal of trees will be noticeable and may also open up views to Clarence Colliery.

5.5.2 Existing Landscape Elements

In general terms, the visual catchments in the study area contain a number of major landscape elements, including:

- ☐ slopes vegetated with native species of trees and shrubs including the site itself and the adjacent Blue Mountains National Park to the east;
- ☐ exposed high points and slopes from which the site may be readily seen (if the topography permits);
- ☐ industrial elements including coal mining infrastructure and reject emplacement to the north of the site and sand quarries to the south and north east of the site;
- ☐ dirt access roads to industrial sites and the Newnes Junction township;
- ☐ small village residences within the township of Newnes Junction; and
- ☐ transportation elements including road and rail infrastructure.

Each of the units found within the study landscape is briefly described to provide an indication of the existing landscape characteristics of the proposed kaolin mine.

Vegetated Slopes – many of the slopes within the area are vegetated with native species including much of the adjacent National park. The slopes have a low visual diversity due to the consistency of form and colour.

Exposed high points and slopes – exposed high points and slopes, including cliffs, pagodas, slot canyons and smaller escarpments characteristic of the sandstone

landscape of the Newnes Plateau occur adjacent to the Wollangambe River to the east of the site. These sites occur at high elevations within the landscape or in areas where vegetation is low or non-existent. No such sites occur within the proposed mining lease.

Industrial elements – within the existing landscape a number of industrial developments occur, and visual elements associated with these developments include coal reject emplacement areas at Clarence Colliery, coal handling infrastructure and stockpiles, rail loading bin, conveyors and buildings, and sand quarries associated with Kables and Rocla.

Dirt roads – dirt roads providing access to the various industrial operations in the area (Kable Sands, Clarence Colliery and Rocla Quarry) and the Newnes Junction township are located to the west of the site.

Village residences – there are half a dozen dwellings in the village of Newnes Junction that are stand alone houses constructed primarily of wood and/or brick. Some of these dwellings are currently being renovated and there is the potential for other blocks to have dwellings constructed on them in the future. There is a buffer of some 200 m from the residences to the proposed mine site and until recently this entire area was vegetated with open woodland eucalyptus species. Recently some of this area has been cleared and a large dirt road has been constructed, providing access for public vehicles to the east. A minimum of 100 m of vegetation will remain between the residences and the ultimate pit limits.

Transportation elements – within the landscape, major roads and railways occur, creating linear visual elements within the landscape consisting of ribbons of clearing the transportation routes within them. The highway surface is asphalt and generally consists of 2 lanes. There are no views of the proposed mine site from the Bells Line of Road.

5.5.3 Assessment Criteria

In assessing the visual impacts of the proposed line, the visual catchment around the corridor was mapped according to the visual sensitivity of the areas within the catchment (refer **Figure 5.2**). The visual effect of the proposed mine site is the result of a complex combination of factors including:

- ☐ the existing visual environment;
- ☐ progressive and final visual characteristics of the proposed mine;
- ☐ distance;
- ☐ topography;
- ☐ vegetation cover;
- ☐ visual contrast generated;
- ☐ number of viewers;
- ☐ duration of view;
- ☐ angle of view; and
- ☐ visual sensitivity.

Existing visual elements - the nature of existing visual characteristics of the landscape is an important element in considering the impacts of the proposed mine.

Given the existing industrial elements within the landscape, including the sand quarries, which contrast with the dark green vegetation of the State Forests and National Park, the proposed mine will not introduce a new visual element into the landscape. The impacts of the proposed development are therefore related to increasing an existing visual element within the landscape.

Visually, the most significant impacts occur at sites closest to the proposed mine and from vantage points which directly overlook the site.

Where the site is not visible from surrounding areas there will be no visual impact. Where the mine is visible from elevated vantage points with uninterrupted views, the impacts will be greater, particularly, if these vantage points are frequented by residents or visitors to the area or users of the National Park.

Where areas of timber interrupt a view of the site, visual impacts will be less than if the screening effects of the timber were not present and such visual impacts diminish quickly with distance. Since clearing of the native vegetation will be required, the visual impacts become higher since the visual contrasts generated as a result are generally stark and highly noticeable over longer distances.

Other issues include the characteristics of backdrop surrounding the mine, and the degree to which the operation can be blended into the landscape. The prominence of the mine within the landscape also plays a role with the site being more visible from ridges located in the adjacent National Park than from sites closer to the mine.

Visual characteristics of the proposed mine - The characteristics of the physical components of the proposed kaolin mine, when compared with the existing landscape elements, contribute to the visual impact of the development.

The visual characteristics of the proposed mine will primarily consist of areas cleared of native vegetation with infrastructure and roads or mine benches located in them. The cleared areas will be light in colour, consisting of fresh sandstone which is white, yellow and light brown. In the early stages of the mine, cleared areas will be limited to the area of the access road and infrastructure and the initial mine stage. As the mine develops further, it will include larger cleared areas and rehabilitating vegetation at the edge of existing benches.

Distance - In terms of the visual impact, areas closest to a mine are generally subject to the highest degree of visual impact, where the mine is clearly visible from such areas.

In general terms, the further the mine is located from a point, the lower the visual impact will be. Within the visual catchment view lengths have been divided into foreground (0-0.5 km), within which the mine site would form a prominent feature in the landscape, middleground (0.5-2 km), within which the mine site can be readily seen but would not be as highly prominent, and background (2-5 km), within which

the mine site can be readily detected within the landscape but is not visually dominant.

Topography - The topography of the viewer will have a significant effect on the visual impact of the proposed mine activities.

High elevations and cleared outcrops - Where the mine is viewed from areas of high elevation or cleared outcrops, it can be silhouetted against the darker surrounding vegetation and will consequently have a high visual impact.

Mid-slopes - when the mine site is viewed from mid-slope areas, the visual impacts are generally lower, due to the view of the site being partially screened by intervening vegetation, making it more difficult to see.

Valley floors – where the site of the viewer is within a gully, it is unlikely that the mine site will be visible since it will be screened from view by the surrounding valley sides and ridges.

Vegetation cover - the amount and nature of existing vegetation in the intervening landscape is very important when determining the visual impact of a mine site. If the landscape between the mine and the viewer is cleared, the mine can be visible for considerable distances. The visual impacts will be highest close to the mine but will still lessen with distance.

Where scattered vegetation occurs, the impacts are generally lower, since scattered vegetation can screen the high contrast areas within the mine site.

Since clearing is required for the mine site in an area of existing vegetation, the visual impacts in terms of vegetative cover will be higher, as a result of the enlargement of a highly contrasting element (ie. cleared areas of exposed sandstone) into the landscape.

Number of viewers affected - when determining the visual impacts of a mine site the number of viewers is taken into consideration. Visual impacts are regarded as higher when a greater number of people are affected by the mine.

Duration of view - the duration of viewing also contributes to the visual impacts of a mine site. Static views (i.e. from residences, recreational areas and tourist lookouts) are regarded as more important than transitory views (i.e. from roads).

Angle of view - Visual impacts also depend on the locations and angles from which the mine is viewed. The greater proportion of given vista the mine site occupies the greater the impact. This is determined by the angle of view and the distance of the mine from the viewer.

Visual Sensitivity - visual sensitivity is a measure of the perceived visual impacts on the visual environment, or the ability of an area to absorb the visual impacts of a development.

5.5.4 Visual Assessment

The following categories of visual impact were established for the visual assessment, based on the assessment criteria outlined above.

- ☐ high visual impact;
- ☐ moderate visual impact;
- ☐ low visual impact; and
- ☐ negligible visual impact.

The categories above have been used in **Table 5.1** to determine the general visual impacts of the proposed mine site on the environment. The existing nature of the environment (including the topography and the presence of otherwise similar industrial elements within the landscape), the distance from which the mine is viewed and the vegetation cover of the area are clearly shown in the table. Other criteria considered for the assessment include the duration and angle of view (road views will be intermittent and of short duration), visual sensitivity and the number of viewers. While these criteria are not all shown in the tables, they were taken into consideration when determining the mapping of the visual impacts.

Table 5.1 - Visual Impacts of Proposed Mine Site

Landscape Element From which mine will be Viewed	Distance								
	Foreground Views 0-500 m			Mid ground Views 500-2000 m			Background Views 2000-5000 m		
	Intervening Vegetation			Intervening Vegetation			Intervening Vegetation		
	None	Scatt- ered	Dense	None	Scatt- ered	Dense	None	Scatt- ered	Dense
Exposed sites	H	M	n/a	H	M	n/a	L	L	n/a
Vegetated slopes	H	M	N	M	L	N	n/a	N	N
Industrial areas	M	L	N	L	L	N	N	N	N
Dirt Roads	H	M	L	M	L	N	L	L	N
Village residences	n/a	M	L	n/a	n/a	n/a	n/a	n/a	n/a
Main Transport elements	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a

H - High visual impact

M - Moderate visual impact

L - Low visual impact

N - negligible visual impact

n/a – mine site not visible from such an area

5.5.5 Visual Impacts

The fact that the existing landscape is dominated by industrial elements to both the north and south of the site has been a major consideration in this visual assessment. Given the existing impacts of industrial developments in the landscape, the visual impacts of the proposed mine have been assessed on the basis of incremental impacts in areas from which existing developments are visible.

The impacts will include visual changes in the landscape associated with clearing of vegetation on site, exposure of the underlying sandstone material and construction of infrastructure required in the mining operations.

Specific visual impacts occurring in relation to the proposed mine are discussed below.

Newnes Junction Residences

In the early stages of mining, the operation will not be visible from any residential dwelling. However, in later stages of mining the reduced intervening timber will be noticed and in final stages of mining it may be possible for residences to view sections of the quarry faces. These views will be mitigated with additional tree planting within the buffer between the quarry and the residences as well as early rehabilitation of completed quarry faces, which will assist in screening the quarry faces.

Blue Mountains National Park

The mine will be located adjacent to the Blue Mountains National Park, with the topography sloping down from the mine site to the park boundary. A minimum 50 m buffer will be left on NKPL land. Only the operating pit will be fenced. An area will be dedicated for walking access from Newnes Junction to the National Park.

The area is currently vegetated with eucalypt woodland, and will therefore offer a substantial vegetation buffer. There are no permanent formed roads in the adjacent portion of the National Park, and public access to any areas within the park from which the mine may be viewed would be restricted to hikers.

The site can be viewed from the unformed track leading to Gooches Crater, a feature known to bushwalkers, but cannot be seen from the feature itself. Views of Clarence Colliery pit top, the two existing quarries, access roads and railway infrastructure are also visible from this location.

Clear views of the kaolin mine would be available from rock pagodas located immediately opposite the site and on the edge of the National Park. Access to the top of these pagodas is extremely difficult and requires rock-climbing equipment. From this site, clear views of other industrial and residential development on the western side of the National Park are available.

Adjacent Industrial Sites

The kaolin mine cannot be viewed easily from any existing industrial sites since each has a small but effective vegetative buffer. The mine could be partially viewed from the Clarence Colliery Coal Preparation Plant and Rail Loading Bin as well as elevated sites within the coal reject emplacement.

Key Transportation Routes

The mine cannot be viewed from Bells Line of Road or Main Western Railway line but could be viewed from the Clarence Rail Loop. The mine will not be visible from the proposed extension to the Zig Zag Railway which will link to Newnes Junction Station, nor from the station itself.

Dirt Roads

The mine will be visible from a section of the access road leading around the Clarence Rail Loop. Residents of Newnes Junction use this road that also passes the Clarence Colliery Pit Top, overlooks the coal stockpiling area and passes beneath the conveyor leading to the main rail-loading bin.

Vegetated Slopes

The proposed buffer between the mine and the National Park is considered sufficient to screen views from lower vantage points heading towards the site. Even at the boundary of the National Park looking west towards the mine, no views will be available due to the dense intervening vegetation.

5.5.6 Mitigation Measures

To reduce the visual impacts of the proposed mine site on the landscape, a number of techniques will be employed. These will include the following:

- ☐ maintaining a minimum 50 m vegetated buffer between the site and the adjacent National Park to minimise visual impacts of the mine site on the park areas immediately bordering the lease boundary;
- ☐ maintaining the remaining vegetation occurring between the residences in Newnes Junction and the proposed mine limits to screen the effects of the mine as much as possible;
- ☐ designing the mine with shallow benches some 3 m high and rehabilitating these benches with native vegetation as soon as practicable to screen the high wall with vegetation. Rehabilitating the edges of the shallow benches will improve views directly into the mine site from the National Park where the mine is visually prominent in the landscape;
- ☐ colouring the stockpile enclosure environmental green, to make it blend into the existing landscape as much as possible;
- ☐ colouring conveyor covers and other constructions on site environmental green where this is practical so that these elements blend into the existing landscape;
- ☐ minimising vegetation removal during construction and mine operation. This will ensure that visual impacts associated with the development are minimised; and
- ☐ infill vegetation planting to further screen the site from local residents if required.

5.5.7 Conclusion

The main visual impacts will occur from elevated vantage points surrounding the mine. This is the case for all industrial activities in the region, which can be invariably seen from higher, or overlooking vantage points. In this case however, views of the site can, with some difficulty, be seen from elevated points within the National Park. These locations are not easily accessible and when located, other industrial sites are equally visible. This is also true along other sections of the park boundary, which abut residential areas, agricultural land, industrial activities and major public infrastructure.

Views of the quarry from residential receptors in Newnes Junction will be mitigated by intervening vegetation that will be maintained during the quarry, and augmented as necessary. Although the project will result in some visual impacts, the net effects are considered acceptable.

5.6 Flora and Fauna

5.6.1 Introduction

The development of the proposed kaolin mine at Newnes will involve significant modification and disturbance to the vegetation and fauna habitat currently existing on the site. Consequently, this flora and fauna report has been prepared to provide a description of the flora and fauna on the site (particularly threatened species), identify sensitive areas in terms of their value for native species of conservation significance, and assist the relevant government authorities in their determination of the proposed mine. This report has been prepared in accordance with the requirements of the *Environmental Planning & Assessment Act 1979* and the *Threatened Species Conservation Act, 1995*.

5.6.2 Methods

General

The site of the proposed area to be disturbed by the mining operation is relatively small, covering an area of approximately 25.5 ha, and consequently extensive survey work was conducted. Survey work was carried out from 20 March to 24 March, 2000. Temperatures during this time were mild, ranging from 15°C during the night, to 25°C during the day.

Prior to the survey being conducted a wildfire swept across the Newnes Plateau in 1997. This fire resulted in extensive tracts of vegetation being severely burnt, including the proposed mine site.

An intense wildfire may be highly damaging to the wildlife. For example, it may take several decades for regrowth to reach a suitable development stage so that arboreal (tree-dwelling) mammals will recolonise the forest. However, fire is vital to many native species that depend on the disturbed landscapes, such as kangaroos, wallabies and wombats who prefer the nutritious new growth after the fire.

At the time of the survey regeneration was advancing, however potential habitat for many fauna species, both arboreal and ground dwelling was reduced. An assessment of potential habitat for native species is included in Section 5.6.5, with particular emphasis on potential faunal habitat once revegetation is at a more advanced stage.

Most dry sclerophyll eucalypts display a combination of vegetative and seed recovery and many are well adapted to fire survival, having thick bark and dormant buds. Few plants, if any, in dry sclerophyll forest cannot survive fire and many require fire for successful reproduction and regeneration.

The greatest flora species diversity occurs immediately after a fire when there is maximum availability of light and space, due to a greatly reduced canopy and shrub layer. Release of nutrients and stimulation of germination by the fire further encourage vegetative growth and establishment. Species diversity gradually declines through time with increased competition for essential elements as the vegetation grows. The post fire succession is largely determined by the species composition before the fire.

The flora survey conducted recorded all species present at the time. The vegetation is a dynamic system, constantly changing. The species diversity and abundance will change through time, and it is expected that there will be a gradual decline in diversity as time since the fire increases. The site was re-visited on 7 March 2003 to update the surveys and conduct further targeted searches for rare or threatened species that may have colonised the area since the initial surveys.

Flora

A number of flora surveys have been conducted previously in the Newnes area. These surveys were reviewed for information regarding the general floristic nature, and any species of conservation significance previously identified and considered likely to occur in the area. The basic vegetation units described in the previous surveys, particularly Benson and Keith (1990) were used as a basis for classifying vegetation in the current study.

Mapping of vegetation classes was done in a desktop study using aerial photographs at a scale of 1:25 000. These areas were then classified according to the vegetation units previously identified, and ground-truthed to verify the vegetation type. Vehicle-based transects were run along each of the existing exploration roads that traverse the area to ground-truth the vegetation units classified from the aerial photographs. Foot-based transects were then run through the vegetation to produce a species list (included as **Appendix D**). These incorporated both north and south-facing slopes, gullies and ridge tops. The level of past and current disturbance was also recorded.

All flora species found within 10 m of both the vehicle and foot-based transects were identified according to the recent nomenclature of Harden (1990, 19991, 1992 and 1993). Structural classification of the vegetation was in accordance with Specht (1988). The conservation significance of plant species was determined with reference to Briggs and Leigh (1996) on a national basis, and in accordance with the *Threatened Species Conservation Act, 1995* - Schedules 1 and 2.

Fauna

The survey found two habitat types within the study area - eucalypt forest and the “wet areas” which include a small swamp (approximately 500 m² in area) and two ephemeral creeks, both of which would remain dry outside of periods with substantial rainfall.

A sampling regime was then adopted that involved recording the presence of fauna species in a number of representative areas. Sampling methods covered a variety of topographical situations such as gullies, ridge tops and side slopes, which were surveyed for all faunal groups likely to be present. The location of each survey point is shown on **Figure 5.4**.

The structure, floristics and condition of the habitat, and an assessment of its value as potential habitat for native fauna was made and used in determining a valuable sampling site. Particular attention was given to the possible presence of resource features such as tree hollows, fallen logs, rock crevices, food and water sources which could be of potential significance for native fauna.

A review of previous fauna surveys in the area and recordings on the NSW National Parks and Wildlife Services database identified threatened species likely to inhabit the area. Targeted searches were conducted for each threatened species identified.

Sampling strategies specific to each faunal assemblage are summarised in the following sections, while a detailed description of fauna sampling methods is provided in **Appendix D**. In addition to the structured sampling regime, all incidental sightings of fauna, either direct or indirect were recorded.

A specific survey of the “wet areas” for frogs was conducted by Dr Arthur White during early May 2002. The focus of this survey was to determine the presence of the Giant Burrowing Frog, or potential habitat within the survey area.

Mammals

Trapping - Trapping of terrestrial mammals was conducted using both small and large hair tube and Elliott traps. A mixture of these traps was used to ensure a comprehensive sample was taken of the faunal assemblage.

Hair tube trapping is effective in sampling small and medium sized terrestrial mammals. They may be useful in detecting carnivorous and omnivorous species such as quolls, cats, dogs, foxes, bandicoots etc, in addition to herbivorous species such as potoroos, bettongs and other small macropods.

Elliott trapping was also employed to target small mammal species, and is capable of providing a more decisive identification of the species than hair tube trapping, where identification may be classed as definite, probable, or possible. Elliott trapping can also enable determination of the size, sex, condition and health of the animal.

Both of these techniques were employed to cover all possible terrestrial mammal groups, as each method has particular advantages over the other, including:

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- ☐ hair tube traps do not result in the physical capture and containment of specimens, thereby reducing stress and the potential for harm to the animal;
 - ☐ hair tube traps are capable of sampling larger species such as dogs (including dingos) which are too large to be caught in Elliott traps;
 - ☐ hair tube traps are less labour intensive and can therefore allow a more extensive sample to be conducted;
 - ☐ Elliott traps allow for a positive identification of the species, whereas samples obtained from hair tube traps may be categorised as either definite, probable, or possible; and
 - ☐ Elliott traps allow an evaluation of the size and health of the specimen and an indication as such of the population, as well as allow determination of the sex of specimens.

Traps were laid within the vegetation along tracks numbered 2 and 6 (see **Figure 5.4**), at intervals of approximately 15 m. These two lines were chosen for the survey as they were representative of the entire study area, and encompassed the wet area and creeklines previously referred to. Both trap mines traversed north and south facing slopes, ridge tops and gullies. The small and large sized traps were placed in a regular pattern.

Spotlighting - Vehicle based spotlighting was conducted during the periods of mammal trapping to target nocturnal arboreal species including both birds and mammals. Spotlighting was conducted for approximately 3 hours each night, with the existing tracks traversing the area being sampled.

Call Back Tapes - Call back tapes were played for a number of rare and threatened mammal and nocturnal bird species previously identified from the Newnes area. Calls of each species were broadcast using a Compact Disc walkman with attached speakers for three minutes, followed by two minutes of silence to detect the presence of the species in the area by a return call. Call back tapes were played in conjunction with spotlighting.

Incidental Sightings - All incidental sightings of mammals while conducting fieldwork were recorded. These included direct visual sightings and indirect evidence such as scats, diggings and burrows etc.

Avifauna

Three sights were selected within the area and surveyed for avifauna present. Bird surveys were conducted within the first 3 hours of sunrise and included the visual and aural detection of birds. Bird surveys lasted for 20 minutes at each site. Specific bird surveys were supplemented by incidental observations. Nocturnal bird species were surveyed through spotlighting and the use of specific call back tapes, as previously described.

Herpetofauna

Three sights were selected within the area and active searches for herpetofauna conducted during the warmest part of the day around noon. Searches lasted for 20 minutes at each site and involved inspection of tracks, large rocks and leaf litter, as well as lifting and rolling of logs and rocks. Specific surveys were supplemented by incidental observation.

5.6.3 Previous Surveys

Previous flora and fauna surveys have been conducted within the Newnes area. The results of these are summarised below.

Flora

Vegetation of the Wallerawang 1:100,000 map sheet was mapped by Benson in 1984, in which 18 vegetation units were described. Based on this vegetation mapping, the area proposed for the Kaolin mine is covered by open forest dominated by *Eucalyptus sieberi* and *Eucalyptus piperita*, referred to as Silvertop Ash - Sydney Peppermint Forest.

Other associated canopy trees include *Eucalyptus radiata* (Narrow-leaved Peppermint), *Eucalyptus mannifera* (Mottled Gum), and *Eucalyptus sclerophylla* (scribbly Gum) on exposed sites. Both *E. mannifera* and *E. sclerophylla* may form pure stands in poorly drained or exposed sites respectively. *Eucalyptus blaxlandii* may also be present on the more sheltered sites, and *Eucalyptus oblonga* on poorer, more exposed sites (Benson, 1984).

This forest type is found predominantly on Sandstone plateaux and ridges with an elevation between 800 and 1050 m. It is characteristic of the Blue Mountains vegetation between Wentworth Falls and Bell. This vegetation is found overlying Narrabeen Group geology, and will intergrade with open forest dominated by *Eucalyptus fastigata* and *Eucalyptus dalrympleana* in valleys (Benson, 1984).

A later survey was conducted for Corkery and Co. (1993) over the Clarence Colliery pit top, which is located immediately to the north of the proposed kaolin mine. The survey of the pit top classified the vegetation as dry sclerophyll woodland / open forest. No species identified were listed as rare or endangered, however a few plants of *Olearia quercifolia* were recorded approximately 200 m north of the northern boundary of the proposed kaolin mine.

A flora species list has been compiled as Appendix D2 listing all species previously identified in the area.

Fauna

Fauna studies have been conducted previously in the Newnes Plateau area. Species identified in earlier studies are listed in Appendix D3.

A fauna survey conducted in 1993 by Corkery & Co. identified few species in the area of the Clarence Colliery pit top. The Red-necked Wallaby was the only macropod observed in the Pit Top and arboreal mammals were sparse and limited to three Greater Gliders within the rail loop area, and a single observation of a Ring-tailed Possum in the south-west corner of the Pit Top. The Southern Bush Rat was trapped in a small gully within the Rail Loop, and evidence of Echidnas and Common Wombat were evident. A number of bird species were recorded, and only one reptile species, the Copper-tailed skink.

A fauna survey was conducted by IEC (1999) on the Newnes Plateau, to the north, west and east of the proposed kaolin mine. This survey recorded a total of 13 mammal species, 23 bird and 3 reptile species.

The only survey to detect any species of conservation significance was that carried out by IEC in 1999, when the Yellow-bellied Glider *Petaurus australis* and the Powerful Owl *Ninox strenua* responded to call back tapes. Both species were found associated with Newnes Plateau Woodland on the Newnes Plateau, approximately 3.3 km north-west of the proposed Kaolin mine site. This vegetation is dominated by *Eucalyptus blaxlandii*, *Eucalyptus dalrympleana*, *Eucalyptus dives*, *Eucalyptus oreades*, and *Eucalyptus sieberi*.

5.6.4 Flora Survey Results

Vegetation Communities

Only one flora community was identified within the study area. This was the Silvertop Ash - Sydney Peppermint Forest, as described by Benson (1984). This vegetation is dominated mainly by the Sydney Peppermint (*Eucalyptus piperita*), with the Silvertop Ash (*Eucalyptus sieberi*) being less abundant at this site.

Along the northwestern corner of the study area *E. piperita* is replaced by the scribbly gum (*Eucalyptus sclerophylla*), where it is the dominant canopy species, as shown in **Figure 5.3**. The almost pure stands of *E. sclerophylla* occur along the north-facing slope at the top of the ridge near the Clarence Colliery boundary, which is a fairly exposed site. Understorey species do not show a change with the replacement of *E. piperita* by *E. sclerophylla*, and this is described as a pattern which occurs within the Silvertop Ash - Sydney Peppermint Forest (Benson, 1984), and is therefore not considered as a separate vegetation unit.

Vegetation on the proposed Kaolin mine site shows signs of severe devastation due to the 1997 wildfire that swept across the Newnes Plateau. The degree of disturbance caused by the fire varies across the site, and consequently the subsequent regeneration of the canopy varies. Regeneration is through epicormic regrowth, and is supported by abundant seedling development of the upper canopy species.

A fairly low diversity was found in the lower strata, with only a few species dominating. This would be likely to be due to the fire. Weed species were not common on the site. **Table 5.2** shows the dominant species in each of the strata.

Table 5.2 - Dominant Species of the Silvertop Ash-Sydney Peppermint Forest

Strata	Species	
Upper Canopy	<i>Eucalyptus piperita</i> <i>Eucalyptus sieberi</i> <i>Eucalyptus sclerophylla</i>	Sydney Peppermint Silvertop Ash Scribbly Gum
Shrub Layer	<i>Lomatia silaifolia</i> <i>Daviesia latifolia</i> <i>Platysace minearifolia</i> <i>Banksia spinulosa</i> <i>Boronia microphylla</i> <i>Acacia terminalis</i> <i>Epacris pulchella</i> <i>Telopea spesiosissima</i>	Crinkle Bush Broad-leaf Bitter-pea Narrow-leaf Platysace Hairpin Banksia Small-leaved Boronia Waratah
Ground Layer	<i>Mirbelia platylobioides</i> <i>Phyllota squarrosa</i> <i>Dampiera stricta</i> <i>Goodenia dimorpha</i> var. <i>dimorpha</i> <i>Grevillea laurifolia</i> <i>Patersonia glabrata</i>	 Blue Dampiera Leafy Purple-flag

Vegetation of Conservation Significance

Vegetation of conservation significance is defined as all vegetation communities, as well as individual flora species and isolated populations whose short or long-term survival is threatened due to restricted distributions or habitat requirements, significant population or distributional range declines, and where threats to their survival still prevail.

Within New South Wales species of conservation significance are listed under Schedules 1 (Endangered) and 2 (Vulnerable) of the *Threatened Species Conservation Act, 1995* (TSC Act). Species of conservation significance at a national level are those listed as Rare or Threatened Plants (ROTAP species) by Briggs and Leigh (1996), and those listed on the Commonwealth *Environment Protection and Biodiversity Conservation Act, 1999* (EPBC Act) as species of National Environmental Significance (NES).

The Atlas of NSW Wildlife is a database maintained by the NSW National Parks and Wildlife Service (NPWS) with information on the flora and fauna of NSW, as recorded by the Service and other organisations. A similar database exists at a national level, and is maintained by Environment Australia.

Threatened Flora Species Recorded

Targeted searches for flora species of conservation concern likely to be present did not reveal the presence of any such species.

Threatened Flora Species known from the Surrounding Area

Table 5.3 lists flora species of conservation significance previously identified from the area. This list has been compiled from a number of sources, including Vegetation

of the Wallerawang 1:100 000 Map Sheet by Benson and Keith (1990), the Atlas of NSW Wildlife maintained by the National Parks & Wildlife Service, the Environment Australia database, and the previous flora surveys conducted by Corkery and Co (1993) and IEC (1999).

Table 5.3 - Flora Species of Conservation Significance Recorded in Region

Scientific Name	Potential Habitat	Conservation Status
<i>Acacia bynoeana</i>	Heath / Woodland	V
<i>Acacia flocktoniae</i>	Forest	N(v)
<i>Almaleea incurvata</i>	Swamp	E
<i>Apatophyllum constablei</i>	Forest	E
<i>Boronia deanei</i>	Swamp	V
<i>Caladenia tessellata</i>	Widespread	N(v)
<i>Derwentia blakelyi</i>	Forest	V
<i>Diuris aequalis</i>	Forest	N(v)
<i>Eucalyptus pulverulenta</i>	Rocky outcrops	N(v)
<i>Haloragodendron lucasii</i>	Forest / Woodland	E
<i>Persoonia acerosa</i>	Forest	V
<i>Persoonia marginata</i>	Forest	V
<i>Prostanthera cryptandroides</i>	Forest	V
<i>Pultenaea glabra</i>	Forest / Scrub	N(v)
<i>Thesium australe</i>	Widespread	N(v)

V Listed as vulnerable under Schedule 2 of the *Threatened Species Conservation Act 1995*.

N Listed under the EPBC Act as (e) endangered or (v) vulnerable.

E1 Listed as endangered under Schedule 1-part 1 of the *Threatened Species Conservation Act 1995*.

Acacia bynoeana - is a low bushy shrub inhabiting heath and woodland with scattered occurrences from the coast to the mountains. Within the area the species has been recorded from Hazelbrook to Bell, Wheelbarrow Ridge and Lower Portland (Fairley and Moore, 1989). It considered to be adequately reserved, being recorded in Blue Mountains and Royal National Parks, Agnes Banks Nature Reserve and Castlereagh State Forest (Briggs and Leigh, 1996).

Potential habitat for the species exists on the site of the proposed kaolin mine site, however was not detected during the current survey.

Acacia flocktoniae - *Acacia flocktoniae* is a slender shrub up to 3 m in height. In inhabits dry sclerophyl forests and is known to occur in the Blue Mountains.

According to Briggs and Leigh, the species is considered as vulnerable, has a known geographic distribution within Australia of less than 100 km, and is present in Blue Mountains National Park.

Suitable habitat for the species exists on the proposed kaolin site, however the species was not observed during the field surveys.

Almaleea incurvata - is an erect shrub up to 1 m high occupying wet areas within the Blue Mountains (Fairley and Moore, 1989) and is present within Blue Mountains National Park (Briggs and Leigh, 1996).

Potential habitat for this species within the survey area would be limited to the wet area and two ephemeral creeklines. However, these sites are not permanently wet, and may only provide intermittent habitat for this species, which was not recorded during the survey.

Apatophyllum constablei - is a small spreading shrub up to 50 cm high, found within sandstone forest (Carolin and Tindale, 1994). The species has been recorded at Glen Davis and is represented in Wollemi National Park (Briggs and Leigh, 1996).

Potential habitat for the species exists on the site of the proposed kaolin mine site, however was not detected during the current survey.

Boronia deanei - *Boronia deanei* is an erect shrub up to 1 m tall, growing on swampy ground in heath and shrubland (Fairley and Moore, 1989). The species is regarded as Vulnerable and listed under Schedule 2 of the TSC Act. *B. deanei* has a distribution in Australia greater than 100 km. It is considered to be adequately reserved with over 1000 plants within a conservation area, including Budderoo National Park, Kanangra-Boyd National Park, Morton National Park and Nalbaugh National Park (Briggs and Leigh, 1996).

Potential habitat for this species is not present within the study area, as there are no swampy areas or heath. Potential habitat is likely to exist elsewhere on the Newnes Plateau.

Caladenia tessellata - *Caladenia tessellata* is a low growing shrub occupying a variety of habitats. The species is regarded as vulnerable, with a distribution in Australia greater than 100 km. The species is not known from any conservation areas.

While the species was not recorded during the flora surveys, suitable habitat does exist within the study area.

Derwentia blakelyi - *Derwentia blakelyi* is a small, slender shrub up to 40 cm. It is known to inhabit roadside margins and sandy slopes above swamps. Known occurrences of the species are from the Newnes Plateau, above a swamp.

Derwentia blakelyi has been assigned a Risk Code of 2K under ROTAP. This indicates that the species has a distribution of less than 100 km within Australia, however has only recently been listed as vulnerable under the TSC Act.

Suitable habitat for *D. blakelyi* does not exist within the proposed development area.

Diuris aequalis - is a plant up to 50 cm high occupying open forest. Recordings of the species are from the Blue Mountains and the Cumberland Plain.

D. aequalis is considered by Briggs and Leigh as vulnerable and has a geographical distribution within Australia greater than 100 km. The species is known from Blue Mountains National Park and Kanangra-Boyd National Park.

While the species was not recorded during the flora surveys, suitable habitat does exist within the study area.

Eucalyptus pulverulenta is usually a straggly shrub and occurs in a restricted area in the Blue Mountains and some hundreds of kilometres away in the southern tablelands, suggesting that it was once much more widespread than now. Suitable habitat for the species is rocky outcrops on hillsides.

According to Briggs and Leigh *E. pulverulenta* is listed as vulnerable with a geographical distribution within Australia greater than 100 km. It is not known from any conservation areas.

Suitable habitat for this species does not exist within the proposed development area.

Haloragodendron lucasii - is a shrub up to 1 m tall, once believed to be extinct. The species grows in sheltered gullies, often at the base of rock faces with a fern understorey and has been recorded at the Wollangambe gorges and Davidson Park (St Ives) (Fairley and Moore, 1989). The species is adequately reserved in Blue Mountains National Park (Briggs and Leigh, 1996).

Suitable habitat for this species does not exist on the site of the proposed mine, with no sheltered gullies or rock facies present.

Persoonia acerosa - is a small spreading shrub growing in dry open forest, woodland and heath on sandy soils of the Blue Mountains (Fairley and Moore, 1989). The species is represented in the Blue Mountains National Park (Briggs and Leigh, 1996).

Suitable habitat for this species is present on the site of the proposed mine, supporting forest on sandy soils, however this species was not observed during the surveys.

Persoonia marginata - is a branching shrub up to 60 cm high occupying dry sclerophyll forest on sandy soils around Capertee (Caromine and Tindale, 1994). The species is not known to be represented within any conservation areas (Briggs and Leigh, 1996).

Suitable habitat for this species is present on the site of the proposed mine, supporting forest on sandy soils, however this species was not observed during the surveys.

Prostanthera cryptandroides - is a small shrub up to 60 cm and is regarded as endangered because of its restricted distribution. It occupies forested slopes and gullies in rocky areas, especially at the base of scree slopes in the Glen Davis - Capertee area, extending to Goulburn River valley (Fairley and Moore, 1989). The species is represented in the Wollemi and Blue Mountains National Parks (Briggs and Leigh, 1996).

Potential habitat for this species is not present at the site of the proposed kaolin mine.

Pultenaea glabra is found in small scattered populations of open forest and scrub, on protected slopes. It occurs in the Blue Mountains between Wentworth Falls and Katoomba.

According to Briggs and Leigh it has a geographical distribution within Australia of less than 100 km. Over 1000 plants are present with conservation areas such as the Blue Mountains National Park and Wollemi National Park.

Suitable habitat for this species is not present within the study area.

Thesium australe - is a perennial herb approximately 30 cm high and occurs in a variety of habitats. According to Briggs and Leigh the species has a geographical range of over 100 km within Australia and less than 1000 plants are known to occur within conservation areas. The species is also known to occur overseas. It is recorded in Mount Greville National Park, Bullen Range Nature Reserve, Kosciuszko National Park, Namadgi National Park, Crowdy Bay National Park, Hat Head National Park, Kattang Nature Reserve, and Cobberas-Tingaringy National Park.

While the species was not recorded during the flora surveys, suitable habitat may exist within the study area.

None of these species were detected within the study area despite targeted searches. It must be acknowledged however, that potential habitat for those threatened species that normally inhabit open forest exists at the site.

5.6.5 Fauna Survey

Potential Habitat

Two potential habitat types have been identified within the study boundary. These are the Silvertop Ash - Sydney Peppermint Forest which covers all of the site, and within the forest are “wet areas”, which include a small swamp (approximately 500 m² in area) and two ephemeral creeks, both of which would remain dry outside of periods with substantial rainfall.

Forest and woodland communities provide potential habitat areas for a range of fauna species. The woodland provides habitat for a variety of passerine birds, including nest sites and material, foraging substrates and a range of food resources. Tree hollows, limbs and trunks of mature trees may also provide suitable shelter for other fauna including arboreal mammals, microchiropteran bats and reptiles.

This vegetation was burnt during the 1997 wildfire, and consequently there are some areas where the canopy is diminished in size and structure, therefore the potential to provide habitat for arboreal species is reduced. Furthermore, few tree hollows are present in the area, which also reduces the value of this habitat for arboreal mammals.

Habitat value will slowly increase as the canopy structure becomes more developed, and will be able to support a greater diversity and abundance of species. Species likely to recolonise the area will include numerous birds, possums and gliders.

The understorey of the Silvertop Ash - Sydney Peppermint Forest is dominated by seedlings of the canopy species, which is usually of low habitat value for ground dwelling mammals and bird species. This is supplemented by a medium density of shrubs and grasses generally of a height up to 2 m, providing substantial habitat for

small mammals and birds. The understorey has shown significant growth since the initial survey, providing additional potential fauna habitat.

As previously mentioned, two ephemeral creeks traverse the area, which in depressions in the topography from “wet areas”. Given the location of the site high within the catchment, these creeks and wet areas provide only transient and short-term habitat, and therefore would not be capable of supporting faunal assemblages normally found associated with permanent water courses. Consequently, these areas have not been regarded as distinct areas of potential habitat and therefore were not specifically sampled. These areas were however, surveyed as part of the normal open forest habitat.

Fauna Species Identified

Mammals

Only two mammal species were detected during the survey. A total of Eight Ringtail Possums (*Pseudocheirus peregrinus*) were observed during spotlighting, and one Eastern Grey Kangaroo (*Macropus giganteus*) was observed moving through the forest around midday. Both the ringtail possum and eastern grey kangaroo are species that are commonly encountered and present in abundance.

No other mammals were detected during trapping, spotlighting, through call back tapes, or directly or indirectly observed through scats, scratches or tracks. Furthermore, there was no indication of any feral animals inhabiting the area. Previous surveys in the Newnes Plateau have detected the presence of rabbits, feral pigs and wild dogs, however these species appeared to be absent from the study area at the time of the survey.

Avifauna

A total of 16 bird species were identified during the survey as shown in **Table 5.4**. All of these were species that are normally found associated with open forests, and all were native to Australia. No nocturnal species were detected during the study.

The species present are representative of a variety of guilds including insectivores (eg thornbills, scrubwrens, fantails and fairy-wrens), pollinators (eg honeyeaters), and scavengers (eg Currawong). No ground dwelling birds were detected, and is likely to be due to the absence of a dense understorey that would normally provide shelter.

Table 5.4 - Avifauna Recorded in the Study Area

Scientific Name	Common Name	Tally
<i>Acanthiza reguloides</i>	Buff-rumped Thornbill	3
<i>Anthochaera chrysoptera</i>	Little Wattle Bird	1
<i>Corcorax melanorhamphos</i>	White-winged Chough	3
<i>Cormobates leucophaeus</i>	White-throated Treecreeper	6
<i>Dacelo novaeguineae</i>	Laughing Kookaburra	3
<i>Eopsaltria australis</i>	Eastern Yellow Robin	3
<i>Lichenostomus leucotis</i>	White-eared Honeyeater	1
<i>Malurus lamberti</i>	Variegated Fairy-wren	5
<i>Manorina melanocephala</i>	Noisy Minor	5

Table 5.4 - Avifauna Recorded in the Study Area

Scientific Name	Common Name	Tally
<i>Manorina melanophrys</i>	Bellbird	3
<i>Platycercus elegans</i>	Crimson Rosella	8
<i>Platycercus eximius</i>	Eastern Rosella	2
<i>Rhipidura fuliginosa</i>	Grey Fantail	1
<i>Sericornis frontalis</i>	White-browed Scrubwren	4
<i>Strepera graculina</i>	Pied Currawong	10
<i>Zosterops lateralis</i>	Silvereye	3

Herpetofauna

Reptile and amphibian species did not appear to be abundant during the survey. Only one frog species, the Common Eastern Froglet (*Ranidella signifera*) was found inhabiting the wet area, and was actively calling both at night and during the day. The only reptile species observed was the Dark-flecked Garden Skink (*Lampropholis delicata*).

A survey conducted by Biosphere Environmental Consultants Pty Ltd in May 2002 for the Giant Burrowing Frog, *Heleioporus australiacus*, or potential habitat found that from the assessment of habitat, it is very unlikely that Giant Burrowing Frogs would be able to survive on the project site or in the immediate local area. This report is included in Appendix D.

Species of Conservation Significance

Fauna species of conservation significance within New South Wales are those species listed under Schedule 1 and Schedule 2 of the *Threatened Species Conservation Act, 1995*, and as such are protected under the act. Threatened species are those species that have restricted distributions, habitats and / or low population numbers, and are subject to threats that could potentially result in a further decline of the species.

Threatened Fauna Species Recorded

Targeted searches for fauna species of conservation concern likely to be present did not reveal the presence of any such species.

Threatened Fauna Species known from the Surrounding Area

A number of species of conservation significance have been detected in the vicinity of the survey area through previous fauna surveys, some of which are listed on the Atlas of NSW Wildlife maintained by the National Parks & Wildlife Service. These species are listed in **Table 5.5**.

Table 5.5 - Rare or Threatened Fauna Species

Scientific Name	Common Name	Potentially Present	Conservation Status
<i>Dasyurus maculatus</i>	Spotted-tailed Tiger Quoll	NPWS, 1993	V
<i>Eulamprus leuraensis</i>	Blue Mountains Water Skink	NPWS, 1993	E1
<i>Hoplocephalus bungaroides</i>	Broad Headed Snake	1993	E1
<i>Ninox strenua</i>	Powerful Owl	NPWS, 1999	V

Table 5.5 - Rare or Threatened Fauna Species

Scientific Name	Common Name	Potentially Present	Conservation Status
<i>Paralucia spinifera</i>	Bathurst Copper Butterfly	NPWS	E1
<i>Petaurus australis</i>	Yellow-bellied Glider	1999	V
<i>Petaurus norfolcensis</i>	Squirrel Glider	1993	V
<i>Phascogale carolinensis</i>	Koala	NPWS, 1993	V
V	Listed as vulnerable under Schedule 2 of the <i>Threatened Species Conservation Act 1995</i> .		
E1	Listed as endangered under Schedule 1-part 1 of the <i>Threatened Species Conservation Act 1995</i> .		
NPWS	Listed as present in the area under the Atlas of NSW Wildlife.		
1993	Identified in the 1993 fauna survey as likely to occur in the area.		
1999	Identified in the 1999 fauna survey on the Newnes Plateau area.		

None of these species were detected within the study area, despite specific searches. The likelihood of each of these species inhabiting the proposed Kaolin mine site is discussed briefly in the following sections.

Spotted-tailed Tiger Quoll - The Spotted-tailed Tiger Quoll (*Dasyurus maculatus*) is a nocturnal carnivore, feeding on a variety of prey ranging from insects to small wallabies. Medium-sized mammals comprise about two thirds of the diet, as well as birds, small animals and carrion from Dingo or wild Dog kills.

This species is recorded from a wide range of habitats, including rainforest, open forest, woodland, coastal heathland and inland riparian forest. It occurs from the coast to the snowline and inland to the western plains in Red Gum forest along the Murray River. Den sites may include rock crevices, caves and hollow logs. The greatest threat to the species is loss of habitat through clearing, poisoning and trapping, shooting where it is considered a pest, and competition with introduced species such as the fox and feral cat.

The Spotted-tailed Tiger Quoll is known to inhabit woodlands such as that present on the study area, however suitable den sites are absent, reducing the likelihood of the species being present on the site. An unconfirmed sighting of the Spotted-tailed Tiger Quoll has been reported by a resident in the Newnes Junction township, however its presence was not detected in the current survey. The Spotted-tailed Tiger Quoll may be an intermittent visitor through the area, opportunistically searching for food.

Blue Mountains Water Skink - The Blue Mountains Water Skink (*Eulamprus leuraensis*) is a dark brown to black shining skink with golden to white stripes and a yellow underside. The skink grows up to a body length of 75 mm, however the average length is 60 mm. The Blue Mountains Water Skink is only found in the upper Blue Mountains, and on the Newnes Plateau where it inhabits wet heath or hanging swamps. It is also known to inhabit artificial wet areas such as water storages and industrial discharge points.

Little is known about the biology or complete distribution of the species, however a population is present in swamps within the Blue Mountains National Park. Permanent wet areas are not present in the study area, given its location at the top of the catchment. Suitable habitat is therefore not present and it is considered highly unlikely that the Blue Mountains Water Skink inhabits the area proposed for the Kaolin mine.

Broad Headed Snake - The Broad Headed Snake (*Hoplocephalus bungaroides*) is a nocturnal species feeding predominantly on small lizards. It inhabits sandstone ridges and rock crevices.

Suitable habitat for this species does not occur within the area proposed for the Kaolin mine, and it is therefore considered highly unlikely that the Broad Headed Snake inhabits the area.

Powerful Owl - The preferred habitat of the Powerful Owl is tall moist open eucalypt forests in hilly terrain, but is also known to occur in a wider range of forest types such as drier forest and woodland and urban bushland. Roosting may be in a variety of places including dense canopy and substorey trees within rainforest and open forest, often in gullies, and canopy trees in woodland. Within coastal areas of New South Wales common roost sites are Red Turpentine (*Syncarpia glomulifera*) in tall open forest and Black She-oak (*Allocasuarina littoralis*) in open forest with dense crowns.

The Powerful Owl is distributed along the coast and ranges of eastern Australia from near Rockhampton in Queensland, south throughout eastern New South Wales and Victoria. It mainly occurs on the coastal side of the Great Dividing Range.

Estimates of the home range vary from 400-600 ha per family group to 800-1000 ha. The diet of the Powerful Owl consists mainly of arboreal mammals such as the Common Ringtail Possum, the Greater Glider, and the Sugar Glider, however this will vary with prey availability.

Suitable habitat exists for this species, however it is patchy where the canopy remains sparse after the wildfire. Based on the findings of this fauna survey, few prey species exist for the Powerful Owl, and it is therefore unlikely that the species would depend on the area.

Bathurst Copper Butterfly - The Bathurst Copper Butterfly (*Paralucia spinifera*) is usually found associated with patches of Blackthorn (*Bursaria spinosa* var. *spinosa*) at an altitude above 900 m. A few small Blackthorn shrubs were identified along the central ridge on the study site during the initial survey. At this time, it was considered that this may provide potential habitat for the Bathurst Copper Butterfly.

However, the follow-up survey failed to find any Blackthorn plants, despite targeted searches for the species. It is therefore currently considered unlikely that the Bathurst Copper Butterfly relies on habitat within the area of the proposed development.

The loss of the Blackthorn that was found in the original surveys is likely attributed to the individuals being out-competed by other species. No evidence of additional physical disturbance was found at the site, and it must therefore be assumed that the Blackthorn has been lost due to natural processes.

Yellow-bellied Glider - The Yellow-bellied Glider (*Petaurus australis*) occurs patchily in tall, mature wet eucalypt forests at a density of 0.05 - 0.14 individuals per hectare. It feeds primarily on plants and insect exudates (sap, nectar, honeydew and manna), and in Queensland eucalypt sap is consumed throughout the year. When

available, Eucalypt blossom provides valuable food. Sap is obtained by biting out small patches of bark of the trunk or main branches of a eucalypt. When this flow dries up, a new excision is made, and heavily used trees become very scarred after a few years.

During the day the glider rests in a den in the hollow branches of trees, usually smooth-barked eucalypts. It emerges at night to forage and may travel up to 2 km from the den. The home range is of the order of 35 ha. Suitable den habitats does not exist within the area and it is therefore considered unlikely that the Yellow-bellied Glider is present.

Squirrel Glider - The Squirrel Glider (*Petaurus norfolcensis*) inhabits dry sclerophyll forest and woodland in south-eastern Australia, however is absent from the dense coastal ranges. The glider feeds on insects, the gum produced by acacias, the sap of some eucalypts, nectar and pollen. Nests are made in a bowl-shaped nest mined with leaves within a tree hollow. Tree hollows appear to be absent or scarce within the study area and it is therefore considered unlikely that the Squirrel Glider inhabits the area.

Koala - The Koala (*Phascolarctos cinereus*) occupies a vast fragmented range throughout eastern Australia. Cold winter temperatures prevent it from inhabiting backbone of the Great Dividing Range, however it is widely distributed on either side. To the south and east it is most abundant in the forest remnants and foothills and coastal plains. To the west it extends well inland, following the River Red Gum forests along the rivers and waterways.

The Koala feeds selectively on a few species of eucalypts, with variations in the preferred trees throughout the range. In the south the Koala feeds preferentially on Manna Gum (*Eucalyptus viminalis*), Swamp Gum (*Eucalyptus ovata*) and Blue Gum (*Eucalyptus globulus*), while Red Gums (*Eucalyptus camaldulensis* and *Eucalyptus tereticornis*), Tallowwood (*Eucalyptus microcorys*) and Grey Gum (*Eucalyptus punctata*) are important in the north.

Preferred food species of the Koala are not present in the area proposed for the Kaolin mine and it is therefore considered highly unlikely that the Koala is present in the area.

SEPP 44 - Koala Habitat Protection

State Environmental Planning Policy No. 44 - Koala Habitat Protection was developed in 1995 to coordinate a state-wide approach to the protection of Koala populations, primarily through the preservation of their habitat. SEPP 44 applies to the Greater Lithgow Local Government Area and as such, Council must consider SEPP 44 in its determination of all development applications.

In consideration of SEPP 44, searches were undertaken to identify any areas of:

- ❑ “Potential Koala Habitat” where native trees as listed under Schedule 2 of the policy constitute at least 15 % of the total number of trees in the upper or lower strata; or

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- ❑ “Core Koala Habitat” which is an area of land supporting a koala population with recent or historical sightings of koalas.

Neither Potential Koala Habitat or Core Koala Habitat areas have been identified within the areas proposed for mining and consequently no further provisions of the policy apply.

5.6.6 Impacts and Mitigation

Potential Impacts

Flora

The proposed development of the kaolin mine will result in the removal of some 25.5 ha of the vegetation that currently exists on the site. Silvertop Ash - Sydney Peppermint Forest is a common vegetation type within the area and occurs in large continuous tracts. Removal of this amount of vegetation represents a small percentage of this vegetation type and will result in negligible impacts on a regional scale.

Furthermore, the site is located in a pocket surrounded by other developments on three of its boundaries, and occurs on the edge of a large continuous tract of vegetation. The proposed development on this site will not leave any other patches of vegetation isolated. Access to the site will not result in any further clearing of the site, as existing roads will be used.

It must be recognised however, that the site is located immediately adjacent to, and up-slope of the Blue Mountains National Park, which is an important conservation reserve in the region, being part of the recently declared World Heritage Area. There exists therefore, the potential for impacts on the vegetation within the National Park if the site is not adequately managed. Measures to prevent impact on the surrounding vegetation are described throughout this EIS document, while specific measures are summarised in a later part of this section.

Fauna

The main potential habitat found to occur within the area to be disturbed by the proposed development is the Silvertop Ash - Sydney Peppermint open forest. Within this, are the “wet areas” that would provide intermittent habitat. This habitat type is extensive throughout the region, and removal of approximately 25.5 ha as a result of the proposed development does not represent a significant loss of this habitat type. The habitat value of the site is also deemed to be low, given the extensive disturbance still evident from the 1997 wildfire.

Few faunal species were identified within the study area. All of these species are commonly encountered within eucalypt forests, and none are likely to be dependent solely on this particular vegetation type for food or shelter. It is expected that any fauna with nest sites that would be destroyed by the proposed development would quickly find new shelter in the adjoining vegetation.

No rare or threatened species were detected during the survey, however a number of threatened species have previously been identified within the Newnes Plateau area, and therefore may use the site as part of their home range.

It is therefore considered that the impact on fauna and their habitat resulting from the proposed development would be insignificant on a regional scale.

Species of Conservation Significance

The Newnes Plateau area is well known for housing many flora and fauna species of conservation significance. However, no such species were identified within the site of the proposed kaolin mine, despite targeted searches aimed at detecting their presence.

The area to be disturbed by the proposed development is relatively small, and was not found to contain any species of conservation significance. In the event that a rare or threatened species is present and was not detected, or is a transient visitor to the area, suitable habitat exists elsewhere in the region, including the neighbouring National Park to provide adequate replacement habitat. It is therefore considered unlikely that any species of conservation significance will be directly impacted by the development, and any indirect impacts will be mitigated by the proposed ameliorative measures discussed throughout this EIS document.

Under Part 5A of the *Environmental Planning and Assessment Act 1979*, as amended by the *Threatened Species Conservation Amendment Act 2002* (as in force at 2 October 2002), an 8-part test of significance is required to determine whether there is likely to be a significant impact on a species or population of conservation significance.

Eight flora species and one fauna species of conservation significance were identified as being potentially present (or potential habitat present) within the area of proposed disturbance. An 8-part test of significance for flora and fauna is included as Appendix D4. Based on the assessments, it is considered that the overall impact on these threatened species will be minor, and a species impact statement is considered unnecessary.

Mitigation Measures

The vegetation to be removed by the proposed development is widely distributed throughout the area. No species of conservation significance were identified, and it is therefore considered that the impact on a regional scale would be negligible. Nevertheless, the following mitigation measures have been recommended:

- ☐ clearing of native vegetation be kept to a minimum area needed to support the operations of the mine;
- ☐ revegetation of all areas no longer required for ongoing operations be conducted as soon as is practicable;

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- ☐ revegetation should include the use of species endemic to the local area to maintain genetic diversity consistent with surrounding vegetation;
 - ☐ a fence erected around the site to prevent native fauna entering hazardous areas such as the pit from the surrounding vegetation.
 - ☐ in the event that a threatened species is observed on the site either during the clearing, construction and establishment or operation of mine, National Parks and Wildlife Service notified immediately and a species management plan prepared by a suitably qualified ecologist;
 - ☐ emissions of dust and noise should be kept to a minimum to prevent disturbance of fauna species inhabiting the surrounding area; and
 - ☐ all runoff from disturbed areas is to be contained on site to prevent erosion and sedimentation in the adjacent National Park, known to house a number of flora species of conservation significance.

Conclusion

No flora or fauna species of conservation significance were observed in the area of the proposed Kaolin mine, however a number of threatened species are known from surrounding areas, and therefore may potentially be transient visitors. The diversity of fauna species, including mammals, birds and reptiles appeared to be low, and the native species that were present are all common, widespread, and tolerant of disturbance to the environment.

Loss of the Silvertop Ash - Sydney Peppermint open forest vegetation will not have a significant impact on the flora of the region, given that it is extensive in the area. Removal of this vegetation will not leave any patches of vegetation disjunct or isolated, and therefore will not reduce the value of the region for wildlife habitat.

It is considered that the proposed operation will have little direct impact on the native fauna. Removal of some potential habitat areas will also not have any major indirect impact on the fauna, due to the fact that the value of these areas as potential habitat is quite low, and the habitat type to be destroyed is common in the region.

It is therefore considered that the proposed Kaolin mine will have only minor impacts on the flora and fauna of the region, and with the incorporation of the mitigation measures described above, it is also considered that the impact on the surrounding vegetation and species of conservation significance known to inhabit the region will be negligible.

It is therefore concluded that there is no basis for preventing the development on the grounds of potential impacts on flora and fauna.

5.7 Aboriginal Archaeology and European Heritage

Robynne Mills, archaeological and heritage consultant, was commissioned to conduct an archaeological survey of the proposed Newnes Kaolin Mine. The archaeological study was designed to identify potential impacts of the proposed development on indigenous and non-indigenous heritage items, sites and places which could be impacted upon, either directly or indirectly by the proposed development.

The field component of the study was conducted by Robynne Mills and Jim Kelton, archaeological consultants on Friday 3rd December, 1999. Bathurst Local Aboriginal Land Council (LALC) was represented by Richard Peters, LALC Sites Officer.

The archaeological report is contained in full in Appendix E, and a summary of the findings present in the following sections.

5.7.1 Initial Investigations

Initial investigations carried out prior to commencement of the field survey included site and archival searches of the NPWS site data base, and the Register of the National Estate, Canberra.

The search of NPWS records identified a total of 63 sites in the vicinity of the development area however, no sites were located within the proposed mine area.

A search of the Native Title Register for the Greater Lithgow Local Government Area identified 8 Native Title Claims. None of these claims apply to the proposed Kaolin Mine area.

Heritage registers and schedules of the Australian Heritage Commission (AHC), NSW Heritage Council and Lithgow City Council were reviewed. There are a total of 45 registered sites listed by the AHC, and 20 sites registered under the State Heritage Register in the Lithgow Local Government Area (LGA). None of these sites are in the vicinity of the proposed kaolin mine.

There are a total of 33 items listed with the National Trust in Lithgow LGA. Of these one is in the vicinity of the proposed development. This item is described as:

All Railway bridges, buildings, tunnels etc on the Main West Line: Newnes Junction to Sodwells.

These items are located to the south-west of the proposed site and will not be impacted either directly or indirectly by the proposed development.

There are 98 items listed in the S170 LEP Schedules of Lithgow City Council. Of the listed items two are in the immediate vicinity of the proposed development. These items are both located at Newnes Junction and include:

Main West Railway line: Railway items Newnes Junction-Sodwalls

Main West Railway Line: Wolgan Valley Railway.

5.7.2 Aboriginal Community Consultation

The survey area is on the boundary of the Deerubbin, Gandangarra and Bathurst LALCs. The mining lease was confirmed to be within the Bathurst LALC after consultation with the State LALC and Deerubbin LALC, Gandangarra LALC, through Mr Lenny Malone CEO and Mr Warwick Peckham of Bathurst LALC. Following these discussions, a fax which formally advised the LALC of the pending field survey and requested LALC involvement was sent to Bathurst LALC.

LALC was asked to provide survey, a *Statement of Involvement* and to detail any concerns that the LALC might have regarding the development proposal. The LALC statement is provided in Appendix E. After the completion of the field survey, a summary document was sent to the LALC on 12th December, 1999 confirming the results of the archaeological survey.

5.7.3 Previous Archaeological Surveys within the immediate vicinity of the proposed Kaolin Mine.

Most of the archaeological investigations on the Newnes Plateau have been conducted as a direct response to development related activity (eg mine developments, power line installations, road construction etc). Such surveys were conducted by Gorecki, (1983), Brayshaw (1981, 1983), Sullivan (1981), Stockton (1983), MacIntyre (1990), Kohen (1992a, 1992b) and Rich (1992). The most comprehensive non-development specific investigation of the Newnes Plateau was done by Klim Gollan for NPWS in 1987. Results of these previous investigations are summarised in Appendix E. No studies have found any sites of significance in the study area.

5.7.4 Development of a Predictive Model

Prior to the commencement of the field survey, a desk top study of the survey area landform and archaeological land systems was conducted. As a result of this assessment, a model of site prediction and sensitivity was developed in conjunction with a strategy for survey area coverage.

Based on previous studies carried out in the area by Gollan and MacIntyre and the desk top studies, the most likely site types in the area were identified. These are:

- ☐ open camp sites which are most likely to be associated with creeklines;
- ☐ sites associated with sandstone landform areas (ie. rock shelters, art sites, grinding grooves etc) Rockshelters are most likely to be located at the base of sandstone outcrops or within eroded sandstone outliers below cliff lines where there is easy access to swamps and creeklines. Grinding grooves would be anticipated in association with water courses;
- ☐ scarred trees may occur across the survey area where old growth timber remains;
and

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- ❑ isolated artefacts may occur across the survey area but are most likely to be located on the ridge lines which were most likely used as transport routes through the area.

Predicted Archaeological Sensitivity

Based on the results of previous archaeological investigations in the region and a study of the topography within the study area, it was predicted that the most archaeologically sensitive micro-landform units in the study area would be ephemeral creek lines and any exposed areas of sandstone. This assessment is supported by previous work done by Gollan (1987), MacIntyre (1990) and Kohen (1992) as detailed in Appendix E.

5.7.5 Field Survey

Survey Methods

Initial reconnaissance of the survey area was conducted by vehicle and a strategy for a combined vehicle and on foot survey was designed. This survey strategy included a full on foot survey of the two ephemeral gullies on the site and a series of east/west and north/south transects along tracks across hill slope areas where visibility was high. As the surface of the site will be totally modified, it was important to cover as much ground as possible. Visibility off the tracks was poor. However the eroded shoulders of the gullies and the vehicle tracks gave access to high visibility samples of all landform units in the survey area. Details of coverage and visibility data are provided in **Appendix E**.

Survey Results

No sites or areas of potential archaeological deposit were identified in the survey. The absence of sites may be the result of physical characteristics of the survey area. The closest permanent sources of water are in Dargan Creek to the south where camp sites have been recorded (Mills 1999) and the Wollangambe River to the east. Although two ephemeral creeklines that are upper tributaries of the Wollangambe River cross the survey area, the steep, sandy nature of the soil may decrease the retention rate of water in the creek beds. The sandy soil would provide a comfortable camping area but the general terrain is steep and unsuitable for large campsites.

No non-indigenous heritage sites or relics were identified in the field assessment.

5.7.6 Site Management and Conclusion

Site Management

NKPL, as a developer, has an obligation under the National Parks and Wildlife Act 1974, to determine if their proposed mine will impact upon indigenous heritage and where required, take ameliorative action. The following recommendation has been developed to minimise the potential impact of the mining development on heritage items and places and to ensure that the proposed development is accommodated

within a management framework that is endorsed by NPWS and includes consultation with Bathurst LALC.

☐ Recommendation 1

In the unlikely event that cultural heritage items should be located during mining, all activity should cease in the vicinity of the heritage item and a representative of NPWS should be contacted so that a plan of management can be prepared for the heritage material.

Legal Requirements and Obligations

All non-indigenous heritage items are protected by the NSW Heritage Act (1975 and the EP & A Act (1979). All indigenous relics (sites and objects), other than those made for sale, are protected under the New South Wales National Parks and Wildlife Act 1967 (amended 1974). Archaeological sites are a non-renewable resource, valued for the information they can provide on the lifestyles of people in the past, and are also valued by local communities who maintain cultural links with the past through these sites and places.

It is illegal to damage or destroy a site or relic without the prior consent of the Director of NSW NPWS and/or DUAP. Any such disturbance requires a permit from the Director. The NPW Act requires that the relics recovered under such a permit come under the custody of the Australian Museum in Sydney or the LALC, if a Care and Control Permit has been issued.

Conclusion

As no sites or areas of potential archaeological sensitivity were identified in the survey, it is concluded that there is no archaeological impediment to the project proceeding as planned.

5.8 Fire Control and Management

The site of the proposed mine has a high risk of bushfire, given that it is surrounded on three sides by native vegetation. The risk of bushfires is evident by the level of past disturbance resulting from the 1997 wildfire that swept across the site. In order to minimise the risk of fire, the following control measures will be employed:

- ☐ cleared vegetation of a suitable size would be mulched, chipped or burnt for use in rehabilitation;
- ☐ any burning would be carried out under controlled conditions with fire fighting equipment on hand;
- ☐ staff would be present at the site to assist in early detection and response;
- ☐ fire fighting equipment would be available on site at all times;

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- ☐ fire extinguishers will be installed on mobile machinery and at appropriate fixed locations;
 - ☐ all site staff will be trained in fire fighting procedures;
 - ☐ access to stored water in ponds for fire fighting purposes will be maintained at all times; and
 - ☐ the project will comply with statutory requirements of the *Bushfire Act 1941*.

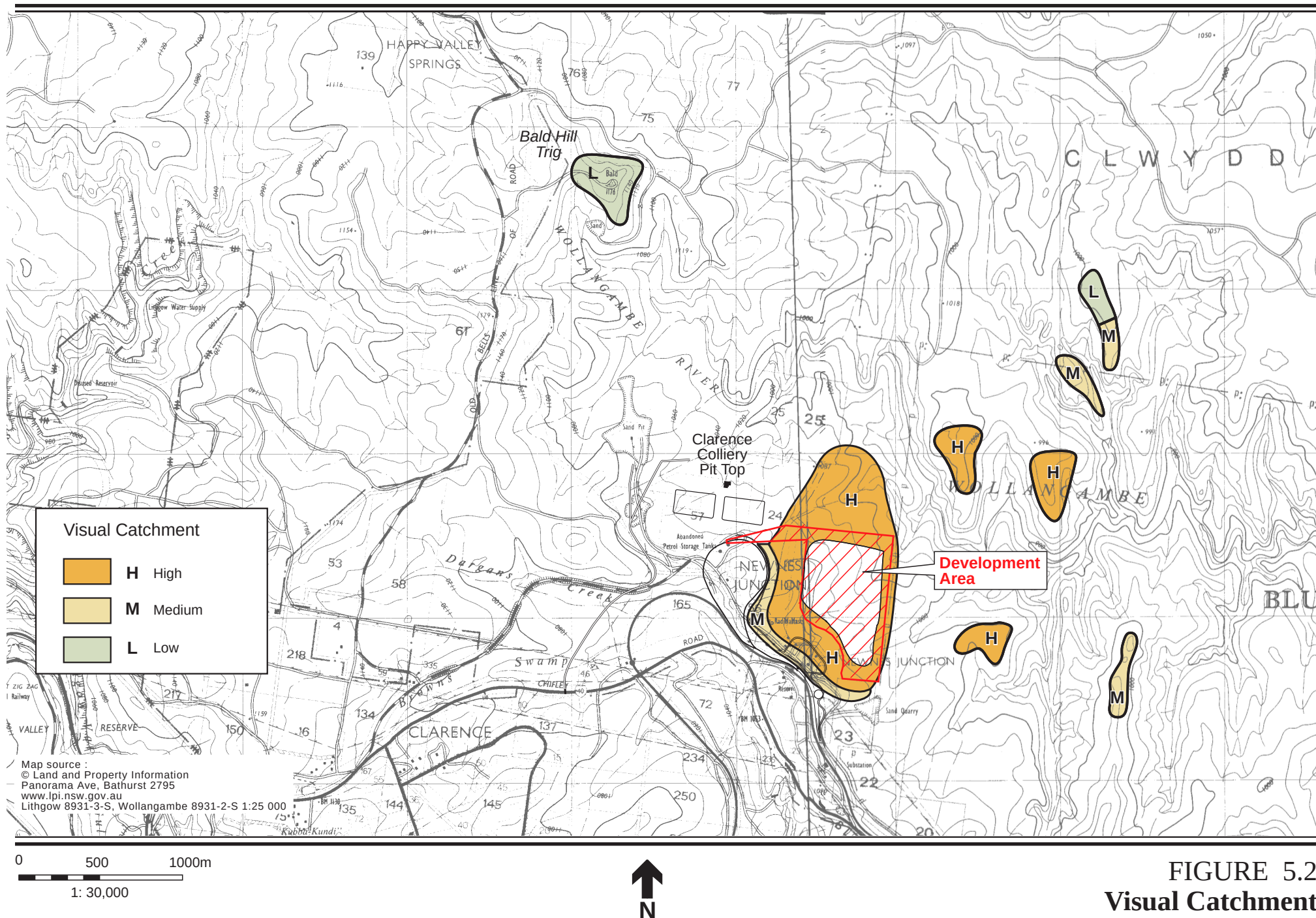


FIGURE 5.2
 Visual Catchment

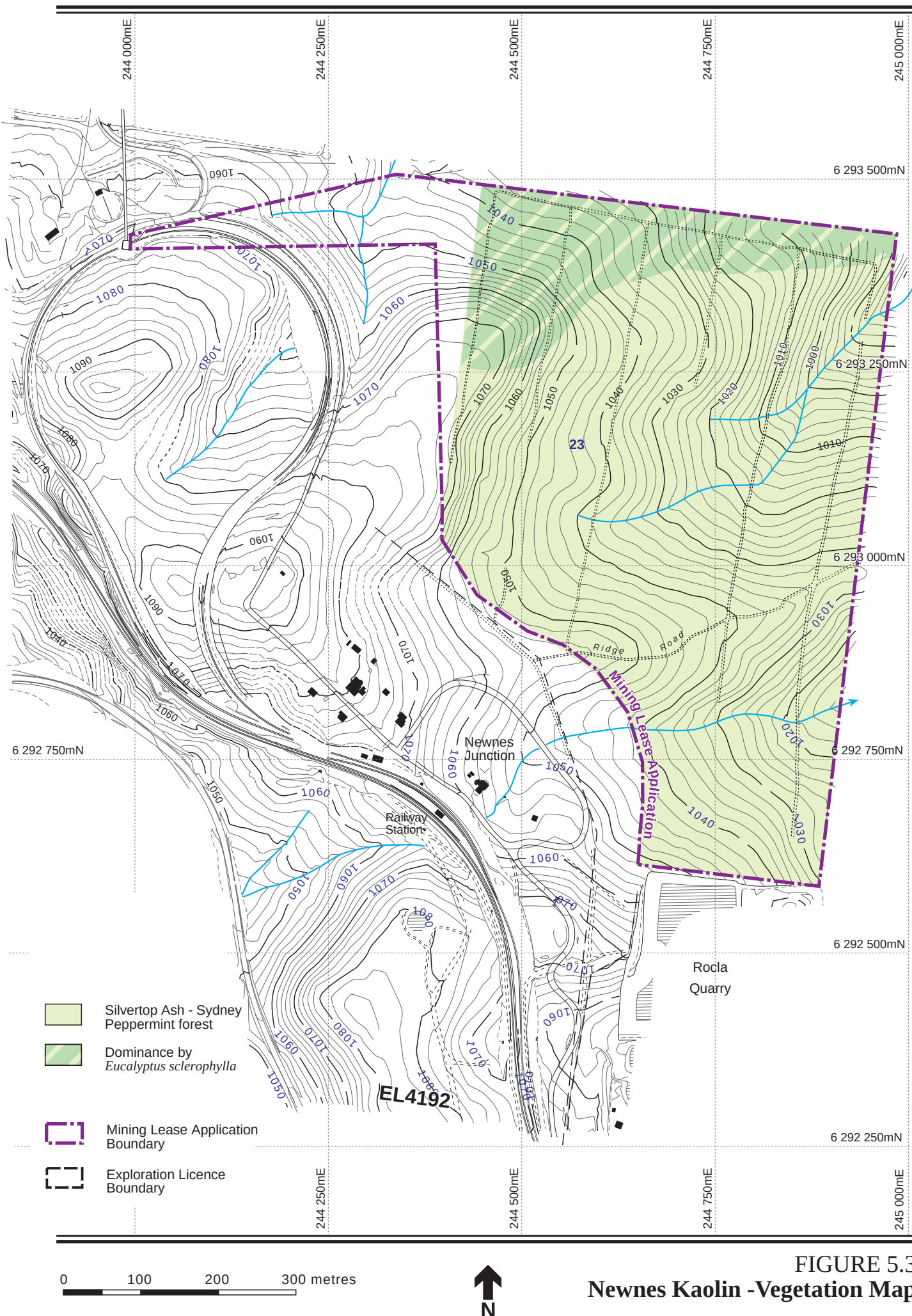


FIGURE 5.3
Newnes Kaolin -Vegetation Map

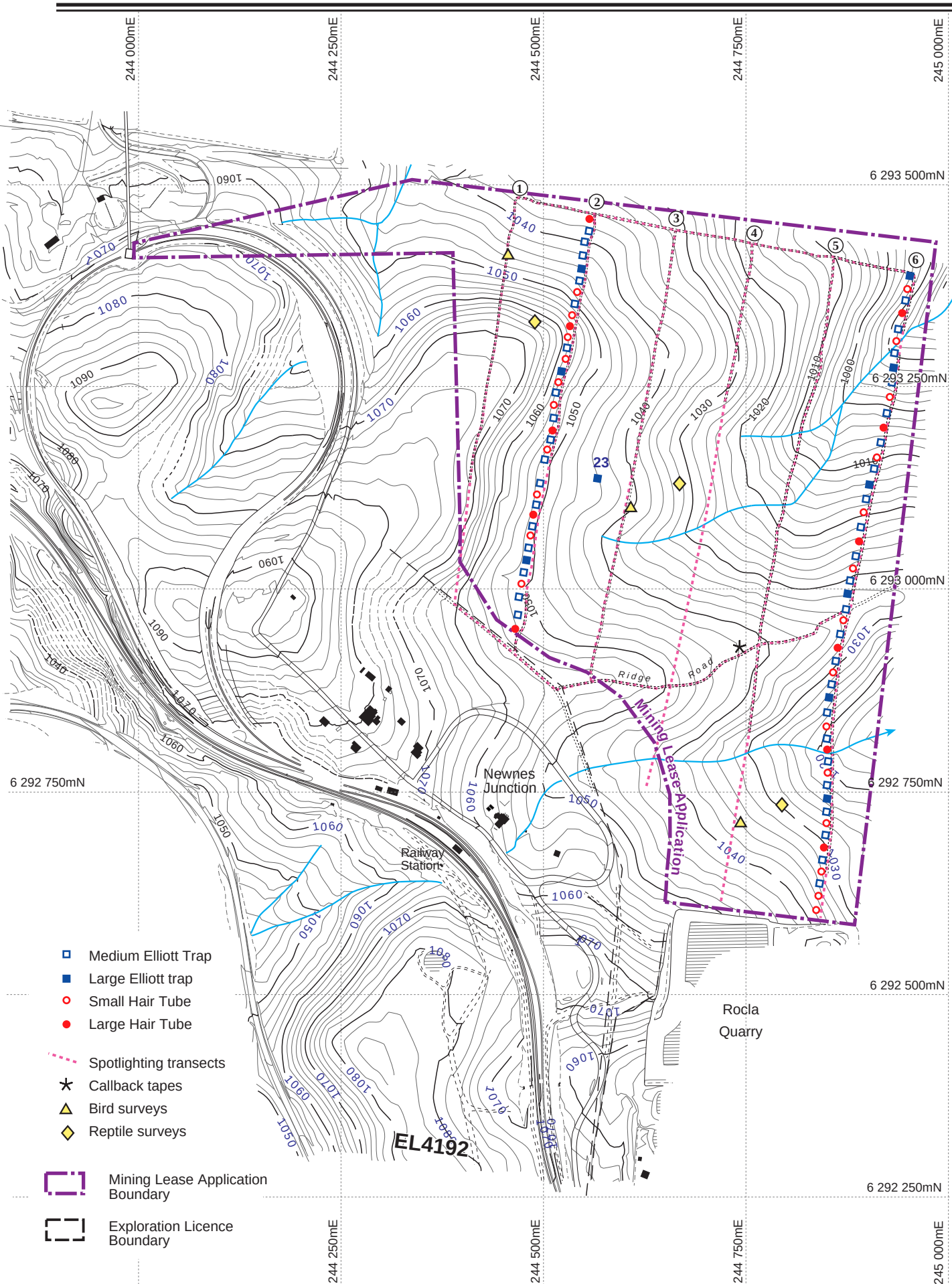


FIGURE 5.4
Newnes Kaolin
Fauna Sampling Sites

6. Emissions and Environmental Effects

This section describes the existing air, noise and water environment of the area within which the proposed mine will be developed and outlines the anticipated effects on them. Safeguards to be implemented to protect the environment are also described.

6.1 Climate

The climate of the Newnes Plateau is typically cool and temperate, characterised by mild summers and cold winters. It is influenced predominantly by the local topography, altitude, aspect and exposure. The rainfall is generally seasonally distributed with higher falls occurring during the summer months, however temperature ranges, frosts, fog and snow incidence increase with increasing altitude. Frosts and snow occur from April through to November, while fogs occur during all months of the year.

Climatic data has been obtained from the Bureau of Meteorology station at the Newnes Forest Centre, located approximately 3 km north of the northern boundary of the proposed site.

6.1.1 Temperature and Humidity

The mean daily maximum and minimum temperature for each month are presented in **Table 6.1** and indicate that temperatures vary seasonally with maximum daily temperatures occurring in the summer months and minimum temperatures occurring during winter.

The annual range for mean daily maximum and minimum temperatures is 16.6°C and 5.0°C respectively. The coldest month is July with a mean daily maximum temperature of 9.5°C and a minimum of -0.9°C. The warmest months are January and February which have mean daily maximum temperatures of 23.4°C and 22.4°C respectively and mean minimum temperatures of 9.9°C and 10.7°C.

The mean relative humidity at 9 am tends to be greatest in June, while the mean relative humidity at 3 pm tends to be greatest in April, and lowest in December. The annual range is 72.8% and 65.9% for 9 am and 3 pm respectively. Due to higher temperatures experienced during summer, the relative humidity is lower than in the winter months (refer to **Table 6.1**).

6.1.2 Rainfall

The mean monthly and yearly rainfall data together with the mean number of rain days for the Lithgow area is presented in **Table 6.2**.

The total mean annual rainfall for Lithgow is 1070.6 mm with maximum falls occurring during January, February and December. The months with the lowest rainfall are July and September. There is a marked seasonality in rainfall with higher

rainfalls occurring in the summer months and drier conditions experienced from April to September.

Table 6.1 - Average Monthly Temperature and Humidity Data

Month	Mean Daily Max Temp (°C)	Mean Daily Min Temp (°C)	9 am Mean Relative Humidity (%)	3 pm Mean Relative Humidity (%)
January	23.4	9.9	70	58
February	22.4	10.7	78	75
March	20.4	8.9	74	78
April	16.3	5.6	78	79
May	13.0	2.3	77	70
June	9.9	0.4	81	70
July	9.5	-0.9	74	66
August	10.5	0.0	77	66
September	13.9	1.5	65	58
October	17.1	5.0	71	62
November	19.9	7.0	67	57
December	22.9	9.4	65	51

Source: Australian Bureau of Meteorology, 1999.

The mean monthly number of rainy days is highest during January, February and March with 12.3, 13.0 and 12.2 rain days respectively. Throughout the remainder of the year there is a fairly consistent number of rainy days per month ranging from 9.1 to 11.2 (refer to **Table 6.2**). The total number of rainy days per year is 130.7 days.

Table 6.2 - Mean Rainfall Data

Month	Mean Monthly Rainfall (mm)	Mean No. of Rain Days
January	119.9	12.3
February	115.5	13.0
March	103.2	12.2
April	79.9	9.1
May	82.2	10.5
June	83.5	10.5
July	66.8	10.0
August	82.4	10.8
September	66.9	9.4
October	89.2	11.2
November	89.5	11.1
December	91.7	10.7

Source: Australian Bureau of Meteorology, 1999.

Based on Australian Rainfall and Runoff (1987) data, the rainfall from a 1 in 100 year, 72 hour storm event in the area is 4.27 mm/hr and the 1 in 50 year, 72 hour storm event is 3.88 mm/hr.

6.1.3 Wind

Data on wind speed and direction have been collected at Mount Piper Power Station. On an annual basis, it can be seen that most winds were from the south-west and west-southwest. This pattern is evident in all seasons except summer, where there is a significant contribution of winds from the east-southeast. To determine if the Mount Piper data would be representative of the wind patterns at Newnes Junction, these

data have been compared with data collected at Lithgow by the Bureau of Meteorology and also with data generated for the site by The Air Pollution Model (TAPM). This is discussed further in Appendix F.

6.2 Air Quality

An air quality impact assessment for the proposed mine was carried out by Holmes Air Sciences and a full report is provided in Appendix F.

6.2.1 Existing Air Quality

Air quality in the proposed mining area is generally considered good. The current air quality in this area is influenced mainly by the two neighbouring operations - Clarence Colliery Pit Top and Kables Sand Quarry. While the vegetation in these areas remains undisturbed air quality is consistently good.

Air quality at the colliery pit top is also considered to be good. This is influenced predominantly by activities on site including vehicle movements on unsealed roads both within the colliery and at the nearby Kables sand quarry; exhaust emissions from plant and equipment at the pit top, on the access road, and along the Bells Line of Road, emissions from occasional diesel locomotives on the Main Western Railway; and exhausted air from the underground workings.

6.2.2 Summary of goals and standards

Table 6.3 and **Table 6.4** summarise the air quality goals that are relevant to this study. It should be remembered that the air quality goals relate to the total dust burden in the air and not just the dust from the project. In other words, some consideration of background levels needs to be made when using these goals to assess impacts.

Table 6.3 - Air quality standards/goals for particulate matter concentrations

Pollutant	Standard / Goal	Agency
Total suspended particulate matter (TSP)	90 µg/m ³ (annual mean)	NHMRC
Particulate matter < 10 µm (PM ₁₀)	50 µg/m ³ (24-hour maximum) 30 µg/m ³ (annual mean)	NSW EPA NSW EPA long-term reporting goal
	50 µg/m ³ (24-hour average, 5 exceedances permitted per year)	NEPM
Particulate matter <2.5 µm (PM _{2.5})	15 µg/m ³ (annual mean) 65 µg/m ³ (24 hour maximum)	US EPA US EPA

Note: bold print indicates goals adopted for this assessment.

Table 6.4 shows the maximum acceptable increase in dust deposition over the existing dust levels. These criteria for dust fallout levels are set to protect against nuisance impacts.

Table 6.4 – EPA Criteria for Dust Fallout

Pollutant	Averaging Period	Maximum Increase in Deposited Dust Level	Maximum Total Deposited Dust Level
Deposited Dust	Annual	2 g/m ² /month	4 g/m ² /month

6.2.3 Air Quality Impacts and Mitigation Measures

Details of estimated dust emissions are presented in the full report contained in **Appendix F**. These estimates assume some control of dust emissions is achievable through the use of watering carts on all unsealed haul roads and by enclosing some of the processing areas. The assessment was done on two different stages of the mine, referred to as Stage 2 and Stage 5.

Stage 2 was modelled to represent the mining operations in its early development. During this stage there would be significant activities taking place in the pit but the total exposed working area of the pit would be small. Stage 5 operations represent the maximum exposed working areas and mining activities. The latter stage is considered to present the worst case in terms of air quality impacts associated with the proposal. Maximum production in any one year was assumed to be 1.4 Mt.

Stage 2

During Stage 2 it is predicted that the maximum 24-hour concentrations will not exceed 50 µg/m³ beyond the exploration lease boundary. Concentrations at the nearest residence are predicted to be below 20 µg/m³ averaged over 24-hours. This is below to NSW EPA 50 mg/m³ goal.

The predicted contribution to existing PM₁₀ concentrations from the mining activities would be very low beyond the boundary of the exploration lease. The most affected residence is predicted to experience annual average PM₁₀ concentrations less than 2 mg/m³. It would be unlikely that the proposed Stage 2 mining operations would cause exceedances of the annual average PM₁₀ goal of 30 mg/m³ at any sensitive receptor.

Similarly, for TSP the annual average predictions at all sensitive receptors are expected to be low. No exceedances of the 90 mg/m³ NHMRC goal would be expected. The predicted TSP concentration due to the mining operations in Stage 2 being around 2 to 3 mg/m³ at the nearest residence (to the south-west of the site).

Dust deposition levels at the nearest residence are predicted to be less than 0.2 g/m²/month. This level is well below the maximum permissible increase allowed by EPA (2 g/m²/month) and compliance with this goal in Stage 2 would be anticipated. Also, it is unlikely that the total deposited dust level would exceed 4 g/m²/month due to Stage 2 mining operations.

Predicted concentrations and deposition levels at the nearest residences due to Stage 2 mining operations are summarised below.

- ❑ Predicted maximum 24-hour PM₁₀ average concentration less than 20 mg/m³;
- ❑ Predicted annual average PM₁₀ concentration less than 2 mg/m³;
- ❑ Predicted annual average TSP concentration less than 3 mg/m³; and
- ❑ Predicted increase in annual average dust deposition less than 0.2 g/m²/month.

Stage 5

Predicted dust concentrations and deposition levels during Stage 5 operations are of similar magnitude to the Stage 2 predictions. The major difference between Stage 2 and Stage 5 is that maximum concentrations and deposition levels would shift further to the south-east. This would be expected with a shift in the activities to the south-east during Stage 5. Modelling results are shown in **Figure 6.1** to **Figure 6.4**.

Examination of the predicted concentration and deposition levels due to the proposed operations during Stage 5 leads to similar conclusions to those drawn from Stage 2 predictions. That is, the maximum 24-hour PM₁₀, annual average PM₁₀ and TSP and annual average dust deposition levels due to the proposed operations during this stage are unlikely to cause exceedences of their respective air quality goals. Predictions at the nearest residence are low and it is unlikely that the proposed operations would be the cause of exceedences of air quality goals.

Predicted concentrations and deposition levels at the nearest residences due to Stage 5 mining operations are summarised below.

- ❑ Predicted maximum 24-hour PM₁₀ average concentration less than 30 mg/m³
- ❑ Predicted annual average PM₁₀ concentration 2 mg/m³ or less
- ❑ Predicted annual average TSP concentration less than 5 mg/m³
- ❑ Predicted increase in annual average dust deposition 0.2 g/m²/month or less.

6.2.4 Greenhouse Gas Emissions

Mining results in the emission of carbon dioxide (CO₂) during the combustion of diesel fuel (used primarily in diesel-powered equipment) and indirectly in the use of electricity to power mining equipment. These are the only significant sources of greenhouse gases involved in the Project. The electrical and fuel requirements for these sources have been used to estimate CO₂ emission rates for the proposed mining operations. In doing this it has been assumed that each MWh of electrical energy used results in the release of 1.06 t of CO₂ and that the cost of electricity is 13 cents per kWh.

Table 6.5 summarises the estimated CO₂ emissions from the Project for each year of operation. It is estimated that over the life of the mine \$2.6 Million will be spent on electricity to power the conveyors, offices and signaling on site. This would equate to 21,200 t of CO₂, assuming the cost of electricity is 13 cents per kWh.

Table 6.5 – Summary of estimated CO₂ Emissions

Year	Diesel Equipment					CO ₂ from electricity (t)	Total CO ₂ emission (t)	CO ₂ emission as % of 2000
	Diesel usage (t/y)	Carbon content (%)	Percent combusted (%)	Carbon left in fuel (%)	CO ₂ emissions (t)			
1	99	86	99	1	308	1,010	1,318	0.00025
2	124	86	99	1	387	1,010	1,397	0.00026
3	151	86	99	1	472	1,010	1,482	0.00028
4	178	86	99	1	557	1,010	1,567	0.00029
5	261	86	99	1	815	1,010	1,825	0.00034
6	289	86	99	1	902	1,010	1,912	0.00036
7	318	86	99	1	992	1,010	2,002	0.00037
8	348	86	99	1	1,088	1,010	2,098	0.00039
9	380	86	99	1	1,186	1,010	2,196	0.00041
10	436	86	99	1	1,361	1,010	2,371	0.00044
11*	507	86	99	1	1,582	1,010	2,592	0.00048
12	507	86	99	1	1,582	1,010	2,592	0.00048
13	507	86	99	1	1,582	1,010	2,592	0.00048
14	507	86	99	1	1,582	1,010	2,592	0.00048
15	507	86	99	1	1,582	1,010	2,592	0.00048
16	507	86	99	1	1,582	1,010	2,592	0.00048
17	507	86	99	1	1,582	1,010	2,592	0.00048
18	507	86	99	1	1,582	1,010	2,592	0.00048
19	507	86	99	1	1,582	1,010	2,592	0.00048
20	507	86	99	1	1,582	1,010	2,592	0.00048
21	507	86	99	1	1,582	1,010	2,592	0.00048
Total	8,159	-	-	-	25,471	21,200	46,671	0.00872

** From Year 11 it has been assumed that peak production is maintained through until Year 21 and that the total diesel usage over life of mine is 9.6 million litres.*

These figures can be compared with the CO₂ equivalent emission estimates from Australia's National Greenhouse Gas Inventory (Australian Greenhouse Office, 2002). There are two widely accepted methods for estimating greenhouse gas emissions (1) the United Nations Framework Convention on Climate Change (UNFCCC) and (2) the Kyoto protocol method. The differences between the two methods relate to the way in which forest sinks are treated. The estimated CO₂-equivalent emission for the two methods for all sectors are:

- UNFCCC - 535.3 Mt;
- Kyoto – 503.3 Mt.

For the purposes of this discussion we will only reference the UNFCCC figure. The 1990 emission using the UNFCCC methodology is 503.3 Mt. There are no practical alternative fuels for a mining project of this type. However, alternative mining methods can lead to greater efficiency in the use of fuels and electricity. These include:

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-
- ☐ Minimising haul distances for waste and ore;
 - ☐ Minimising double handling of materials; and
 - ☐ Using the most practical and efficient machinery.

6.3 Noise

A noise impact assessment for the proposed development was carried out by Atkins Acoustics. A summary of the report is provided below and the full report is provided in **Appendix G**.

The key objectives of the study were to:

- ☐ inspect the site and identify nearby residential dwellings and other sensitive areas potentially exposed to noise emissions from the proposal;
- ☐ measure, review and comment on the existing ambient background noise levels prevailing in the vicinity of the site;
- ☐ recommend noise assessment goals in accordance with the Environment Protection Authority, Industrial Noise Policy (EPA, INP);
- ☐ recommend noise assessment goals in accordance with the Environment Protection Authority, Environmental Noise Control Manual (EPA, ENCM);
- ☐ identify and quantify the main noise sources associated with the proposal;
- ☐ predict and evaluate the likely range of noise emissions;
- ☐ assess the noise impacts;
- ☐ prepare noise contour plots for the mine operations under varying operational and meteorological conditions; and
- ☐ where assessment goals are exceeded, recommend ameliorative noise control measures.

6.3.1 Existing Ambient Noise Levels

Ambient Noise Measurements

For the purposes of assessing noise from the proposal, the existing ambient background noise levels were measured and recorded from Thursday 16 March 2000 to Tuesday 18 April 2000.

The reference locations selected to acquire ambient noise levels that are representative of those presently experienced by local residences in Newnes Junction included:

- ☐ *Measurement Location 1:* 5 Sandham Road (representing the residences at the north-western portion of the Newnes 'village' on the south-western side of

Sandham Road. The residences are exposed to noise from rail traffic and distant road traffic noise from Bells Line of Road).

- ❑ *Measurement Location 2:* Sandham Road, opposite Newnes Junction Railway Station (representing the residences at the south-eastern portion of Newnes ‘village’ on the north-eastern side of Sandham Road. The residences are shielded from noise from road traffic on Bells Line of Road).

The ambient noise levels were measured and assessed as percentile A-weighted sound levels. The parameters regarded as being the most important amongst these, are the “ L_{A90} ”, the level exceeded for 90% of the sample period and referenced as the “background or average minimum noise level”, and the “ L_{Aeq} ”, which is the A-weighted energy equivalent continuous (constant) sound level.

Results

Using procedures recommended in the EPA, “Industrial Noise Policy”, the Rating Background Level (RBL) and ambient L_{Aeq} noise levels were established to assess noise emissions from the proposal. The RBL is the median of the tenth percentile background levels for each assessment period over the seven (7) day measurement period. The L_{Aeq} level represents the energy averaged noise level for each assessment period. Measured noise levels at the two sites are summarised in **Table 6.6** and a full data set is provided in **Appendix G**.

Table 6.6 - Measured RBL and (L_{Aeq}) Noise Levels - dB(A) re: 20×10^{-6} Pa

Date	Assessment Background Level L_{A90}			Equivalent Continuous Level L_{Aeq}		
	Day	Evening	Night	Day	Evening	Night
Location 1: 5 Sandham Road						
Thu 16.3.00		32	29		57	51
Fri 17.3.00	32	32	29	56	58	50
Sat 18.3.00	37	31	30	51	49	52
Sun 19.3.00	31	32	31	54	50	51
Mon 20.3.00	38	37	34	57	58	54
Tue 21.3.00	42	39	36	56	59	54
Wed 22.3.00	42	37	33	57	58	55
Thu 23.3.00	34	33	31	56	56	54
Fri 24.3.00	33	32	29	55	51	50
Sat 25.3.00	32	29	28	50	46	45
Sun 26.3.00	30	29	28	48	48	49
Mon 27.3.00	31	31	30	53	52	54
Tue 28.3.00	34	33	38	53	53	54
Wed 29.3.00	31	31	30	52	56	52
Thu 30.3.00	32	29	30	54	56	53
Fri 31.3.00	39	34	34	55	55	54
Sat 1.4.00	34	29	29	49	40	47
Sun 2.4.00	33	30	30	48	45	51
Mon 3.4.00	36	33	31	52	57	53
Tue 4.4.00	32	29	30	53	56	51
Wed 5.4.00	43	39	39	54	58	54
Thu 6.4.00	36	32	30	56	58	52

Table 6.6 - Measured RBL and (L_{Aeq}) Noise Levels - dB(A) re: 20×10^{-6} Pa

Date	Assessment Background Level L_{A90}			Equivalent Continuous Level L_{Aeq}		
	Day	Evening	Night	Day	Evening	Night
Fri 7.4.00	33	31	28	52	54	51
Sat 8.4.00	32	31	29	51	51	50
Sun 9.4.00	30	29	28	49	46	51
Mon 10.4.00	34	33	28	50	53	49
Tue 11.4.00	31	30	28	50	55	51
Wed 12.4.00	31	31	29	53	55	50
Thu 13.4.00	31	30	31	53	56	52
Fri 14.4.00	36	34	30	52	55	50
Sat 15.4.00	36	28	28	51	54	46
Sun 16.4.00	38	29	35	49	48	52
Mon 17.4.00	35	29		50	54	
Thu 16.3.00		28	28		47	36
Fri 17.3.00	32	29	29	49	47	36
Sat 18.3.00	33	28	28	46	49	40
Sun 19.3.00	31	28	29	54	43	41
Mon 20.3.00	42	34	31	53	50	45
Tue 21.3.00	40	38	33	50	50	45
Wed 22.3.00	41	37	31	50	46	42
Thu 23.3.00	34	32	30	51	46	41
Fri 24.3.00	31	31	29	47	44	41
Sat 25.3.00	30	28	28	47	37	37
Sun 26.3.00	29	28	28	48	41	40
Mon 27.3.00	30	29	32	50	56	46
Tue 28.3.00	40	41	33	51	57	45
Wed 29.3.00	34	29	28	53	48	42
Thu 30.3.00	31	29	32	48	46	45
Fri 31.3.00	38	34	30	49	45	45
Sat 1.4.00	31	28	28	47	32	43
Sun 2.4.00	29	29	30	47	35	45
Mon 3.4.00	34	36	31	52	55	44
Tue 4.4.00	30	28	29	48	45	46
Wed 5.4.00	38	36	38	48	50	50
Thu 6.4.00	34	31	30	52	47	43
Fri 7.4.00	30	30	28	47	42	40
Sat 8.4.00	30	30	28	49	36	38
Sun 9.4.00	29	27	27	44	32	41
Mon 10.4.00	40	40	27	49	45	44
Tue 11.4.00	30	29	27	48	45	42
Wed 12.4.00	29	30	28	45	44	37
Thu 13.4.00	31	29	32	49	45	43
Fri 14.4.00	34	33	29	46	44	42
Sat 15.4.00	36	27	27	67	43	40
Sun 16.4.00	32	27	32	47	42	45
Mon 17.4.00	30	28	28	47	45	44
RBL	32	29	29			
Ambient L_{Aeq}				54	48	43

NOTE: Daytime : (7.00am to 6.00pm)
Evening : (6.00pm to 10.00pm)
Night-time : (10.00pm to 7.00am)

Appendix G also presents a summary of the meteorological conditions recorded during the survey period (Thursday 16 March 2000 to Tuesday 18 April 2000).

Additional meteorological information, supplied by Holmes Air Sciences, identified dominant wind directions (see **Table 6.6**). The data also showed that E and F Stability Class conditions at wind speeds of less than 3m/s occur for less than 30% of the time within the study area. Accordingly the EPA, INP recommends that adverse meteorological conditions need only be assessed when wind speeds of 3m/s or below occur for 30% or more of the time in any assessment period or season.

Table 6.7 - Predominant Wind Direction and Percentage Occurrence

Meteorological Station	Time Period	Wind Direction	Percentage Occurrence (%)
Mount Piper	Winter 1997	SW	16
		WSW	15
		Calm	10.3
	Autumn 1997	SW	13
		WSW	10
		Calm	8.8
	Spring 1997	SW	13
		WSW	15
		Calm	6.5
	Summer 1997	ESE	11
		Calm	4.6
Lithgow	Annual 1997	SW	13
		WSW	13
		Calm	7.9
	Winter 1997	W	31
		SW	17
		Calm	17.4
	Autumn 1997	W	20
		SW	11
		SE	18
		Calm	17.8
	Spring 1997	W	30
		SW	13
		NW	19
		Calm	10.5
	Summer 1997	W	15
		SE	18
		E	15
		NW	15
		Calm	15.2
	Annual 1997	W	24
		SW	12
		SE	15
		NW	15
		Calm	15.3

Audit Noise Measurements

Site attended audit measurements of noise generated by existing rail traffic were conducted to assist in assessing the potential noise impact associated with increased rail movements as a result of the proposal. Measurements were conducted at the rear

of the residence identified as 5 Sandham Road on the 7 March 2000 and 18 March 2000. A summary of the L_{Amax} noise level and sound exposure level (SEL) recorded are presented in **Table 6.8**. The location was approximately sixty (60) metres from the main western rail line, and is partially shielded by existing cuttings.

Table 6.8 - Audit Train Measurements at 5 Sandham Road (rear-60m from rail line) (dB(A) re: 20×10^{-6} Pa)

Date	Train Type	Speed	Duration	Direction	Sound Exposure Level dB(A)	Sound Pressure Level L_{Amax} dB(A)
7.4.00	Silver commuter	fast	15s	W	79.7	70
	Silver commuter	fast	15s	E	82.1	71
	Goods train	med	38s	W	87.6	72
	Silver commuter	fast	13s	W	79.9	70
	Silver commuter	med	15s	E	82.6	72
18.4.00	Silver commuter	slow	20s	W	78.7	68
	Silver commuter	fast	22s	E	81.4	70

6.3.2 Noise Assessment Goals

In accordance with the Environment Protection Authority, Industrial Noise Policy (EPA, INP) and Environmental Noise Control Manual (EPA, ENCM) the following goals have been considered for assessing noise associated with the proposed mine operations.

Construction

The NSW Environment Protection Authority, Environmental Noise Control Manual (ENCM) ^(Chapter 171) construction noise guidelines have been adopted for this assessment. These guidelines consider the L_{A10} noise level (the noise level exceeded for 10% of the time) from construction activities and provide assessment goals depending on the construction period. These are:

Short Term – 4 weeks or less. The L_{A10} level of construction noise should not exceed the L_{A90} background noise level by more than 20dB(A).

Medium Term – greater than 4 weeks but less than 26 weeks. The L_{A10} level of construction noise should not exceed the L_{A90} background noise by more than 10dB(A).

Long Term – greater than 26 weeks. The L_{A10} level of construction noise should not exceed the L_{A90} background noise by more than 5dB(A).

In setting these goals the EPA recognises that the levels set will not always be achieved. Accordingly where there is a technical exceedance of the goals, it is generally recommended that the construction activities be restricted to daytime hours.

Considering the duration of the proposed construction activities is less than 26 weeks, the recommended goal for assessing noise emissions from construction activities associated with the proposal is background $L_{A90} + 10\text{dB(A)}$.

Mining Operations

The EPA, INP assessment procedure for industrial noise sources has two components, namely:

- ☐ controlling intrusive noise; and
- ☐ maintaining noise level amenity.

The intrusiveness of a noise source is considered to be acceptable if the $L_{Aeq, 15 \text{ minute}}$ noise level does not exceed the RBL by more than 5dB(A). In order to determine the amenity noise goal, the ambient L_{Aeq} noise levels should not normally exceed the acceptable noise levels (**Table 6.9**). Where existing L_{Aeq} noise levels approach or exceed acceptable noise levels, design goals are set below the existing L_{Aeq} in order to limit any further increase or “creep” in the ambient levels.

Table 6.9 - EPA Noise Policy Amenity Criteria (dB(A) re: 20×10^{-6} Pa)

Type of Receiver	Indicative Noise Amenity Area	Time of Day	Recommended L_{Aeq} Noise Level - dB(A)	
			Acceptable	Recommended Maximum
Residence	Rural	Day	50	55
		Evening	45	50
		Night	40	45
Area specifically reserved for passive recreation	All	When in use	50	55

It is noted (EPA, INP ^{Section 1.4.1}) that the criteria presented above are best regarded as planning tools. They are not mandatory, and an application for a noise producing development is not determined purely on the basis of compliance or otherwise of noise criteria. Numerous other factors need to be taken into account in the determination. These factors include economic consequences, other environmental effects and the social worth of the development.

Located to the west of the proposed mine is the Blue Mountains National Park/World Heritage Area. The EPA, INP provides recommended noise levels for areas specifically reserved for passive recreation such as National Parks. Section 2 (Table 2.1) of the EPA, INP recommends a L_{Aeq} noise level of 50dB(A), with a maximum of 55dB(A) for these areas when in use.

Considering the measured ambient noise levels and the EPA guidelines, **Table 6.10** presents the assessment RBL's and the L_{Aeq} noise levels, together with the intrusive and amenity noise goals.

Table 6.10 - Assessment RBL and Ambient L_{Aeq} Noise Levels (dB(A) re: 20×10^{-6} Pa)

Period ⁽¹⁾	Recommended Noise Level L_{Aeq}	Existing RBL L_{A90}	Existing L_{Aeq}	Intrusive Criterion L_{Aeq}	Amenity Criterion L_{Aeq}
Location 1:	5 Sandham Road				

Table 6.10 - Assessment RBL and Ambient L_{Aeq} Noise Levels (dB(A) re: 20×10^{-6} Pa)

Period ⁽¹⁾	Recommended Noise Level L_{Aeq}	Existing RBL L_{A90}	Existing L_{Aeq}	Intrusive Criterion L_{Aeq}	Amenity Criterion L_{Aeq}
Day	50	33	53	38	43
Evening	45	31	55	36	45
Night	40	30	52	35	42
Location 2: Sandham Road					
Day	50	32	54	37	44
Evening	45	30 ⁽²⁾	48	35	38
Night	40	30 ⁽²⁾	43	35	33
Location 3: Blue Mountains National Park					
Day	50 ⁽³⁾	-	-	-	50 ⁽³⁾
⁽¹⁾ Daytime: (7.00am to 6.00pm) Evening: (6.00pm to 10.00pm) Night-time: (10.00pm to 7.00am)					
⁽²⁾ In accordance with the procedures of the EPA, INP ^{Section 3.1.2} where the rating background level (RBL) is found to be less than 30dB(A), then it is set to 30dB(A)					
⁽³⁾ Recommended maximum level of 55dB(A)					

Site Preparation – Noise Mitigation Works

Site preparation and the construction of bunding for the purposes of noise control will be required prior to the commencement of extraction operations for each mine stage. In order to construct noise control bunds plant and equipment will be required on the surface for removal and placement of topsoil and overburden material. Considering the short duration (less than 4 weeks) of the noise mitigation works, the goal adopted for assessing noise impact is background (L_{90}) +20dB(A).

Train Loading Operations

Train loading activities involving the use of a front end loader, conveyers and surge bin were assessed in terms of the recommended EPA, INP noise goals for mechanical plant outlined in Section 6.3.2.

Train Movements

In accordance with the EPA, ENCM^{Chapter 163} the recommended maximum noise goals for residential receivers are specified as a $L_{Aeq,24hour}$ 60dB(A) and a L_{Amax} 85dB(A).

6.3.3 Recommended Goals

Having regard to the measured noise levels and the recommended guidelines, the goals recommended for assessing noise emissions from the proposal are tabulated in the table below.

Table 6.11 - Recommended Noise Goals (dB(A) re: 20×10^{-6} Pa)

Noise Goals	Sound Pressure Levels (dB(A))	
	Day (7.00am–6.00pm)	Evening (6.00pm–10.00pm)
5 Sandham Road (R1)		
Construction (L_{A10})	43	41
Stage Preparation (L_{A10})	53	51
Mining Operations (L_{Aeq})	38	36
Train Loading (L_{Aeq})	38	36

Table 6.11 - Recommended Noise Goals (dB(A) re: 20 x 10⁻⁶ Pa)

Noise Goals	Sound Pressure Levels (dB(A))	
	Day (7.00am–6.00pm)	Evening (6.00pm–10.00pm)
Train Passby (L _{Aeq,24hour})		60
Train Passby (L _{Amax})		85
Sandham Road (R2) – opposite railway station		
Construction (L _{A10})	42	40
Stage Preparation (L _{A10})	52	50
Mining Operations (L _{Aeq})	37	35
Train Loading (L _{Aeq})	37	35
Train Passby (L _{Aeq,24hour})		60
Train Passby (L _{Amax})		85
Blue Mountains National Park		
Mining Operations (L _{Aeq})		50-55

For the purposes of assessing noise levels at residences, the noise is assessed at the most affected point on or within the residential property boundary or, if this is more than 30 m from the residence, at the most affected point within 30 m of the residence (EPA, INP ^{Section 2.2.1}). When assessing noise levels at passive and active recreation areas, the noise level is to be assessed at the most affected point within 50 m of the area boundary (EPA, INP ^{Section 2.2.1 NOTES}).

6.3.4 Site Plant And Equipment

Noise emissions from the proposal have been modelled and assessed in terms of continuous noise from the fixed and mobile plant, haul truck movements, conveyors and train loading operations.

Construction

The main plant of acoustical significance associated with the construction activities would consist of a dozer, excavator, front end loaders, grader, vibratory roller, truck mounted boring machine, haul trucks, water cart, crane, concrete trucks, generator, grader, and compressor. For the assessment of noise emissions from the plant and equipment, sound pressure levels have been established from site attended audit measurements, published data and discussions with the proponent (see **Appendix G**).

Mine Operations

Prior to commencing each mining stage dozers, front-end loader and trucks will be utilized to establish the required bunding for the purpose of noise mitigation. The sound power levels summarised in Table 6.12 were adopted for the purposes of assessing noise during the stage preparation and construction of noise bunds.

The main plant of acoustical significance operated on the mine site would consist of 1-2 dozers, front-end loaders, haul trucks, generator, crusher and conveyors. For the assessment of noise emissions from this plant, the following sound power levels (Table 6.12) have been established from site attended audit measurements.

Table 6.12 - Mine Plant Sound Power Levels (dB(A) re: 10⁻¹² Watts)

Plant Description	Sound Power Level (dB(A) re: 10 ⁻¹² Watts)								
	dB(A)	63	125	250	500	1k	2k	4k	8k
Dozer (Komatsu D375A)	112	111	113	109	108	107	104	100	93
FEL (Volvo L150C)	105	115	109	106	100	96	99	90	81
50tn Haul Truck (CAT 969C)	108	110	105	99	102	103	103	96	92
Generator	106	103	102	96	105	102	99	94	92
Crusher*	106	114	108	104	104	100	99	96	90
Conveyor (1) Drive – 30kW	85	69	74	76	79	82	77	71	58
Conveyor (1) Belt – 70m	96	79	85	87	90	93	88	82	69

* - crusher located below ground in a 'room' excavated within bedrock, with an opening facing nominally north (R. Smith)

Train Loading Operations

It is expected that train-loading operations would have a duration of forty-five minutes to one hour. For the purposes of assessing noise from train loading operations the sound power levels of typical equipment have been established from site attended audit measurements and published data, and are presented in Table 6.13.

Train loading operations involving the use of a front end loader, conveyors, surge bin and Class 81 locomotives were assessed with all mine plant and equipment operating under normal extraction presenting a worst case scenario.

In terms of train movements on the main rail line, the train noise was assessed in terms of a maximum passby noise level, and a $L_{Aeq,24hour}$ taking into account existing train activities and additional train activities as a result of the proposal. Information available at the time of the assessment projected a maximum of two trains being loading within any twenty four hour period, with a maximum of seven trains per week. However it is considered unlikely that more than one train will be loaded on any one day within the first nine years of extraction.

Table 6.13 - Train Loading Sound Power Levels (dB(A) re: 10⁻¹² Watts)

Item Description	Sound Power Level (dB(A) re: 10 ⁻¹² Watts)								
	dB(A)	63	125	250	500	1k	2k	4k	8k
Surge Bin	112	98	100	104	102	104	108	105	92
Class 81 Locomotive*	114	106	99	99	105	107	110	106	100
Conveyor (2) Drive – 200kW	93	77	82	84	87	90	85	79	66
Conveyor (2) Belt – 400m	104	89	94	96	98	101	97	93	78
FEL (Volvo L150C)	105	115	109	106	100	96	99	90	81

* at Notch 3 power setting

Information provided by FreightCorp has identified that between two (2) and three (3) Class 81 (3000hp – diesel/electric) locomotives would be used for rail transportation of the ore. It is understood that a train may be loaded with two (2) locomotives operating at a power setting of Notch 2 to 3. The noise modelling predictions for train loading has assumed this operational situation.

Previous studies (James Heddle Acoustical Consultants) of Class 81 Locomotives have been conducted and train noise levels recorded. These measurements were used

and adjusted to account for a power setting of Notch 3 for the locomotives and sixty (60) wagons, providing an SEL of Lw111dB(A).

6.3.5 Site Noise Emissions

Noise emissions from the site operations were modelled with the EPA approved Environmental Noise Model (ENM) computer model using the EPA, INP^(Section 5.3.1) guidelines for assessment under varying wind conditions.

The meteorological scenarios modelled are:

- ☐ Calm: no wind, relative humidity of 70%, and air temperature of 18°C;
- ☐ West wind: 3m/sec west wind (270°), relative humidity of 70%, and air temperature of 18°C.

Construction

The predicted noise emissions for the construction activities show that recommended noise goals are satisfied at the reference assessment locations during construction works. The results of the modelling are presented in the table below.

Table 6.14 - Predicted Construction Noise Levels - LA10 dB(A) re: 20 x 10⁻⁶ Pa

Reference Location	Predicted Noise Level dB(A)	
	Stage 1	Stage 2
5 Sandham Road (R1)	42	40
Sandham Road (R2)	42	41

Mine Operations

The mine development stages considered in the noise modelling included:

- Stage 1:** Before any substantial worked faces are established, removal of vegetation, erection of infrastructure, pit depth of RL 1020.
- Stage 2:** Four (4) benches have been formed with elevations of RL 1053, RL 1044, RL 1035 and RL 1020 respectively.
- Stage 3:** Further bench established, five (5) benches with elevations of RL 1053, RL 1044, RL 1035, RL 1026, and RL 1020.
- Stage 4:** Pit widened significantly with three (3) large benches of RL 1008, RL 999 and RL 993; and four small benches of RL 1017, RL 1026, RL 1035, RL 1044 and RL 1053 respectively.
- Stage 5:** Pit is doubled in size with seven (7) benches of RL 993, RL 999, RL 1008, RL 1017, RL 1026, RL 1035 and RL 1044 respectively.
- Stage 6:** Pit increased in depth and extended further south, one (1) main bench forming base of pit RL 993.

The above scenarios generally cover the situations envisaged throughout the life of the mine. They were selected to present the range of activities, situations and noise levels likely to be emitted from the site.

During initial establishment of the mine stages (Stages 1 to 6) equipment will be located on the existing ground surface for short term periods, before any substantial bunds or working faces are established. This situation will result in the emission of higher noise levels in the short-term. In order to minimise potential noise impacts associated with these activities, it is proposed to stockpile the striped overburden and topsoil, and form a bund approximately 3 to 4 metres high along the southern and western mine boundaries during Stages 1 to 6.

Normal mine extraction was modelled on the assumption that up to two (2) metres of soil and overburden had been removed from the existing ground level within the mine area and a earth bund of a height not less than three (3) metres had been constructed at the perimeter of the stage to the south and west. Additional noise levels have been predicted for extraction at the base of the finished bench level of each stage.

The assessment was based on the assumption that all the fixed and mobile plant was operating simultaneously. Whilst this working situation will not occur all of the time, for the purpose of the noise assessment the worst case scenario has been presented. A review of the production schedule for the mine identified that more than one (1) dozer would be required from Stage 3 to Stage 6 inclusive. Specifically from Year 5 (approximately Stage 3) 1.1 dozers would be required, increasing to 1.7 dozers for Years 11-20 (Stages 5 and 6), equating to 10% use of an additional dozer during Stage 3 increasing to 70% use during Stages 5 and 6. The assessment has considered the continuous operation of two (2) dozers for Stage 3 through to Stage 6.

Table 6.15, 6.16 and 6.17 present a summary of the predicted noise levels at the reference assessment locations for each stage of operations and under various meteorological scenarios during initial stage establishment, normal mine extraction and base of bench level. Predicted noise levels with the operation of an additional dozer are presented in parenthesis. Results have been rounded for presentation purposes, that is 0.1 to 0.4 were rounded down to the nearest dB(A), whilst 0.5 to 0.9 were rounded up to the nearest dB(A).

Table 6.15 - Predicted Noise Levels: Mine Operations –Mine Stage Establishment - (L_{A10} dB(A) re: 20×10^{-6} Pa)

Meteorological Scenario	Predicted Noise Level dB(A)					
	Stage 1	Stage 2	Stage 3	Stage 4	Stage 5	Stage 6
5 Sandham Road (R1)						
Calm	33	35	39 (41)	36 (39)	37 (39)	35 (37)
West Wind	26	33	37 (39)	32 (34)	32 (34)	30 (32)
Sandham Road (R2)						
Calm	36	39	41 (44)	41 (44)	55 (57)	53 (55)
West Wind	34	39	42 (44)	41 (43)	52 (54)	50 (52)

NOTE: Exceedance of recommended goal presented in BOLD
Level in parenthesis represents two dozers operating

Table 6.16 - Predicted Noise Levels: Mine Operations – Normal Mine Extraction
(L_{Aeq} dB(A) re: 20×10^{-6} Pa)

Meteorological Scenario	Predicted Noise Level dB(A)					
	Stage 1	Stage 2	Stage 3	Stage 4	Stage 5	Stage 6
5 Sandham Road (R1)						
Calm	32	34	34 (36)	35 (37)	36 (38)	35 (37)
West Wind	29	32	33 (34)	33 (35)	31 (33)	31 (32)
Sandham Road (R2)						
Calm	35	36	36 (38)	36 (37)	45 (48)	48 (52)
West Wind	33	36	36 (38)	36 (37)	43 (46)	45 (48)

NOTE: Exceedance of recommended goal presented in BOLD
Level in parenthesis represents two dozers operating

The results of the noise modelling for six (6) stages during calm meteorological conditions and normal extraction activities with two dozers operating are presented as noise contours in **Figure 6.5** to **Figure 6.10**.

Table 6.17 - Predicted Noise Levels: Mine Operations – Base of Bench
(L_{Aeq} dB(A) re: 20×10^{-6} Pa)

Meteorological Scenario	Predicted Noise Level dB(A)					
	Stage 1	Stage 2	Stage 3	Stage 4	Stage 5	Stage 6
5 Sandham Road (R1)						
Calm	27	33	32 (34)	32 (34)	35 (37)	28 (29)
West Wind	24	31	30 (32)	30 (31)	32 (34)	25 (26)
Sandham Road (R2)						
Calm	28	34	34 (35)	32 (33)	40 (42)	31 (32)
West Wind	27	34	34 (35)	32 (33)	38 (40)	29 (30)

NOTE: Exceedance of recommended goal presented in BOLD
Level in parenthesis represents two dozers operating

The noise predictions presented in **Table 6.15** show that during initial stage establishment the recommended goals are satisfied at 5 Sandham Road (R1). The predictions has shown exceedances of 3-5 dB(A) (Stage 5-calm), 2 dB(A) (Stage 5-west wind) and 1-3 dB(A) (Stage 6-calm) occur at Sandham Road (R2).

The noise predictions presented in **Table 6.16** show that under normal extraction activities and both calm and west wind meteorological conditions the recommended noise goals are satisfied for all Stages at 5 Sandham Road (R1). The results also show that the recommended noise goals are generally satisfied for Stages 1-4 (approximately 9 years of mining activity) at Sandham Road (R2) during both calm and west wind meteorological conditions. The results show that during Stage 5 noise exceedances of 8-11 dB(A) (calm) and 6-9 dB(A) (west wind), and during Stage 6 of 11-15 dB(A) (calm) and 8-11 dB(A) (west wind) are predicted.

The noise predictions in **Table 6.17** show that during the conclusion of extraction for all stages, the recommended goals are satisfied at 5 Sandham Road (R1). During Stage 5 noise exceedances of 3-5 dB(A) (calm) and 1-3 dB(A) (west wind) are predicted.

6.3.6 Train Loading Operations

Train loading operations have been considered with all mine plant operating under normal extraction activities. While this situation may not occur all of the time it represents a worst case prediction. A summary of the predicted noise levels during each stage of development and under varying meteorological conditions, are presented in **Table 6.18**.

The predicted noise levels (**Table 6.18**) show that the recommended goal is generally satisfied during all stages at 5 Sandham Road (R1). The Exceedance of 1dB(A) during Stage 5 (calm) with two (2) dozers operating is considered marginal. At Sandham Road (R2) the results have shown a marginal noise exceedance of 1-2dB(A) (Stage 3 – calm and west wind) and 1dB(A) (Stage 4 – calm and west wind) respectively. During Stage 5 an exceedances of 8-11dB(A) (calm) and 6-9dB(A) (west wind) were predicted; whilst Stage 6 predicted an exceedance of 11-14dB(A) (calm) and 8-11dB(A) (west wind).

Table 6.18 - Predicted Noise Levels: Train Loading and Normal Operation
L_{Aeq} dB(A) re: 20 x 10⁻⁶ Pa

Meteorological Scenario	Predicted Noise Level dB(A)					
	Stage 1	Stage 2	Stage 3	Stage 4	Stage 5	Stage 6
5 Sandham Road (R1)						
Calm	33	35	35 (37)	36 (37)	37 (39)	36 (38)
West Wind	32	34	34 (35)	34 (36)	33 (34)	33 (34)
Sandham Road (R2)						
Calm	35	37	37 (38)	37 (38)	45 (48)	48 (51)
West Wind	35	37	37 (39)	37 (38)	43 (46)	45 (48)9

NOTE: Exceedance of recommended goal presented in BOLD
Level in parenthesis represents two dozers operating

6.3.7 Train Movements

The maximum noise levels for a train passby (Class 81 Locomotive) set to Notch 3 power setting at the entrance to the rail loop for the receiver identified as 5 Sandham Road (R1), and the main western rail line for the receiver identified as Sandham Road (R2) were predicted. A summary of the predicted maximum passby noise levels are presented in **Table 6.19**.

Table 6.19 - Predicted Train Passby Noise Levels (Class 81 Locomotive)
(L_{Amax} dB(A) re: 20 x 10⁻⁶ Pa)

Reference Location	Predicted Noise Level dB(A)	
	Facade	Within 30m of Dwelling
5 Sandham Road (R1)	77	81
Sandham Road (R2)	78	80

Taking account of the projected maximum of two (2) trains in a twenty four (24) hour period (Section 5.2), a maximum of seven (7) trains per week, and the measured SEL noise levels of train passbys (**Table 6.8**), **Table 6.20** provides a summary of the existing and projected rail movements, and calculated existing and predicted L_{Aeq, 24hour} noise levels.

Table 6.20 - Predicted Train Noise Levels ($L_{Aeq,24hour}$) (dB(A) re: 20×10^{-6} Pa)

Reference Location	Existing Daily Rail Movements	Projected Daily Rail Movements	Existing $L_{Aeq,24hour}$	Predicted $L_{Aeq,24hour}$	Increase dB(A)
5 Sandham Road (R1)	25 ^(c) 20 ^(f)	25 ^(c) 22 ^(f)	54.9	55.4	+0.5
Sandham Road (R2)	25 ^(c) 20 ^(f)	25 ^(c) 22 ^(f)	55.6	56.0	+0.4

NOTE: (F) Freight Train – indicative provided by RailAccess Corporation
(C) Commuter Train – provided by CityRail

The calculated noise levels for the additional rail movements projected for the proposal satisfy the recommended goal of $L_{Aeq, 24hour}$ 60dB(A).

6.3.8 Assessment

The results of the predictions associated with noise emissions from construction activities has shown that the recommended noise goals are satisfied at the reference assessment locations during both Stage 1 and Stage 2 construction works.

The assessment has shown that during the short term activities associated with initial stage establishment, noise exceedances will occur during Stage 5 and Stage 6 works at the reference location identified as Sandham Road (R2).

Similarly the assessment has shown that noise exceedance during mine extraction and train loading activities will occur during Stage 5 and Stage 6 at Sandham Road (R2) with marginal exceedances of 1-2 dB(A) predicted for worst case scenario during Stage 3 and Stage 4 respectively. It is understood that Stages 1 to 4 represent more than nine (9) years into the development of the mine.

The assessment has also shown that predicted noise levels associated with rail movements on the main rail line satisfy the recommended L_{Amax} noise level of 85dB(A) and the recommended $L_{Aeq, 24hour}$ noise level of 60dB(A) when assessed to 5 Sandham Road (R1) and Sandham Road (R2).

With respect to the Blue Mountains National Park and World Heritage Area to the east, the assessment has shown under normal extraction operations, the recommended noise goal of 55dB(A) will be achieved within fifty (50) metres of the common boundary.

6.3.9 Findings and Recommendations

The results of noise predictions associated with the construction and development of the proposed mine has shown that the recommended noise goals are satisfied at the reference assessment locations.

Noise modelling has shown that during stage preparations involving the construction of bunds for noise control, the recommended goals are satisfied at 5 Sandham Road (R1). Noise exceedances of 3-5dB(A) (Stage 5-calm), 2dB(A) (Stage 5-west wind) and 1-3dB(A) (Stage 6-calm) are predicted at Sandham Road (R2).

Noise modelling for normal mining activities during calm and west wind meteorological conditions has shown that the recommended noise goals are satisfied for all stages at 5 Sandham Road (R1). The modelling has also shown that the recommended noise goals are generally satisfied for Stages 1-4 (approximately 9 years of mining activity) at Sandham Road (R2) during both calm and west wind meteorological conditions. Predicted 1dB(A) exceedance during Stage 4 with two dozers operating is considered marginal. During Stage 5 exceedances of 8-11dB(A) (calm) and 6-9dB(A) (west wind), and during Stage 6 of 11-15dB(A) (calm) and 8-11dB(A) (west wind) are predicted.

Noise predictions during the final extraction for all stages, has shown that the recommended goals are satisfied at 5 Sandham Road (R1). During Stage 5 noise exceedances of 3-5dB(A) (calm) and 1-3dB(A) (west wind) are predicted at Sandham Road (R2).

The assessment has shown that Stages 1 to 4, that is the first nine years of an estimated twenty-one year lifespan of the mine generally comply with the recommended noise goals. The technical exceedances of 1-2dB(A) are considered marginal. The proponent (Newnes Kaolin Pty Ltd) has consulted with the local community comprising six residential premises on Sandham Road, and discussed potential mitigation strategies including purchase. These strategies will be executed if:

- ☐ the owner believes he or she is adversely affected by noise from the proposal; and
- ☐ noise level measurements confirm the recommended goals are exceeded.

The assessment has indicated that although noise exceedances are anticipated in the later stages of the mine development, the affected residences will be given the opportunity to negotiate the sale of their property if the two conditions presented above are confirmed. Additionally the proponent has indicated the potential of a 'peppercorn' lease back arrangement, whereby the occupant may remain within the dwelling for a nominal rent for the duration of the mining activities. With the implementation of the proposed negotiated agreements for affected properties, the operation of the mine will be technically compliant with the recommended assessment goals throughout the twenty-one year life of the mine.

With respect to the Blue Mountains National Park, the assessment has shown under normal mining operations, the recommended noise goal of 55dB(A) is satisfied within fifty metres of the park boundary.

With respect to the cumulative noise during train loading operations the assessment has shown that the recommended noise goal is satisfied during all stages at 5 Sandham Road (R1). At Sandham Road (R2) the results have shown a marginal noise exceedance of 0.2 dB(A) (Stage 3) and 0.4 dB(A) (Stage 4) respectively. During

Stage 5 an exceedance of 8.3 dB(A) was predicted, whilst Stage 6 predicted an exceedance of 11.6 dB(A) (calm) and 7.9 dB(A) (west wind). The noise increase resulting from train loading activities (generally 1-2 dB(A)) would normally be considered marginal.

The assessment has shown that predicted noise levels associated with rail movements on the main rail line satisfy the recommended L_{Amax} noise level of 85 dB(A) and the recommended $L_{Aeq\ 24hour}$ noise level of 60 dB(A).

Noise Control Recommendations

To minimise noise emissions from the operations the following recommendations are made:

- ☐ to minimise the degree of noise generated during the construction activities, it is recommended that as part of the contractors undertaking that an “Construction Noise Management Plan” (CNMP), be prepared to address the issue of construction noise;
- ☐ all construction activities shall only take place between the hours of 7.00am – 6.00pm Monday to Friday, and 7.00am-1.00pm Saturday;
- ☐ the tree mulcher shall be located as far as practicable within the valley located adjacent the northern boundary of the lease area;
- ☐ all construction site plant and equipment shall satisfy the acoustic performance specified in Appendix G;
- ☐ all loading and building conveyor systems shall be belt type conveyors;
- ☐ all permanent site plant and equipment shall satisfy the acoustic performance specified in Appendix G;
- ☐ where practical all permanent site mobile plant shall be fitted with secondary/residential grade noise controls and acoustic treated engine enclosures;
- ☐ where practical audible alarms shall be replaced with flashing lights or a similar warning system;

6.3.10 Conclusion

The results of ambient noise monitoring and environmental noise audits conducted in the area have confirmed that the existing ambient noise is typically rural and influenced by road traffic on the Bells Line of Road, rail traffic, local domestic, existing colliery and Rocla quarry operations and natural elements such as wind, birds, animals, etc.

The finding of the prediction of noise emissions associated with construction activities has shown with appropriate selection of plant and equipment, restriction of

construction hours, and preparation of a CNMP the recommended assessment goals can be achieved.

The findings of the noise modelling for the proposal have shown that with appropriate selection of equipment, effective noise controls and management procedures, noise from the mine under normal extraction operations and train loading operations can be controlled to generally satisfy the daytime assessment goals under calm and west wind meteorological conditions for Stages 1 to 4. That is for the first nine years of an estimated twenty-one year lifespan of the mine when assessed to 5 Sandham Road (R1) and Sandham Road (R2). It is anticipated that an approval for the mine will include conditions relating to any predicted noise exceedances. The proponent is confident that any exceedances identified during the latter stages of the mine development will be able to be negotiated.

With respect to the Blue Mountains National Park to the east, the assessment has shown under normal extraction operations, the recommended noise goal of 55 dB(A) is achieved within fifty metres of the common boundary.

The assessment also found the predicted noise levels associated with rail movements on the main rail line satisfy the recommended L_{Amax} noise level of 85 dB(A) and the recommended $L_{Aeq\ 24hour}$ noise level of 60 dB(A).

Based on the findings of the assessment and as part of the Noise Management Plan for the proposal it is recommended that noise monitoring be conducted during initial stages of mine development to confirm the above findings and establish the practicability of additional noise controls where required.

6.4 Hydrology and Water Quality

Water management and pollution control systems for the proposed mine have been investigated in detail. In essence, the proposed system provides for the containment of storm runoff within inlet ponds and sumps designed to contain all runoff from a 1 in 50 year, 72 hour storm event. Stored water would be used for dust suppression purposes with any excess water treated within a purpose built treatment plant prior to discharge. The discharge quality will need to meet stringent guidelines to ensure that downstream water quality impacts are avoided.

The following sections detail existing surface and groundwater quality (Section 6.4.1), surrounding hydrological systems (Section 6.4.2), proposed pollution control systems (Sections 6.4.3 to 6.4.5) and details of the treatment plant required (Section 6.4.6). Proposed internal drainage systems and water management structures are also shown on **Figures 3.2 to 3.8**. These figures show how the water management system changes as the quarry develops.

An important component of the water management system is the control of sediment within the quarry area. These matters are described in Section 6.4.7. Groundwater issues also form part of the water management system and these are discussed in detail in Section 6.4.8 while the full consultants report is provided as Appendix H.

6.4.1 Water Quality

Water quality within the upper reaches of the Wollangambe River into which the site waters flow is primarily controlled by runoff from:

- ☐ vacant Crown Land;
- ☐ industrial areas within the catchment, including Clarence Colliery and Rocla Quarry. These sites have controlled discharges into the Wollangambe system and water management systems in place to minimise their impact;
- ☐ the Main Western Railway at the top of the ridge;
- ☐ the township of Newnes Junction including dirt roads, septic systems and cleared areas.

Existing water quality in the Wollangambe River is generally good, naturally low in pH (4.5 – 5.5), iron, manganese and suspended solids, as shown in **Table 6.21**, while expected groundwater inflows into the pit are shown on **Table 6.22**.

Water quality guidelines relevant to this project include:

- ☐ Australian and New Zealand for Fresh and Marine Water Quality (ANZECC, 2000); and
- ☐ Schedule 2 of the Clean Waters Act 1970 (now incorporated into Part 3 of Schedule 5 of the Protection of the Environment Operations Act 1997).

Table 6.21 – Background Water Quality

Parameter	Upstream of Newnes Kaolin	Downstream of Newnes Kaolin
Acidity		
to pH 3.7 (as CaCO ₃) mg/L	<1	<1
to pH 8.3 (as CaCO ₃) mg/L	4	4
Alkalinity		
CO ₃ (as CaCO ₃) mg/L	<1	<1
HCO ₃ (as CaCO ₃) mg/L	2	2
OH (as CaCO ₃) mg/L	<1	<1
Calcium mg/L	1.3	0.8
Chloride mg/L	9.0	6.0
Specific Conductance uS/cm	31	27
Iron (total) mg/L	0.06	0.39
Iron (filterable) mg/L	<0.05	<0.05
Potassium mg/L	0.9	1.4
Langelier Saturation	-6.7	-6.9
Magnesium mg/L	0.7	0.4
Manganese (total) mg/L	<0.05	<0.05
Manganese (filterable) mg/L	<0.05	<0.05
Sodium mg/L	4.8	2.9
PH	4.5	4.5
Total Sulfur as SO ₄ mg/L	3.7	2.3
Total Dissolved Solids mg/L	20	15
Total Hardness (as CaCO ₃) mg/L	6.1	3.6

Total Suspended Solids mg/L	<1	3

Table 6-22 – Expected Groundwater Quality

Parameter	Ponded Groundwater Sample 1	Ponded Groundwater Sample 2	Fresh Groundwater
ACIDITY			
to pH 3.7 (as CaCO ₃) mg/l	<1	<1	<1
to pH 8.3 (as CaCO ₃) mg/l	<1	4	20
ALKALINITY			
CO ₃ (as CaCO ₃) mg/l	4	<1	<1
HCO ₃ (as CaCO ₃) mg/l	17	6	6
OH (as CaCO ₃) mg/l	<1	<1	<1
Calcium mg/l	5.0	1.9	1.9
Chloride mg/l	11.0	11.0	10.0
Specific Conductance uS/cm	60	30	35
Iron (filterable) mg/l	<0.05	<0.05	<0.05
Potassium mg/l	1.5	1.4	0.9
Langelier Saturation	-0.4	-5.3	-6.0
Magnesium mg/l	0.7	0.4	1.1
Manganese mg/l	0.11	0.09	0.06
Sodium mg/l	9.0	3.7	5.4
pH	9.2	5.3	4.6
Total Sulfur as SO ₄ mg/l	3.6	1.8	8.7
Total Dissolved Solids mg/l	40	20	20
Total Hardness (as CaCO ₃) mg/l	15.5	6.6	9.2
Total Suspended Solids mg/l	10	27	1350

6.4.2 Surface Water Hydrology

The key objective of the water quality and erosion and sediment control system is to prevent sediment loss and protect the water quality of the local area. Water management and erosion control on site is a key issue given that the site is located within the Wollangambe River catchment that flows into the Blue Mountains National Park and World Heritage Area.

There are no major permanent watercourses through the site, however two minor ephemeral creeks occur on the site, as shown on **Figure 6.11**. Both of these creeks form part of the upper tributaries of the Wollangambe River, which flows into the Colo River.

The Wollangambe River and the Colo River have both been recognised as “wild and scenic” rivers under section 61 of the *National Parks and Wildlife Act, 1974*. These rivers are important in that they are of significant conservation value, and are popular recreational areas.

The waters into which the proposed mine site discharges are classified as Class P Protected Waters. The water quality of controlled mine discharges would need to meet a suspended solids standard of 15 mg/L – ie. sensitive water standards according to current ANZECC guidelines. There would also need to be a dilution factor of 19:1 – ie. such discharge cannot raise background suspended solids levels by more than 1.5 mg/L.

In order to protect the local water and soil resources in the area a comprehensive Soil and Water Management Plan will be prepared for the project following approval, as required by the DLWC. This plan will address in further detail all aspects of soil disturbance, storage and movement, retention of any mobilised sediments and water management on and off the site.

To protect the surface waters of the surrounding areas, and in particular those of the adjacent National Park and World Heritage Area, numerous water quality and erosion and sedimentation control measures will be incorporated into the mine design as outlined below.

6.4.3 Surface Water Management

A primary objective of the water management plan is the separation of clean and dirty water systems. Clean water will be diverted around the disturbed areas and allowed to flow into the natural drainage system. Dirty water will be contained on site and treated before controlled discharge off site.

There are two key disturbed areas to be controlled. The first contains the mine and internal access roads from the in-pit crusher to the various mine benches. The second consists of the stockpile and infrastructure areas.

The water management system has been designed to contain runoff from a 1 in 50 year, 72 hour storm event. This will ensure the maximum level of safety for the Wollangambe River by providing zero discharge of untreated water during such events. Water will be treated prior to discharge to the natural waterways.

6.4.4 Hydrologic Basis for Management of Surface Waters

The intensity of various duration and Average Recurrence Interval (ARI) storms at the Newnes Junction site would be similar to those that can be estimated from standard intensity-frequency-duration (IFD) methods as outlined in Australian Rainfall and Runoff. From the IFD data, the estimated rainfall intensities (in mm/hour) and total rainfall (in mm) for the Newnes Kaolin site are presented for various years and storm durations in **Table 6.23**. A conservative runoff coefficient of 0.8 has been used.

Table 6.23 – Estimated Rainfall Intensities and Volumes

Mine Stage	Average Return Interval (years)	Duration (hours)	Rainfall Intensity (mm/hr)	Total Rainfall (mm)	Area disturbed (ha)	Total volume of water to be stored ¹ (ML)
Stage 1	10	2	24.72	49.44	0.75	0.3
Stage 1	50	72	3.88	279.36	0.75	1.7
Stage 2	10	2	24.72	49.44	4.25	1.7
Stage 2	50	72	3.88	279.36	4.25	9.5
Stage 3	10	2	24.72	49.44	5.5	2.2
Stage 3	50	72	3.88	279.36	5.5	12.3
Stage 4	10	2	24.72	49.44	10.75	4.3
Stage 4	50	72	3.88	279.36	10.75	24.0
Stage 5	10	2	24.72	49.44	21.5	8.5
Stage 5	50	72	3.88	279.36	21.5	48.1
Stage 6	10	2	24.72	49.44	25.5	10.1
Stage 6	20	72	3.36	241.92	25.5	49.4
Stage 6	50	72	3.88	279.36	25.5	57.0

1 – Runoff coefficient of 0.8 has been used

6.4.5 Sediment and Surface Water Control

It is recognised that it is generally higher intensity, shorter duration storms that provide the major part of any exported suspended sediment load from a dirty or erodible area. However, it is also acknowledged that sediment loads carried by longer duration, lower intensity storms must be treated as well.

Site runoff management facilities have been designed to fully contain and treat all the 50 year ARI, 72 hour storm event. This storm event represents a considerable volume of water, as shown in the table above.

The surface water control plan has been based on:

- ☐ completely capturing site runoff in a 1 in 50 year, 72 hour storm event;
- ☐ detaining the runoff in sediment dams within the open cut void; and
- ☐ treating the runoff before discharging water of a suitable quality into an ephemeral creekline on site that will direct water into the Wollangambe River.

To control stormwater within the quarry area, the catchment area flowing into the quarry will be minimised to limit the water make in the area. Clean water diversion channels will be constructed up slope of disturbed areas to divert clean water away from disturbed areas. These channels will be established at the commencement of construction activities.

Dirty water from the stockpile and infrastructure area will be limited as far as possible. The stockpile area will be covered and water from the roof of the stockpile will be clean. This water will either be stored for potable supply or discharged into the dirty water systems. Any areas, such as around the office, which will generate clean runoff will be directed to the natural water system. Dirty water that is generated

in these areas will be directed into the open cut pit and water treatment plant for treatment.

The volume of the sediment control structures required will vary as the mine progressively disturbs a greater area. Proposed internal drainage systems and water management structures are shown on **Figures 3.2 to 3.8**. These figures show how the water management system changes as the quarry develops. During the first 3 stages of the mine's development, stormwater flows will be contained in:

- ❑ The void created by the initial Stage 1 development will include a large sedimentation pond that will readily contain the 1 in 50 year, 72 hour storm event for Stages 1-3 of the project. This void will be capable of containing well in excess of the volumes required.
- ❑ Smaller sumps that will be constructed on each working bench to treat the sediment laden water prior to discharge into the larger sedimentation pond.

As the mine develops further, additional sedimentation sumps will be constructed on each working bench. These sedimentation sumps will be used to treat stormwater flows generated on working benches during Stages 4, 5 and 6. These will ensure that short-duration storms are contained and solids loading reduced prior to passing into the main pollution control ponds for treatment prior to discharge.

For large storm events, water will be stored in the base of the pit. During Stages 1 to 3, the storage area will be the void constructed during Stage 1, which will hold a volume well in excess of the 1 in 50 year storm event. During Stages 4, 5 and 6, water volumes greater than the 1 in 50 year storm event will be contained within the floor of the lowest bench of the mine. This area will contain a number of sediment dams (or equivalent) that will contain the majority of smaller storm events. During large storms, such as the 1 in 50 year 72 hour storm event, water will be stored in the base of the mine.

Once a rainfall event has stopped, water in the sediment control structures will be treated to ensure the water is within EPA limits. Once water quality is suitable, treated waters will be discharged to the ephemeral creek line that drains to the Wollangambe River. The discharge will consist of a pipe fitted with a valve that will be locked at all times excepting when treated water is discharging.

6.4.6 Water Treatment

There will be two main forms of treatment, mechanical and chemical. The primary mechanical method will be use of sediment control ponds, particularly those located within the advancing pit. These will both slow the water as well as settle the larger sand particles. The slowest settling, most mobile particles in the runoff from the mine area will be those that consist of the finest kaolin clays, and therefore the most valuable material on site. Given that the quality of treated water to be discharged to the National Park must be very high, and that the kaolin product is a valuable part of the Newnes resource, chemical treatment of sediment laden water will be carried out before any discharge to the National Park.

A treatment plant will be installed which will include several separate processes. The processes will include flocculation to remove the finer clays with additional chemical treatment to remove slightly elevated manganese levels. This later process will include pH adjustment, addition of an oxidising agent such as potassium permanganate followed by filtration to remove the collected material. The processing plant will be fully automated for both start up and operation. The location of the treatment plant is shown on **Figures 3.2 to 3.7**. The plant will be relocated in the early stages as the mine develops, however, the plant capacity (in the order of 1 ML per day) will remain constant.

There are two processes used to chemically remove suspended solids from waste water, namely coagulation or flocculation. In general, turbid raw waters contain suspended matter – both settleable solids, particles large enough to settle on standing, and dispersed solids, particles that will not readily settle. A significant proportion of these non-settleable particles are colloidal. Each particle is stabilised by negative electrical charges on its surface, causing it to repel neighbouring particles. Since this prevents these charged particles from colliding to form larger settleable masses, they do not settle. Coagulants are positively charged, and they destabilise these colloids by neutralising the forces that keep them apart.

There are several types of coagulants available, however the primary selection criteria is the ability to bind completely with solids within the waste stream. When this occurs, all the coagulant is essentially used in the process and no material is lost by way of the discharge.

The material collected from the plant will be a non hazardous sludge of neutralised coagulant and clays. This will be disposed of in pit along with overburden and waste rock and ultimately form part of the rehabilitation program.

There is a range of coagulants available and flocculation trials will be undertaken to determine the most appropriate coagulant for the kaolin fines. A coagulant will be chosen to avoid ecological effect.

6.4.7 Erosion Control

Temporary Systems

The primary objective of the proposed erosion and sedimentary control systems is to safeguard against soil loss and consequently, control the risk of water quality impacts in the National Park downstream. The types of systems to be used are described below.

Prior to any construction work on site, including clearing of vegetation, soil stripping or access road construction, temporary erosion and sedimentation control structures will be put in place. Any exposed areas where erosion hazards exist will be controlled to avoid sedimentation impacts on downstream waterways.

Sedimentation Control Pond

A sedimentation control pond will be constructed to collect and contain sediment-laden runoff from disturbed areas prior to the major construction works. This pond will be constructed in the location of the in-pit sump that will be used for mining Stages 1-3.

Silt Fences

A series of parallel silt fences will be erected downstream of critical drainage locations where ground disturbance has occurred in order to contain sediment generated during construction and prior to the stabilisation of surfaces by revegetation works.

The filter fabric used in the silt fences will have a permeability coefficient of 0.02 m/s, allowing sufficient flow during minor storm events without water build up. Each fence will have a silt retention efficiency of at least 75%, however having the two fences in parallel will increase the overall retention efficiency.

Exposed Batters

Any batters required will be constructed to minimise exposed areas and consequent soil erosion. In addition, any disturbed loose batters will be topsoiled and revegetated as quickly as possible following disturbance. The batters will be stabilised with grasses to hold the topsoil on site.

If necessary, hydromulching will be used to protect underlying fill material from wind and water erosion, thereby minimising sediment loss. The hydromulching applications typically consist of straw, bitumen or polymer binder, seed and fertiliser. The value of the mulch application is that it provides instant protection of the surface soil from erosion and well as protecting seeds, improving water holding capacity and germination. Materials used in hydromulching are also biodegradable, decomposing to form an organic humus.

Disturbed batters that may require treatment include those on access roads and other construction areas. Since some of these surfaces may be relatively steep, the potential for erosion will be high. It will therefore be necessary to undertake revegetation works quickly in order to provide the necessary vegetation for surface stabilisation.

Drainage Culverts

Additional erosion and sedimentation control systems will be used during construction of drainage line crossings or other activities near drainage depressions. Silt traps will be constructed downstream of each crossing and will remain in place during the life of the mine or until subsumed into the mine pit.

Drainage beneath each crossing will be provided by a series of pre-cast concrete pipes if required. The combined cross-sectional area of the pipes will be sufficient to cater for all flows up to a 1 in 50 year, critical duration storm event.

Permanent Systems

In order to protect the soil and water resources of both the site and the adjacent areas, a number of key features will be built into the mine design. These will include diverting run-on water around the site, containing and treating dirty water on the site and rapidly rehabilitating the site as soon as areas become available.

Details regarding each of these are provided below.

Clean Water Diversion

The surface of the Newnes Plateau and the Newnes Kaolin Mine Site generally consists of permeable sandy soils with friable sandstone outcrops. While a certain proportion of the rainfall is absorbed into the sandy soil terrain, surface runoff does occur during heavy rainfall events so particular attention needs to be paid to site drainage and erosion control.

Clean water diversion channels will be constructed around the mine to prevent ingress of clean water into the pit area. This will minimise the amount of water needing to be contained, handled and treated on site.

Run-on water from upslope of the mine will be directed around the site and back into the same natural drainage channels lines which flow eastward into the Blue Mountains National Park. This will be achieved by installing diversion drains and banks upslope of the area to be disturbed by mining activities, as shown in **Figure 3.7**.

Containment and Treatment of Dirty Water

The silt fences and straw bales installed during construction works to reduce the sediment content of runoff from disturbed areas will be maintained as required during the mining operation. It is anticipated that these structures will be installed around access roads and infrastructure areas where necessary. These structures will be maintained to ensure that their capacity to contain sediment is not significantly reduced.

The sedimentation pond constructed in the early stages of the construction works will be enlarged to form a large in-pit sump as the mining progress to collect sediment-laden runoff from the mine site. This sump will be the key containment dam for the project.

The sump will be designed to allow the site to operate as a nil-discharge site for storm events of 1 in 50 years (72 hours) and less. It is proposed to apply for a discharge licence from the EPA to enable discharges of treated water to be made in-between storm events as needed. This will permit the storage capacity of the in-pit sump to be maintained at a reasonable level.

The stormwater collected will contain suspended clays that will contain a significant amount of high value kaolin product. It will be treated to remove the suspended material since this contains a significant amount of high value kaolin product both to protect the waters of the Blue Mountains National Park and to maximise clay recovery.

Discharges from the site would occur in a controlled manner once the water quality has been verified as meeting discharge requirements. Water treatment will be carried out to ensure that the water quality is suitable for discharge.

Treatment of the Opencut High-Walls

The opencut highwalls will be terraced (see **Figure 3.12** and **Figure 3.13**), retarding surface water flows within the pit and assisting with infiltration rates. In addition, the berms will be revegetated as rapidly as possible to further encourage water retention. Water collection on these berms will be directed to specific sections of the berm for discharge to the next bench. This will allow the safe discharge of the water down the batters, minimising the risk of long term erosion of the mine high wall.

As the benches are developed, water will flow from one bench to the next lower bench during rainfall events. To prevent the benches from accumulating water, concentrating it into low points and discharging in an uncontrolled fashion, the benches will be constructed to direct water into the wall, and the water will be directed to specific overflow points and discharged in a controlled fashion to the next bench (see **Figure 3.14**). This will prevent gully erosion occurring on the rehabilitated areas and the removal of topsoil resources and rehabilitating vegetation.

The batters between the berms will be constructed so they are vertical or near vertical to minimise the erosion risk on them. The nature of the sandstone in this area results in greater erosion of sloped sandstone batters versus vertical batters. This is related to the clay content in the sandstone causing rilling where water concentrates. The steeper the sandstone batters, the less erosion occurs over longer time periods, as evidenced on sites nearby which have exposed sandstone batters in similar material.

The berms will also be rehabilitated as soon as possible after mining. This early and progressive stabilisation and revegetation of the mine benches will minimise the disturbed areas exposed at any one time, limiting sediment movement generated on the site and increasing infiltration.

6.4.8 Groundwaters

An assessment of the hydrogeology of the Newnes Kaolin site and the potential hydraulic and water quality impacts of the proposed pit on the surrounding groundwater system was prepared by Dr F Kalf, of Kalf and Associates Pty Ltd. The main findings of the assessment are summarised in the following sections, and the full report is contained in **Appendix H**.

Groundwater through the proposed site occurs in both primary and secondary structures in the Triassic sandstone and is supplied entirely by infiltration and recharge to a shallow groundwater system in the upper sandstone. This aquifer system is distinct from additional much deeper aquifer zones beyond 100 m and 200 m or more within the coal measure strata.

Depth to the potentiometric surface over the site area could be expected to be at a depth from ground surface in the range less than 2 m to 25 m. These depths, however, are consistent with the emergence of seepages in the lower lying sections of the drainage gullies that cross the western boundary of the site.

In summary, the predominate groundwater flow occurs in an easterly to north-easterly direction with some groundwater flow being re-directed towards the Rocla Sand Quarry. Beyond the main western railway line groundwater would flow in a general south-westerly direction towards Dargans Creek.

Groundwater Quality

The groundwater quality from the shallow groundwater system in the area generally has low to moderate salinity. The groundwater currently being extracted from nearby bores would be similar to that which could be expected from groundwater inflow in the new pit, since all sites lie at a depth that is within the sandstone shallow groundwater flow system in the area.

Expected groundwater quality is shown on **Table 6.21**. This table shows that although ground water quality varies, it is predominantly very good with generally low salinity, low metals and soft. The pH varies but this is typical of soft water with low dissolved solids. Indeed, the material being mined at Newnes represents the edge of the shallow aquifer used for domestic water supply to Clarence Village as well as a commercial bottled drinking water company. Water quality, although excellent, has slightly elevated manganese, which will require removal to meet discharge quality criteria, as discussed in Section 6.4.6.

Impact Assessment

During the excavation of the proposed kaolin pit, the local watertable within the sandstone will be intersected, and as the pit is deepened, groundwater will flow towards the mined out voids. Based on existing data the total drawdown in the pit from the initial watertable level is likely to be in the range of 15 m to 25 m.

As groundwater flows into the pit the watertable will be lowered progressively around the periphery of the pit. The drawdown will migrate outwards from the pit until it reaches equilibrium. This will occur when rainfall recharge into the sandstone strata, within the created cone of drawdown depression, balances the inflow to the pit. Once equilibrium conditions are established further migration of the watertable drawdown will not occur once the final pit depth has been achieved.

The creation of a drawdown zone of influence will cause groundwater flow directions to be directed towards the pit. Outside of this zone of influence the groundwater flow directions will remain unaffected and unchanged from the pre-mining flow directions.

It is anticipated that the proposed pit will not have any hydraulic effect on the groundwater system within the Clarence Village.

Any significant drawdown influence will be restricted to within about 500 m or so from the pit under maximum development. Ultimate steady state conditions will be reached within a year or so once the 21-year pit floor depth has been achieved. Note however, that these are predicted maximum levels, and they will develop slowly to such levels over time as the mining progresses.

Drawdowns around the periphery of the pit will not affect vegetation since these species rely largely on soil moisture conditions. This is verified by the sound condition of tree species evident in the areas surrounding the existing Rocla Quarry where drawdown conditions occur.

The drawdown influence on the tributary streamflow will also be small. Some baseflow and surface water seepage will be lost to the easterly drainage gullies, but the volume would not be measurable in the lower reaches of the main draining tributaries. Any change would be well within the normal fluctuations created by climatic variations.

Final pit inflow is expected to average around 0.2 Ml/day, but the major proportion of this will be lost in evaporation from the high walls of the pit and storages within the floor of the pit. No groundwater would exit from the pit during active mining operations since the watertable gradient will be directed toward the pit.

Once mining ceases the mined out pits will fill with groundwater, rainfall and rainfall runoff. Filling will occur until a new equilibrium is established between the ponded water depth, evaporation and natural groundwater seepage. It would be expected that a new lake system would be finally established as regrowth occurs and natural seepage of good quality water re-enters the catchment area.

Groundwater Monitoring

At least three monitoring boreholes will be sunk in a westerly direction at increasing distances from the western boundary of the proposed pit. These holes will be established prior to commencement of mining to enable background water quality to be determined. The holes will be sunk to a minimum depth of 50 m and fitted with 50 mm slotted PVC and gravel filter and be completed as permanent observation holes with a surface concrete block and cap fitted in the usual manner. Water samples taken will be analysed for the major ionic constituents to establish baseline conditions for the active and post mining period.

Water level measurements will also be conducted initially on a monthly basis in each hole over time to establish seasonal trends and then at 3 monthly intervals to verify the impacts predicted.

6.5 Transportation Impacts

6.5.1 Existing Transportation Network

Road Network

The proposed mine site is located north of the Bells Line of Road, a major east-west transportation route linking the north west of Sydney with Lithgow and central NSW.

The other major road in the vicinity is the Great Western Highway, which provides access to sites north and south of the Bells Line of Road.

Annual traffic volumes travelling along the Bells Line of Road are shown in **Table 6.24**. The annual average daily traffic volumes along the Bells Line of Road are relatively stable during the years recorded.

Table 6.24 - Traffic Volumes in the Region

Monitoring Site	1996 AADT	1997 AADT	1998 AADT	1999 AADT	2000 AADT
[99.037] Bells Line of Road (Bell)*	N/A	3175	3200	3227	3181
[99.927] Bells Line of Road (Clarence)**	3301	N/A	N/A	3166	N/A

Source: RTA AADT figures, 2001

AADT = Average annual daily traffic, measured as axle pairs

* Traffic Count Station located on the Bells Line of Road, immediately west of the intersection with the road (unnamed) joining Bell and Mount Wilson. This is a permanent station, established in 1996 (1996 count not applicable).

** Traffic Count Station Located on the Bells Line of Road at Clarence, west of the Clarence Colliery access road. This is a temporary station.

6.5.2 Existing Access Arrangements

The site is joined to major route Bells Line of Road by a 2 km two lane, sealed road, used for access to Clarence Colliery and Kable Sands.

The section of Bells Line of Road immediately to the east and west of the site access road is a high standard highway, with sealed shoulders and regular stopping provisions, with 4 lanes in some sections. Heavy vehicles regularly use the road.

6.5.3 Expected Traffic Generation

During the construction phase of the project, a variety of road registered vehicles will be used to transport personnel, materials and equipment to and from the proposed mine site. Vehicles likely to be used during construction include:

- ☐ light personnel transportation vehicles;
- ☐ small concrete trucks;
- ☐ mobile crane;
- ☐ earthmoving equipment.

These vehicles will either be already located within the region, being owned by local contractors used during construction, or will enter the region via the Bells Line of Road before following the smaller access road to the construction site. A worst case scenario of 20 vehicles per day is anticipated at any one location along the transmission line.

6.5.4 Assessment Criteria

The Ausroad Traffic Assessment Criteria for Rural Roads is provided in **Table 6.25**. This data provides the basis for establishing the expected level of service for various road formation and design. The bulk of the roads to be affected by this proposal include the “Unsealed”, “Sealed Undivided” and “Sealed Divided” roads.

Table 6.25- Austroad Traffic Service Assessment Criteria for Rural Roads

Road Stereotype	Quality of Traffic Service		
	Poor (vpd)	Fair (vpd)	Good (vpd)
Unsealed			
Natural Surface	over 100	61 to 100	up to 60
Formed	over 100	61 to 100	up to 60
Gravel one lane (up to 4.5 m)	over 100	61 to 100	up to 60
Gravel two lane (up to 4.5 m)	over 150	61 to 150	up to 60
Sealed Undivided			
One lane (up to 4.5 m)	over 300	151 to 300	up to 150
Narrow two lane (4.6 to 6.4 m)	over 4 000	1 001 to 4 000	up to 1 000
Wide two lane (6.5 to 9.1 m)	over 6 000	4 001 to 6 000	up to 4 000
Three lane (9.2 to 11.6 m)	over 10 000	6 001 to 10 000	up to 6 000
Four lane (over 11.6 m)	over 15 000	10 001 to 15 000	up to 10 000
Divided			
Four lane (up to 9.1 m x 2)	over 30 000	15 001 to 30 000	up to 15 000

vpd = vehicles per day

6.5.5 Transportation Impacts

Construction Road Impacts

At any one time, construction traffic is expected to be in the order of 10 vehicles per day and a worst case scenario is anticipated to be 20 vehicles in any one day. These will include large vehicles transporting heavy machinery, equipment and construction materials.

Construction vehicles will not have any major impacts along the majority of the transportation route. There will be no major impacts on local Newnes Junction residents since the construction traffic will access the mine site to the north of the village and will not be required to pass the local residences.

Construction traffic will only be a minor portion of the total traffic using the Bells Line of Road for the duration of the period of construction and no inconvenience to other road users is anticipated. The worst case scenario of 20 vehicle movements generated during any one day represents approximately 0.6% (based on traffic counts in 2000) of the traffic flow on the Bells Line of Road and will therefore have no significant impact on the regional road network. Any impacts will be minor in nature and short term in duration.

The local access road leading from the Bells Line of Road to the mine site is currently used by light vehicles accessing Newnes Junction, industrial sites and the State Forests in the vicinity, and heavy vehicles accessing the various industrial sites in the area. The roads have more than sufficient capacity to take an additional 20 traffic movements a day and no significant negative impacts are anticipated.

Wide or long loads being transported during the construction activities may require lead and/or chase vehicles to warn local traffic as appropriate. The roads in the area are not particularly steep or winding and therefore the long loads are not regarded as a particular transportation issue.

Construction Rail Impacts

No rail transportation will occur during the construction phase of the project and there will therefore be no impacts on the rail network during construction.

Operational Road Impacts

Since the vast majority of the product will leave the site via the rail system, road usage during the site operations will be limited to light vehicles used to transport workers to the site, deliveries of fuel and occasional heavy vehicles that may transport spot loads from the site to specific markets nearby.

There will be an estimated 10 light vehicles a day entering and exiting the site. While it is not possible to accurately determine the number of heavy vehicles that will transport material from the site the number of such vehicles will be very small. Road transportation of kaolin ore will be limited to very occasional loads to meet spot market demands. It is not anticipated that such transportation will occur on a frequent basis. Any such loads will be covered prior to leaving the site to control dust generation.

The existing road network is able to absorb the additional vehicle movements without upgrade and no significant impacts of the road network will occur during the operation of the proposed facility.

Operational Rail Impacts

During the operation of the site, the rail loop currently owned and operated by Clarence Colliery will be used for the transportation of the kaolin ore to the Sydney based processing area. For the purposes of this assessment it has been assumed that the kaolin ore will be transported over 50 weeks of the year and that the maximum tonnage of 1.4 million tonnes will be transported.

The transportation of 1.4 million tonnes of material per year on a 50 week basis will require 9 unit trains (each carrying 3,000 t) per week.

Rail loading arrangements will be ultimately determined by the rail authority that wins the contract to transport the material and consequently details of the arrangements are not yet available. However, a number of restrictions exist on the use of the existing rail facilities.

Clarence Colliery is committed to 3 unit trains per week and has priority over the use of the loop. Clarence Colliery loading generally occurs early in the morning (for example 5:00 am) on three mornings of the week. Clarence Colliery may, on occasion, load all three unit trains in one day. This would require only 3 hours of time and would still allow sufficient time for the loading of the kaolin ore.

The rail loop is connected to the Main Western Railway Line that is used to transport regular freight to the eastern seaboard.

6.6 Waste Disposal

The proposed mine will incorporate current best practice with respect to waste management and minimisation. Recycling will occur as much as practicable within the local area but will include as an anticipated minimum, glass, empty drums, pallets and paper if collection services are available.

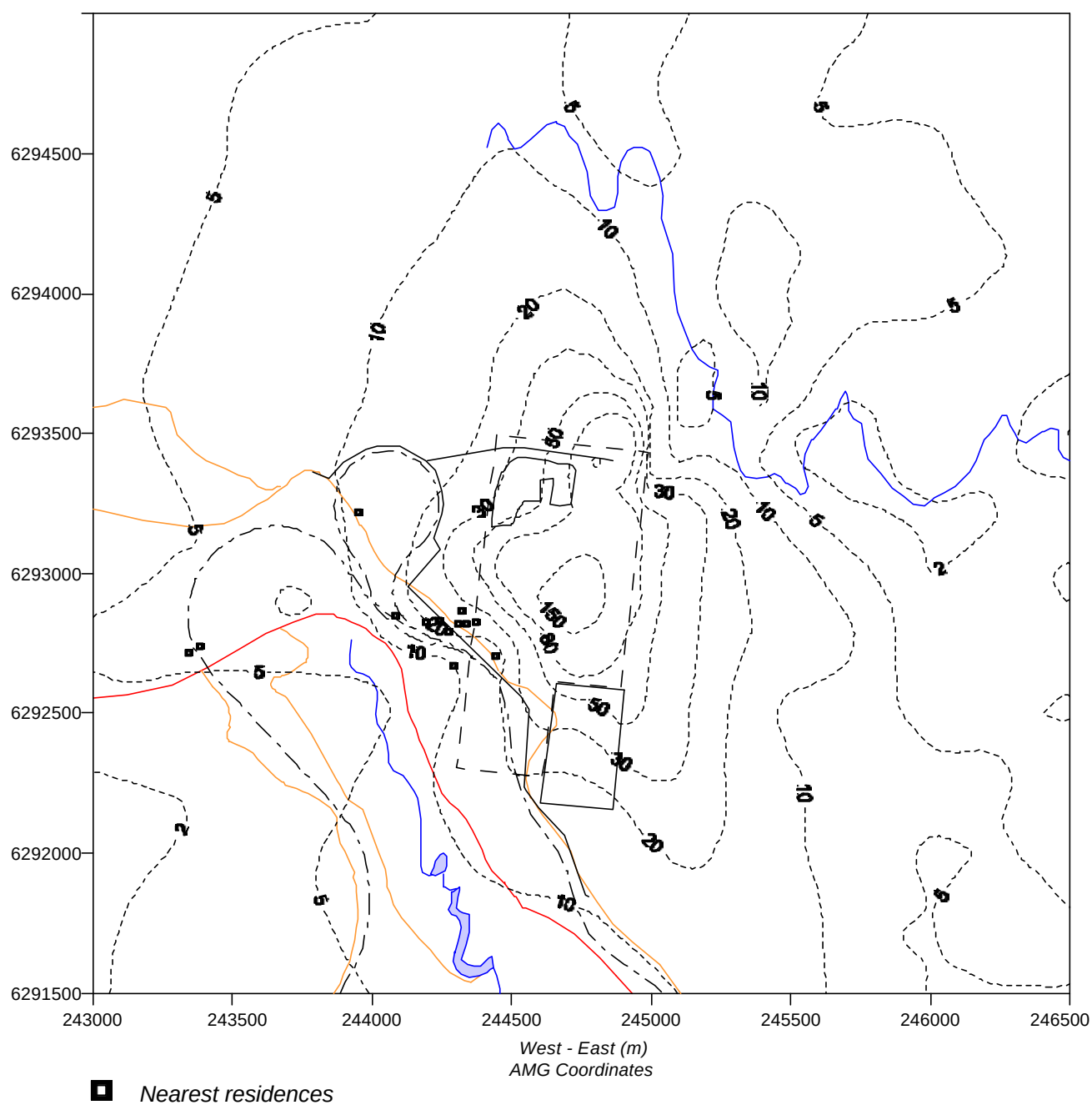
The operation does not require the use of chemicals and licensed contractors will transport all waste oils off site.

All servicing of vehicles will occur at designated locations within the pit. No oils will be deposited on the site and all waste material will be removed from site and disposed of appropriately.

Other wastes will be appropriately disposed of at licensed local landfill sites.

Domestic wastes will be disposed of via normal collection services. Bulk wastes such as tyres and non-recyclable equipment will be disposed of by contractors in approved facilities in the area.

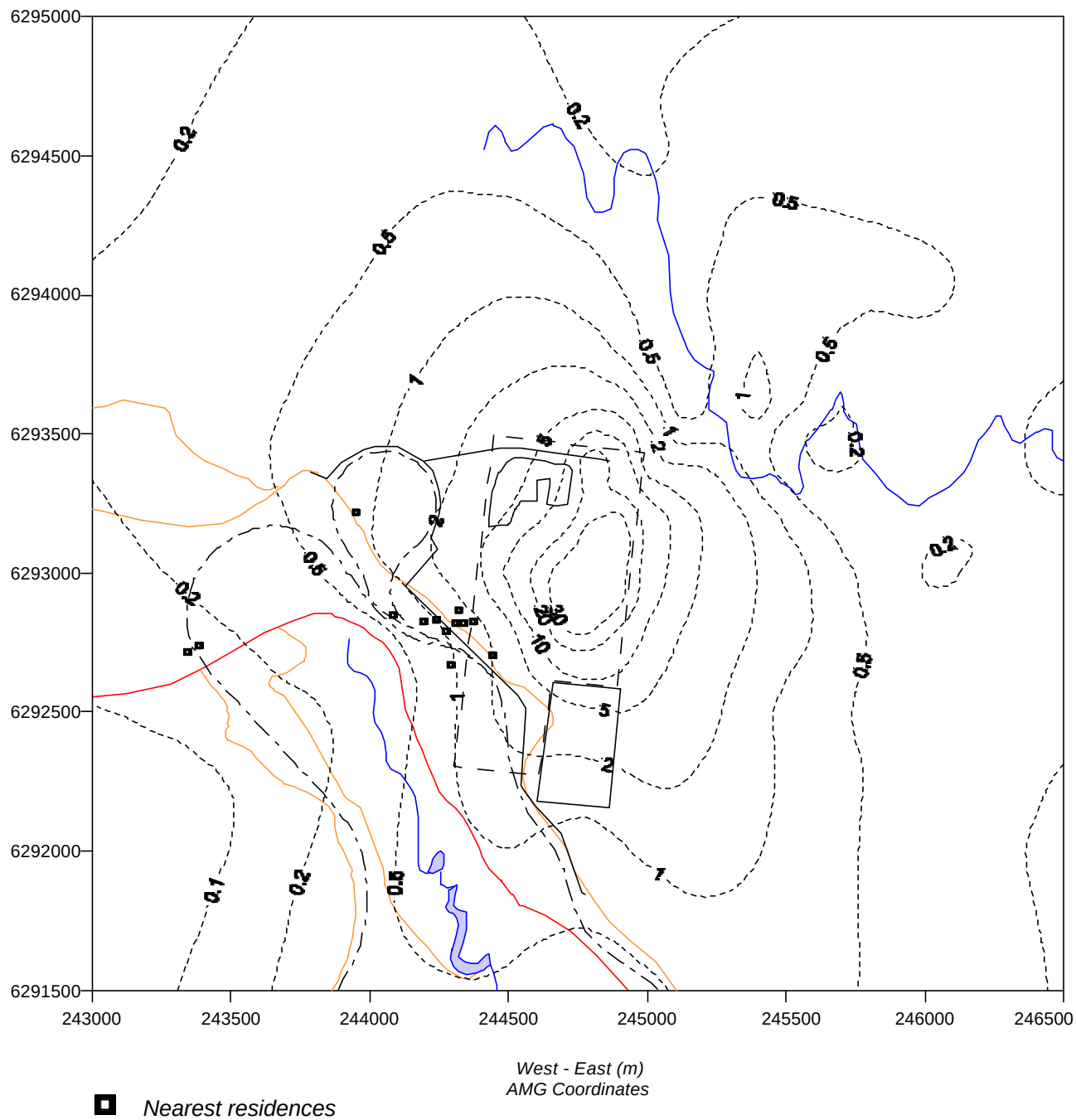
Vegetation cleared during the construction program will be managed by mulching or chipping for use in the rehabilitation program.



Source : Holmes Air Sciences

0 1000 metres

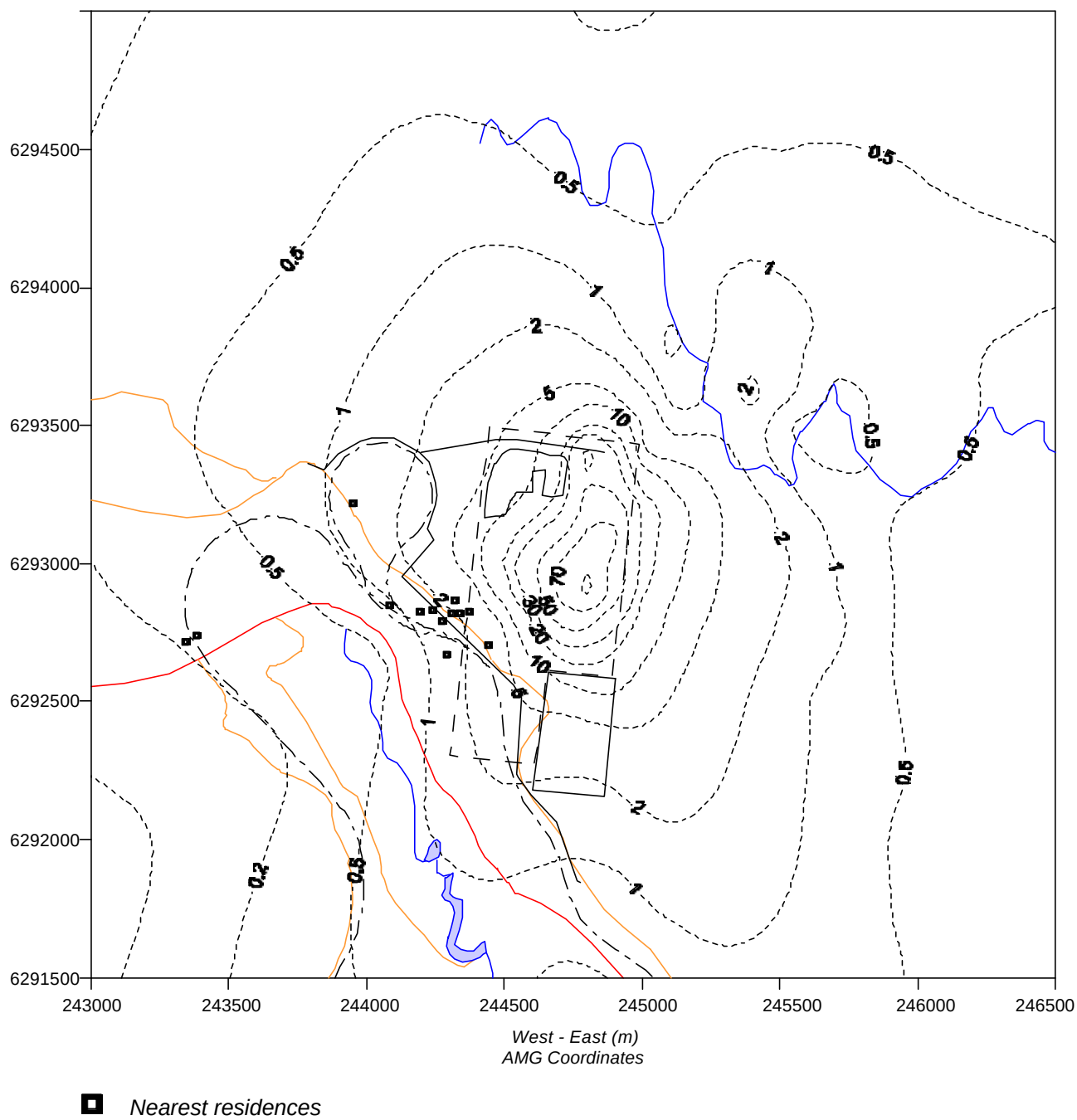
FIGURE 6.1
Predicted maximum 24-hour average PM₁₀ concentration
at ground-level (Stage 5 Operations) - µg/m³



Source : Holmes Air Sciences

0 1000 metres

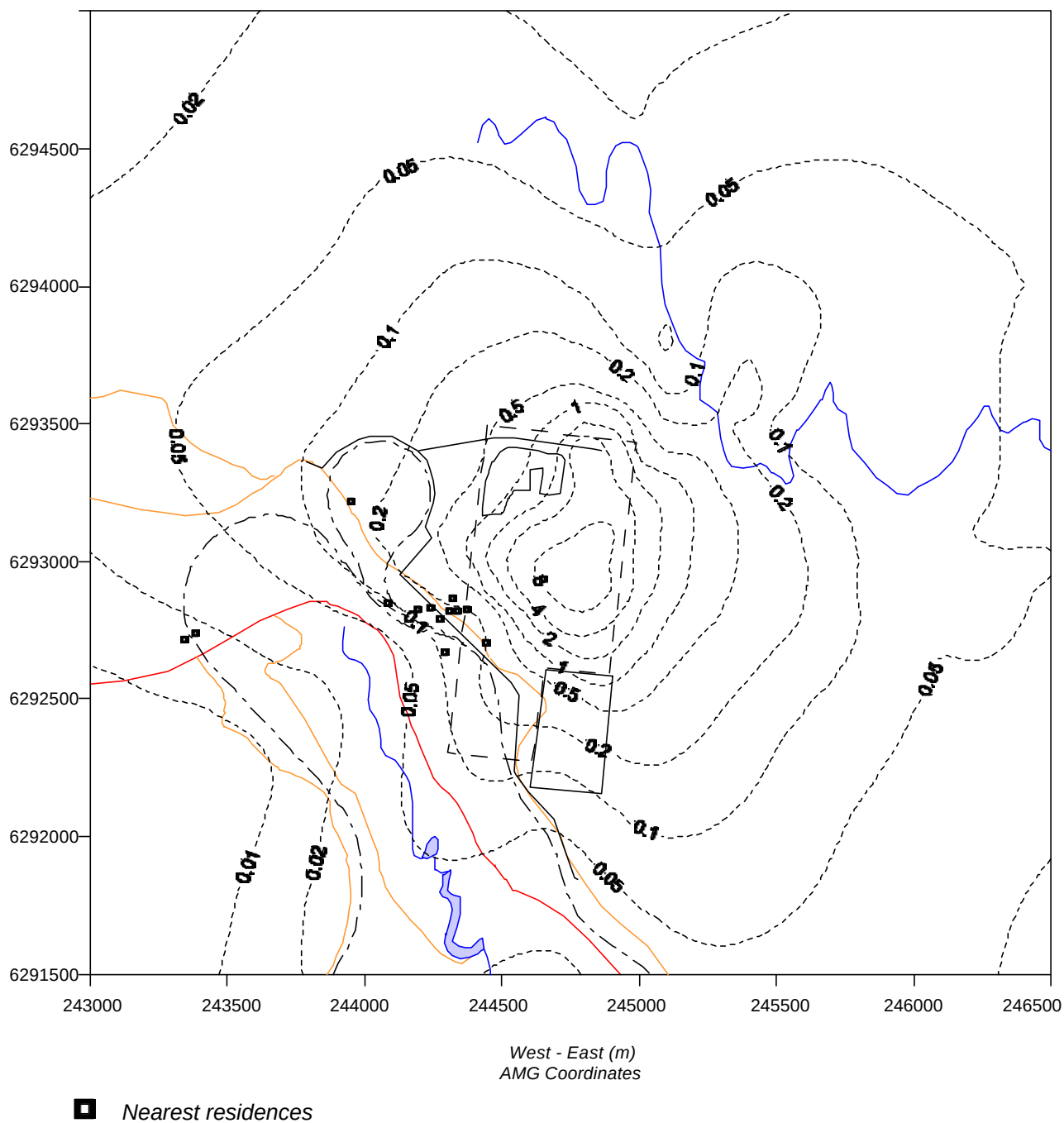
FIGURE 6.2
Predicted annual average PM₁₀ concentration at
ground-level (Stage 5 Operations) - µg/m³



Source : Holmes Air Sciences

0 1000 metres

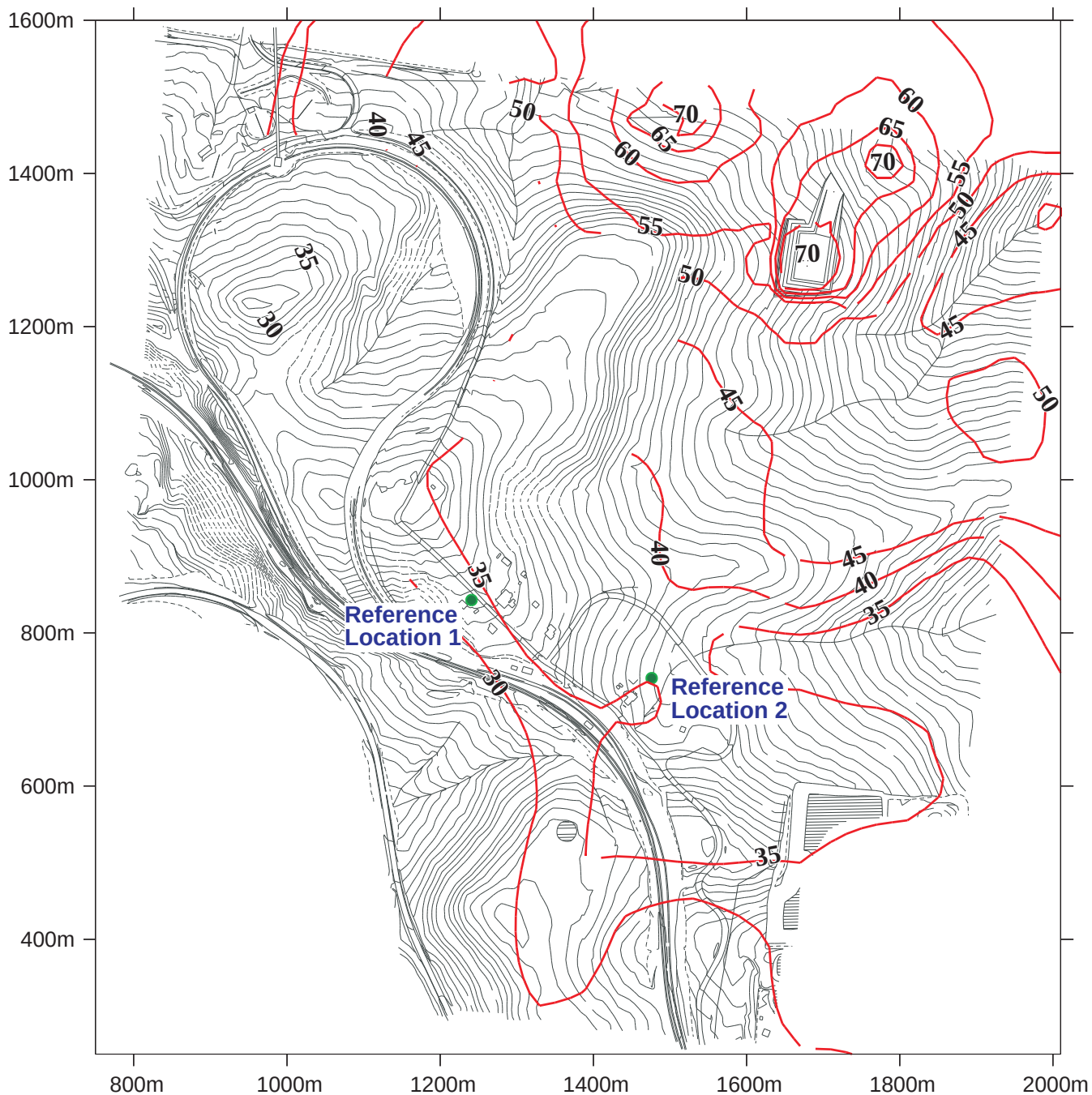
FIGURE 6.3
Predicted annual average TSP concentration
at ground-level (Stage 5 Operations) - $\mu\text{g}/\text{m}^3$



Source : Holmes Air Sciences

0 1000 metres

FIGURE 6.4
Predicted annual average dust deposition concentration
at ground-level (Stage 5 Operations) - g/m²/month

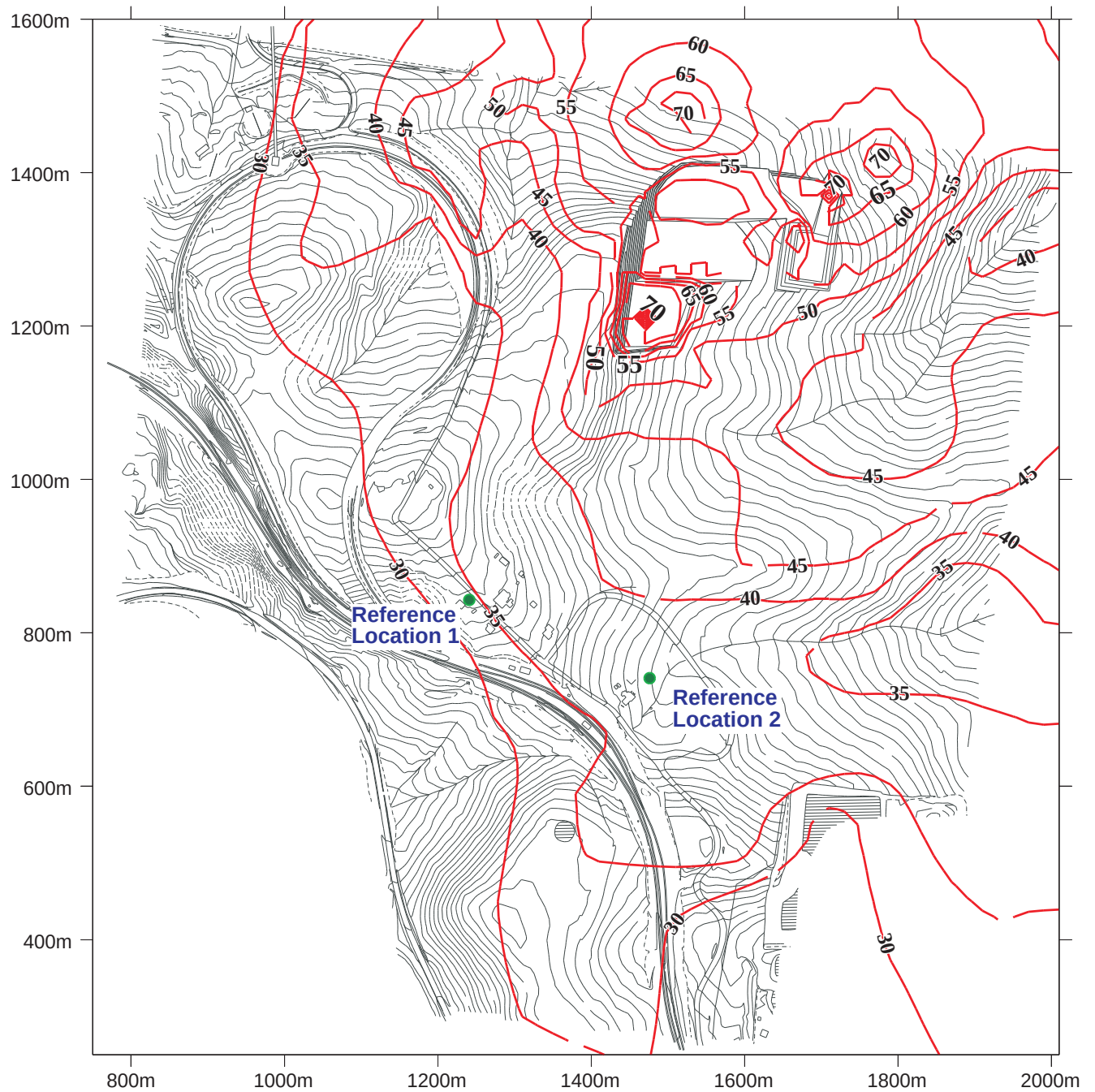


Source : Atkins Acoustics, Jul 2001

0 100 200 metres



FIGURE 6.5
Noise Contour Plot - Extraction (Calm)
Stage 1

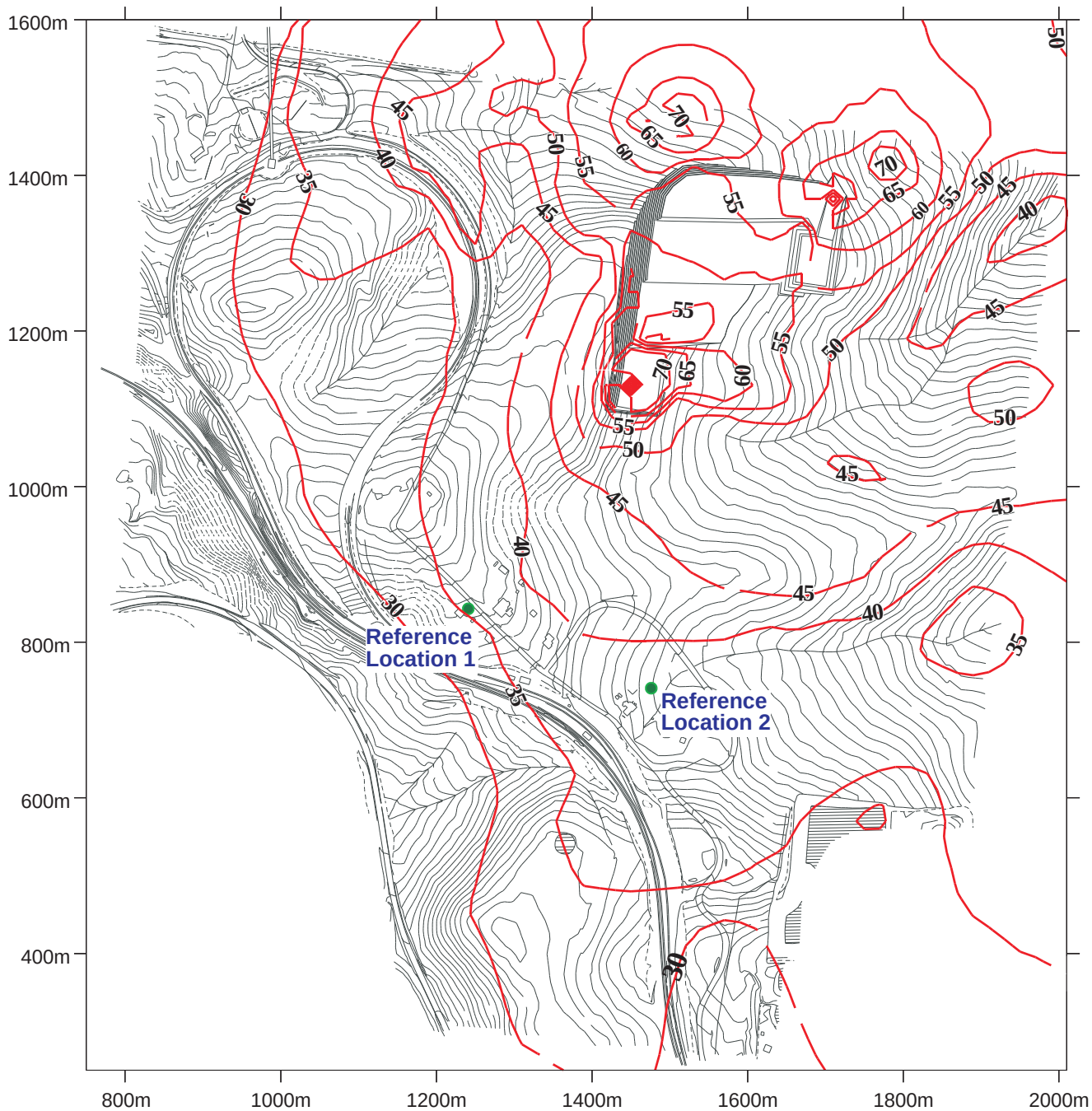


Source : Atkins Acoustics, Jul 2001

0 100 200 metres



FIGURE 6.6
Noise Contour Plot - Extraction (Calm)
Stage 2

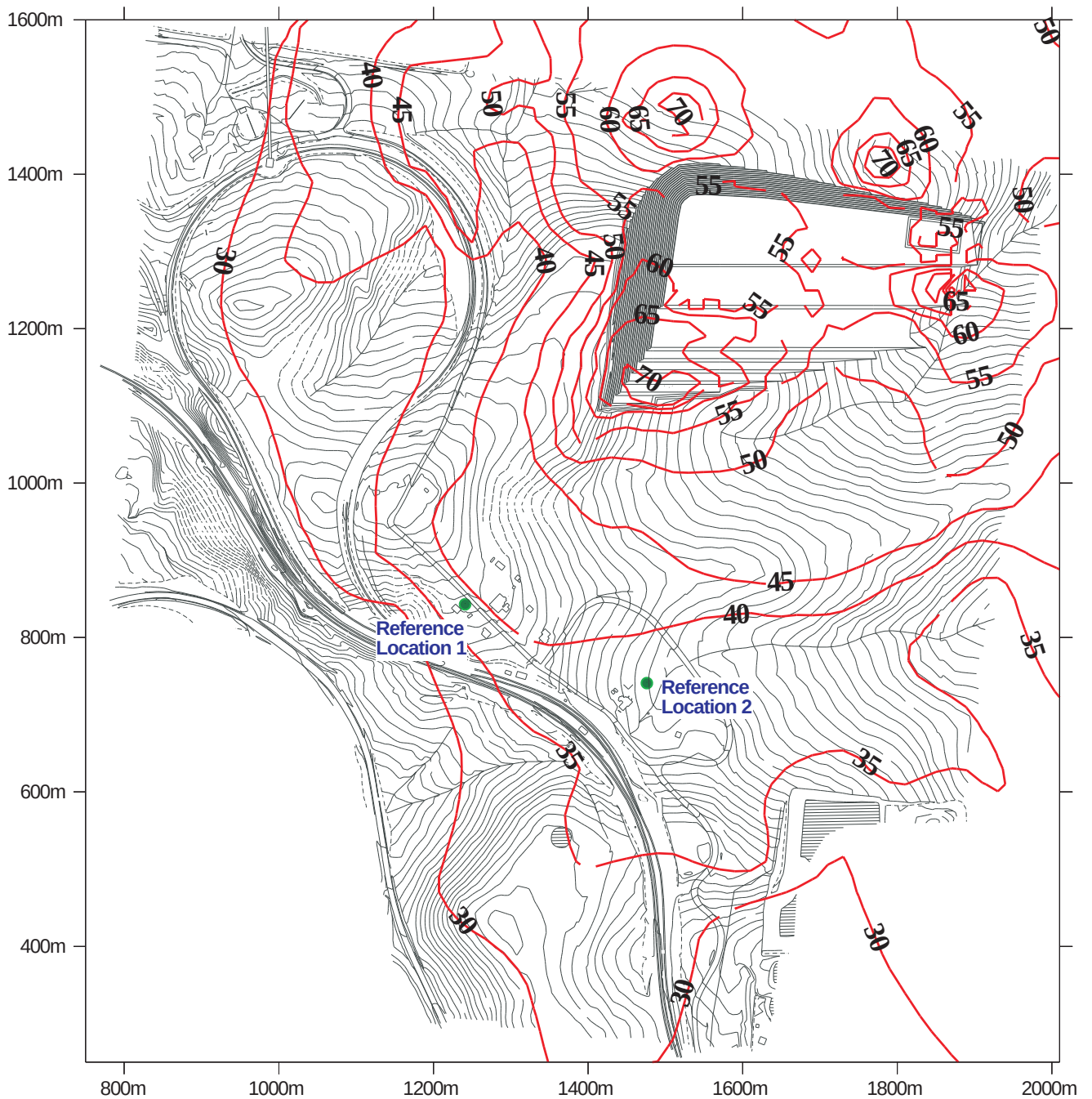


Source : Atkins Acoustics, Jul 2001

0 100 200 metres



FIGURE 6.7
Noise Contour Plot - Extraction (Calm)
Stage 3

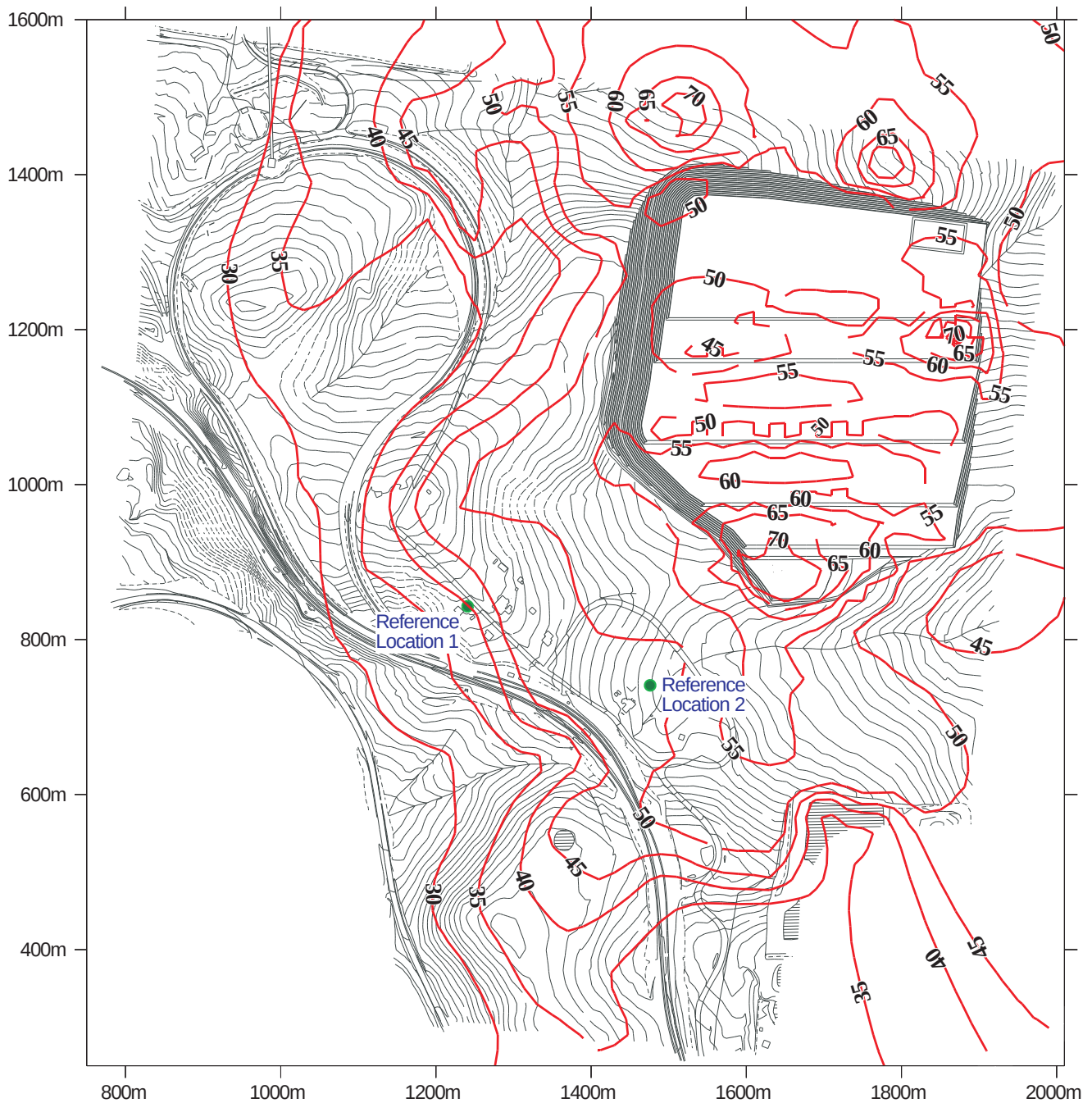


Source : Atkins Acoustics, Jul 2001

0 100 200 metres



FIGURE 6.8
Noise Contour Plot - Extraction (Calm)
Stage 4



Source : Atkins Acoustics, Jul 2001

0 100 200 metres



FIGURE 6.9
Noise Contour Plot - Extraction (Calm)
Stage 5

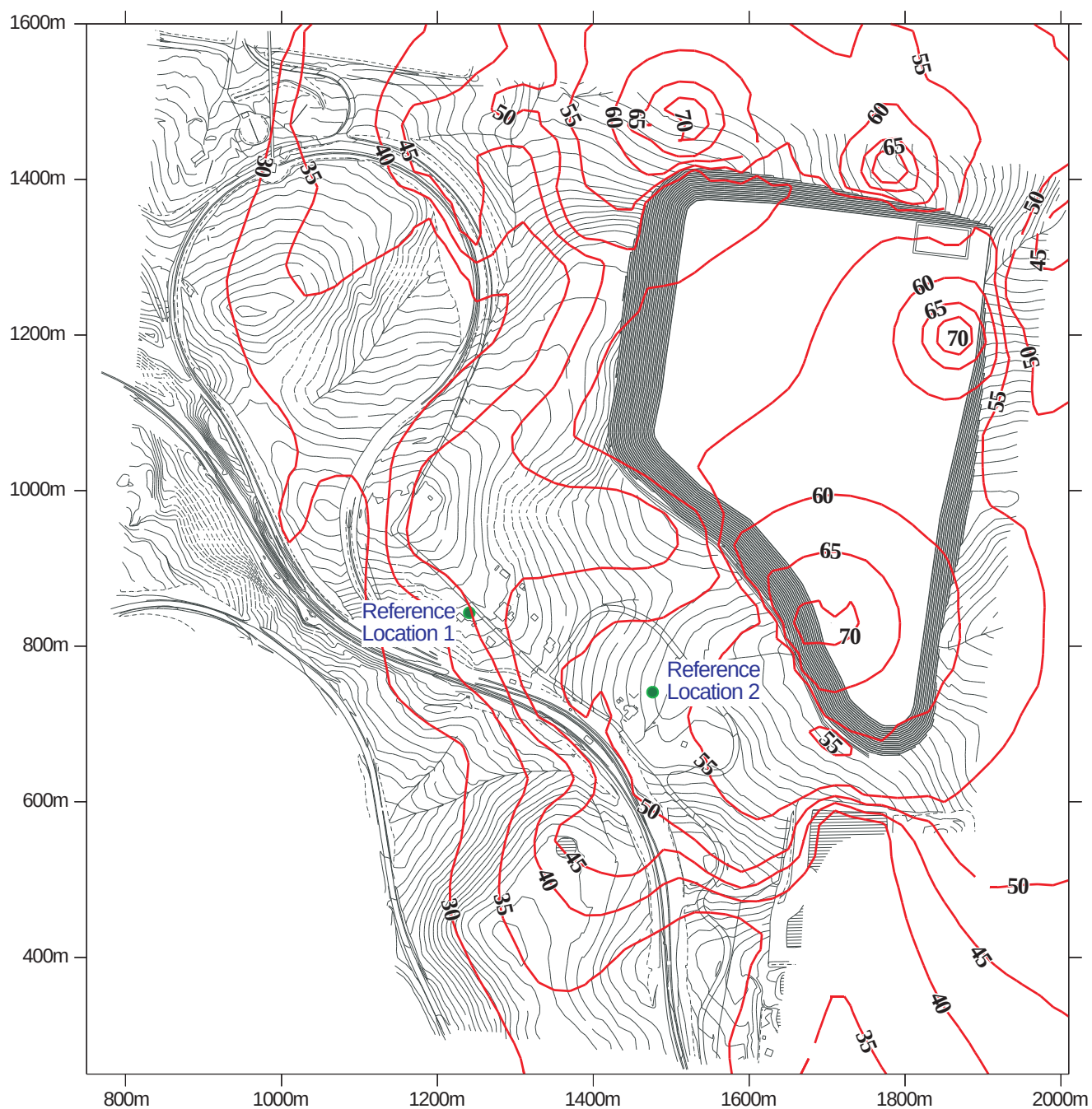


FIGURE 6.10
Noise Contour Plot - Extraction (Calm)
Stage 6

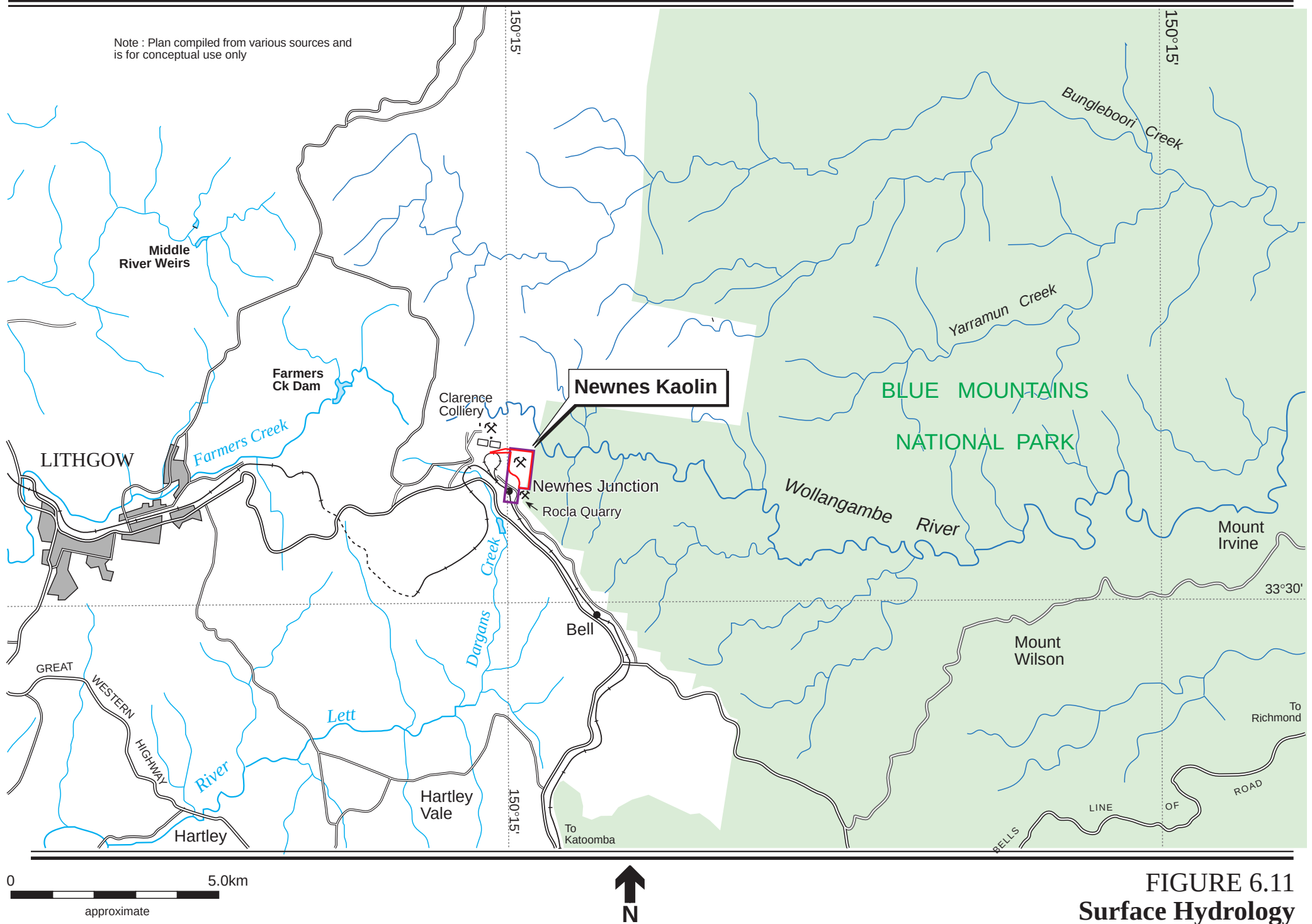


FIGURE 6.11
Surface Hydrology

7. Social and Economic Considerations

The potential positive and negative implications of the proposed development on the existing social and economic framework of the region are discussed in this section.

7.1 Existing Social Framework

The proposed development site lies within the City of Greater Lithgow. The population has remained reasonably steady over the last decade with the 1996 census population being 19,248 as compared with the 1986 population of 19,785. The region covers an estimated area of 3,516 km² with Lithgow being the major population centre. Smaller urban centres are located at Cullen Bullen, Wallerawang, Portland and Capertee.

The population information outlined below has been derived from the Australian Bureau of Statistics census data for the Greater Lithgow local government area (LGA).

7.1.1 Population Numbers

Between 1986 and 1996 the population of Greater Lithgow has declined slightly with a decrease of approximately 3%. This is in contrast to the previous decade (1976-1986) when the population increased in the area by 60.3%. This increase in population was attributed to mining and power station developments. The minor decrease in the population indicates that growth in such areas has declined, leading to a relatively stable population in the area.

In terms of age distribution, the vast majority of the population in the area is aged less than 45. The age bracket with the greatest number of people is 35-39, followed by the 5-9 and then the 10-14 age brackets. This reflects a high number of families with young children in the area.

In the order of 15 people generally live within the village of Newnes Junction and others use the village for weekend purposes.

7.1.2 Occupational Structure

In the decade from 1976 to 1986 the number of people employed in the area rose from 4,993 to 8,367, an increase of 68%. In the last decade, from 1986 to 1996, employment in the area declined by 10% to 7,498. The male population employed in the workforce decreased from 5,786 (1986) to 4,522 (1996). The female population experienced an increase in employment numbers, from 2,579 (1986) to 2,976 (1996). There is a higher proportion of females working in part-time positions than that occurring in the male population.

The main sources of current employment in the area (in decreasing order) are mining, retail trade, manufacturing, health and community services, and transport and storage.

These figures reflect the high number of females employed in the retail trade and community services. Mining and transport and storage employ the greatest number of males in the area.

The total number of people unemployed in the work force in 1996 was 850, of which 530 were male and 320 were female. This represents an unemployment rate of approximately 10%.

7.1.3 Housing

The vast majority of people in the Lithgow LGA live in separate houses (11%). The remainder, in decreasing order, live in semi detached dwellings (or town houses), flats or apartments and caravans.

Newnes Junction village has 6 dwellings located within it, 5 of which are permanently occupied and one of which is used for weekends and holidays. A few sites in the village may be built on in the future.

7.2 Services

A range of services for the local community are available in the Lithgow region, including meals on wheels, homecare, child care centres, sheltered workshops, St Vincent de Paul and the Salvation Army.

Long day care facilities and preschool kindergartens are available for families with young children. For older children a number of state and private primary schools are located in the area in addition to state and private high schools within the region. Tertiary education is provided at the Technical and Further Education which offers courses in academic, commercial, technical and lifestyle subjects.

A new hospital has recently been constructed on the Great Western Highway just east of the town centre that will provide improved medical facilities to the community of the Lithgow region.

Many other community groups also exist for a variety of craft or artistic disciplines and include arts and theatre groups, music groups and craft groups.

7.3 Recreation and Tourism

The Lithgow area is a popular tourist destination as it is located within a region that also contains national parks, state forests, areas of historical interest such as Hartley Vale Historical Village, the Small Arms Factory, Esbank House, Hoskins Church, rainforest areas, waterfalls, picnic facilities and areas of natural beauty. It is approximately two hours drive from Sydney and is easily accessible by road via the Great Western Highway and rail services. Consequently, it is an attractive destination for day trippers and longer stay tourists. A variety of accommodation is available in the large and smaller centres in the region.

Attractions that are located close to Lithgow include the Zig Zag Railway and viaducts and the Jenolan Caves. Both these sites have a high number of visitors every year. Other popular attractions include the Wallerawang and Mount Piper Power Station, Lake Wallace and Lake Lyell. Tourists can visit the remains of former shale mining towns of Glen Davis and Newnes, now only ruins.

A number of scenic drives are available in the area including the Lithgow City Drive, Hartley Valley Drive, Newnes Historic Ruins, Glen Davis, Portland, Hampton, Sunny Corner, Mount Tomah Botanic Gardens and Oberon Dam.

In addition to the above attractions the national parks and state forests in the area attract a large number of tourists each year. There are three main national parks in the area: Kanangra Boyd, Blue Mountains and Wollemi National Parks. There are also areas of State Forest which are well used by both local and non-local visitors. The usage of these areas remains fairly constant over the year, with an autumn high reflecting the importance of mushroom picking, and a slight winter low, reflecting the cool tableland climate.

7.4 Economic and Social Impacts

7.4.1 Employment Generation

The proposed mine will employ a number of workers both during the construction and operational phases.

During the construction period a significant number of contractors may be employed on site undertaking varied activities. The construction workforce will be a skilled team employed to carry out specialised work. It is anticipated that the workforce employed during construction will include local contractors. This would be for activities such as earthworks, materials provision, installation of specialist equipment, construction of access tracks and fence erection.

As outlined in **Section 3**, the operation of the proposed kaolin mine will result in direct long term employment opportunities for approximately 6-10 people.

The number of people employed at the Kaolin mine on a day to day basis during the operation of the mine is anticipated to fluctuate, depending on production. The single shift workforce will typically require 7 or 8 people, some of whom may be drawn from the local Newnes Junction village providing the relevant skills are available in town.

The workforce for the mine will be readily available locally, as evidenced by the high proportion of unemployed people in the region, many of whom will have mining skills. Consequently, with the exception of some management staff it is expected that project employment can be mainly satisfied from the surrounding region with little or no in-migration.

The proposed development will provide long term job security for the workforce once it becomes established, and as production increases further employment opportunities

may be available. Outside contractors may also be employed to assist with clearing and stripping operations, the establishment of site drainage, sediment catchment, water reticulation and rehabilitation systems.

The mine will also generate indirect employment benefits in the local and regional area. Those involved may include external suppliers, service providers, contractors, marketing personnel and consultants as outlined in **Section 3**.

The construction and operational workforce would contribute to the local economy through purchasing food and other daily requirements, which would usually be supplied through towns and villages in the region.

Factors for indirect employment generation vary according to the type of industry and location. For mining and extractive industries, an employment multiplier of 1.46 has been previously used and is considered appropriate in this case.

On this basis, total indirect employment associated with the operation will be in the order of 9 to 14 people. This figure excludes employment generated by transport operations and processing operations. There are several other areas however, where the mine will supply valuable products to various industries including pharmaceutical, ceramics, building and construction, cement and glass manufacturers.

Consequently, the project will have a positive impact on the employment in the area, and though the numbers to be employed are not regarded as particularly great, the period of employment for the workers will be long term.

7.5 Housing

The mine site will not provide accommodation for its workforce and any workers would be expected to find their own housing in the area. The small number of additional people in the area will not result in any measurable influence on the local housing market.

Arrangements for accommodation would vary according to the preferred practice of contractors and employees undertaking the work. For those requiring temporary or permanent housing, adequate housing is available in local hotels, motels, rented premises or caravan parks. Permanent accommodation would be available in Lithgow.

7.6 Social Amenity Issues

The character of the area will not be significantly altered as a result of the proposed mine since mining and quarrying is a major source of employment in the area, both locally and regionally. However, the mine will nevertheless cause a cumulative affect on the residences of Newnes Junction, particularly from increased noise and general activity at the site. Although some visual screening is available between the mine and the residences, the operation will be visible from elevated vantage points.

The development may also have a negative affect on property values of Newnes Junction however, this effect would not extend to other residential areas not directly affected by the development such as Clarence Village. To mitigate against loss of property value within Newnes Junction, the proponent is prepared to purchase affected residences for a negotiated value which assumes the kaolin mine was not operational. The price would include relocation costs, however, should residences take up the offer but do not wish to move from the area, they will be allowed to continue to reside for a nominal rent.

There may also be some localised effects due to construction activities but these will be limited in nature, and mitigation measures will be employed to minimise these as far as possible. Specifically, a separate construction access road will be developed along a disused track running adjacent to the Clarence Rail Loop which will avoid using the main road in Newnes Junction to bring equipment onto the site.

As requested by residents in Newnes Junction, access to the National Park via the proposed mine site will be established at the southern end of the site. The access will be maintained and will be fenced to ensure the safety of those using it.

7.6.1 Conclusion

From the above discussions, it can be concluded that with the adoption of mitigation measures including the offer of purchase of affected residences in Newnes Junction, socio-economic impacts of the proposed kaolin mine can be mitigated.

7.7 Assessment in Terms of Ecologically Sustainable Development

Ecologically sustainable development (ESD) may be regarded as development that meets the needs of the present without compromising the ability of future generations to meet their own needs. It calls for a balance between conservation and development and is related to using resources in a manner that provides quality of life, equity, biodiversity and maintenance of ecological processes.

Sustainability is essentially about developing a system which is not self-destructive and does not take from the world's future, but which takes account of social, environmental and economic factors in the decision making process. By integrating conservation practices and principles into the development process, a sustainable balance can be achieved between environmental and economic objectives.

The Federal Government released the *National Strategy for Ecologically Sustainable Development* in December 1993. This strategy provided a goal and core objectives relating to ESD.

The Goal

- ☐ Development that improves the total quality of life, both now and in the future, in a way that maintains the ecological processes on which life depends.

The Core Objectives

- ❑ To enhance individual and community well being and welfare by following a path of economic development that safeguards the welfare of future generations.
- ❑ To provide for equity within and between generations.
- ❑ To protect biological diversity and maintain essential ecological processes and life-support systems.

The well being of our current community is associated with the ability to mine resources for manufacturing of numerous products and construction purposes. In order to gain the associated benefits, these resources must be removed from the ground. The current productivity and land uses of the area will not be significantly altered and the land will be available following rehabilitation for the use of future generations. Biological diversity will be maintained, as will essential ecological processes and life-support systems in the area. Although the site contains faunal habitat it is not critical habitat for rare or endangered species.

The proposal effectively takes into account long and short-term considerations regarding economic, environmental, social and equity considerations. The proposed timing of the works is designed to ensure that valuable resources currently on site are not wastefully managed. The proposal will contribute to a strong, growing and diversified economy that enhances the capacity for environmental protection. The well being of the current generation will be enhanced through the development of this resource.

The extraction of kaolin will be carried out in an environmentally sound manner and will help to maintain and enhance Australia's international competitiveness, providing for the well-being of both existing and future generations. The sand component will be used within the Greater Sydney Region, which will increasingly experience a shortfall of construction sand as well as industrial grade silica sand.

7.7.1 Precautionary Principle

The precautionary principle, as defined by the EP&A Regulation (incorporating the *Intergovernmental Agreement on the Environment and National Strategy for Ecologically Sustainable Development* (Commonwealth of Australia, 1992) definition), dictates:

.....that if there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation.

The precautionary principle is based on the premise that many of the potential benefits of the natural environment may be unknown and it is prudent and ethical to keep options open for current and future generations (DUAP, 1997).

Application of the precautionary principle to mining proposals involves ensuring that there has been careful evaluation of the proposal and that decision making for the

proposal has been predictable and transparent. This EIS documents the extensive and careful evaluation of project components. Detailed assessment of all potential impacts and necessary management procedures has been conducted and is also comprehensively documented in this EIS.

The kaolin mine proposal has integrated the precautionary principle in the operation, along with adopting mitigation measures to prevent significant environmental degradation associated with the project.

The studies undertaken prior to and during the preparation of this EIS have not indicated any threats of serious or irreversible environmental damage. However, where risk of potential degradation has been identified, mitigation measures have been developed to ensure that significant adverse impacts do not occur. Similarly, the topography following mining will be different to the existing topography of the site but rehabilitation plans have been developed to ensure that the area is revegetated with native species indigenous to the local area. Consistent with the requirements of the precautionary principle, the mitigation measures incorporated into the proposed development form an integral component of the operation.

7.7.2 Intergenerational Equity

Under the EP&A Regulation, the principle of intergenerational equity requires:

...that the present generation should ensure that the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations.

The Rio Declaration on Environment and Development (Agenda 21) also adopted the principle that:

...the right to development must be fulfilled so as to equitably meet developmental and environmental needs of present and future generations.

The principle of intergenerational equity identifies a need to ensure that the requirements of the present generation can be met without precluding options for future generations. The mining project will not prejudice future use of the land in the area nor affect the land use of adjacent areas.

Mitigation measures to ensure that the environmental impacts associated with the operation are minimised are also required under the principle of intergenerational equity. Protection of the air, water, biological and noise environment of the area will contribute to meeting the requirements of intergenerational equity, protecting the quality of the environment for both the existing and future generations. Such mitigation measures will help ensure that the land following mining activities will be left in a manner that enables other land uses to be carried out.

A key objective of the development will be overall project management and investment in plant and equipment that minimises pollution and waste and is efficient. Where possible, recyclable materials will be used in the operation and employees will be educated regarding waste minimisation, re-use and recycling

NKPL will develop an Environmental Management System based on ISO 14,000 for the kaolin mine. Once implemented the system will assist in maintaining current best practice in environmental management in accordance with responsible environmental practice.

7.7.3 Conservation of Biological Diversity and Ecological Integrity

There is a need to maintain the biological diversity and ecological integrity of the region within which the operation is located. Conservation of ecological integrity requires that natural processes in the area continue to function. The proposed development incorporates measures to minimise potential impacts on vegetation communities and habitat value. The nearby Blue Mountains National Park/World Heritage Area and Wollangambe Wilderness Area are located to the east of the site will not be significantly affected by the proposed development.

Rehabilitation initiatives and stringent water management controls that form part of the project will also assist in maintaining the biological diversity and ecological integrity of the area.

A range of specific management initiatives have been proposed to minimise the disturbance to existing natural resources of the site. These and other measures discussed in the EIS will assist in conservation of ecological integrity.

7.7.4 Improved Valuation and Pricing of Environmental Resources

The goal of improved valuation of natural capital has been included in Agenda 21 of Australia's Intergovernmental Agreement on the Environment. The principle of improved valuation and pricing refers to the need to determine proper values of services provided by the natural environment.

The proposed operation improves the valuation and pricing of the resources on the Newnes Plateau by:

- ☐ optimising available use of the resource and minimising resource sterilisation;
- ☐ allowing a valuable resource to be mined without permanent degradation of existing environmental resources;
- ☐ using existing transport facilities to transport product to a processing site and then to existing markets;
- ☐ cost effective use of a potential resource that has been marked for development. The separation of the kaolin from the insitu friable sandstone significantly increases the value of the resource.

8. Environmental Management & Conclusions

Environmental management strategies to be incorporated into the project are provided in this section of the EIS and a summary of the key findings of the environmental studies undertaken as part of this EIS is given. A list of mitigation measures proposed to meet environmental performance criteria is also provided.

8.1 Benefits of the Proposal

The Newnes Kaolin Project will allow the efficient extraction and use of a valuable state resource, consisting of kaolin and sand, while supplying sand products to Sydney markets that are being rapidly exhausted of supplies. The project will provide additional jobs for the local workforce, as well as benefiting the community through expenditure from the mine and personnel. The primary benefits of mining the resource include the:

- ☐ regional significance of the friable sandstone resource and the range of kaolin and silica products to be produced and marketed;
- ☐ need to optimise the State's resources and to develop a valuable resource that is recognised by the NSW Department of Mineral Resources;
- ☐ ongoing and increasing need to meet demand for a range of construction sands from local and regional markets as alternative sources continue to be exhausted;
- ☐ location of the resource away from densely populated areas and close to existing rail loading facilities, thereby eliminating the need to road haul product off site.

8.2 Potential Environmental Impacts

8.2.1 Project Specific Impacts

Specific environmental impacts that will result from the construction and operation of the proposed kaolin mine are summarised below:

- ☐ potential negative effect on property in the village of Newnes Junction;
- ☐ the final topography of the site will be altered, leaving a final void in the landscape which could be used a wetland providing habitat for native flora and fauna species;
- ☐ the sandy soils on site are susceptible to erosion when the ground cover is disturbed. Erosion of the active mining area and final walls may occur if rehabilitation and stabilisation is not undertaken in an appropriate time frame;
- ☐ visual impacts will include changes in the landscape associated with clearing of vegetation on site, exposing underlying sandstone material and constructing

infrastructure required in the mining operations. The most sensitive sites in relation to the visual impacts are local residences and viewing locations within the adjacent Blue Mountains National Park, including Bald Trig, a section of the unformed track leading to Gouches Crater, and the rock pagodas at the edge of the National Park;

- ❑ a maximum of approximately 25 ha of native woodland vegetation will be destroyed. This will also result in the loss of fauna habitat;
- ❑ the noise modelling has shown that during each stage establishment period the recommended goals are satisfied at 5 Sandham Road (Location 1). Exceedances of 3-5dB(A) (Stage 5-calm), 2dB(A) (Stage 5-west wind) and 1-3dB(A) (Stage 6-calm) have been predicated at Sandham Road (Location) during stage establishment activities;
- ❑ for mining operations, recommended noise goals are generally satisfied for Stages 1-4 (approximately 9 years of mining activity) at Sandham Road (Location 2) during both calm and west wind meteorological conditions. The predicted 1dB(A) exceedance during Stage 4 with two (2) dozers operating would be considered marginal. The results show that during Stage 5 noise exceedances of 8-11dB(A) (calm) and 6-9dB(A) (west wind), and during Stage 6 of 11-15dB(A) (calm) and 8-11dB(A) (west wind) are predicted.
- ❑ the noise predictions during the conclusion of extraction for all stages, has shown that the recommended goals are satisfied at 5 Sandham Road (Location 1). During Stage 5 noise exceedances of 3-5dB(A) (calm) and 1-3dB(A) (west wind) are predicted at Sandham Road (Location 2).
- ❑ a minor drawdown will be created on the local water table, resulting in ground water being drained into the mine. This has been assessed as not significant and will not impact on other groundwater users or ecosystems.

All other impacts will be controlled to ensure that an acceptable level of environmental management is maintained.

8.2.2 Cumulative Impacts

This EIS has identified and assessed the key environmental issues relating to the proposed kaolin mine at Newnes. As with all development projects, there will be some environmental impacts. The purpose of this EIS is to identify and quantify these impacts and to assess their significance.

The results of the various environmental investigations have demonstrated that resultant impacts are within acceptable criteria with regard to dust, traffic and transportation, flora, fauna, archaeology and water quality implications. Noise impacts are acceptable for the first 4 stages of mining, following which impacts exceeding criteria have been predicted.

It is important with any development project to monitor its ongoing environmental performance. An ongoing environmental monitoring program for the kaolin mine will

be developed, allowing early identification of potential problems.

8.3 Compilation of Mitigation Measures

Impacts resulting from the project will be mitigated by the application of the mitigation measures outlined in the previous sections. These are summarised in Table 8.1.

Table 8.1 - Summary of Mitigation Measures

Issue	Proposed Mitigation Measures
Landuse	- A buffer zone of 200 m between the mining lease and the closest residential dwellings will be maintained to limit the impact of the operation on these dwellings. These houses will have no direct views of the operation and land use in the area will remain residential. - An additional 50 m minimum buffer between the mine and the Blue Mountains National Park
Air Quality	- Careful management procedures will be employed including: - minimising disturbance to natural ground cover where possible - enclosing stockpiles and conveyor belts to minimise wind blown dust generated by materials handling - revegetation of disturbed areas in accordance with the erosion and sediment control plan - watering of internal haul roads if necessary - all equipment used on site is maintained in a good condition and operated in a proper and efficient manner.
Noise	- a "Construction Noise Management Plan" (CNMP) is to be prepared to address the issue of construction noise; - all construction activities shall only take place between the 7.00am – 6.00pm Monday to Saturday, and 8.00am-6.00pm Sunday and public holidays; - the tree mulcher shall be located as far as practicable within the valley located adjacent the northern boundary of the lease area; - all construction site plant and equipment shall satisfy the acoustic performance specified; - all loading and building conveyor systems shall be belt type conveyors; - where practical train loading shall be restricted to the hours of 7.00am – 6.00pm Monday to Saturday, and limited to one (1) movement per twenty four (24) hour period; - all permanent site plant and equipment shall satisfy the acoustic performance specified; - where practical all permanent site mobile plant shall be fitted with secondary/ residential grade noise controls and acoustic treated engine enclosures; - where practical audible alarms shall be replaced with flashing lights or a similar warning system; - during Stages 1 to 6 of mining operations a bund shall be formed from stockpiled overburden and/or topsoil to a height not less than three (3.0) metres above the existing ground level. The bund shall be constructed on the western and southern perimeter during Stages 1 to 6 as close as practicable to the finished pit limits; - a "Noise Management Plan" (NMP) shall be implemented
Hydrology	- 3 boreholes will be maintained to monitor the quality of water and detect any potential water quality problems.
Water Quality	- In order to protect the local water and soil resources in the area a comprehensive Soil and Water Management Plan will be prepared. - numerous water quality and erosion and sedimentation control measures will be incorporated into the mine design - a water treatment system will be installed to treat water make to a suitable quality so it can be discharged
Flora & Fauna	- the area of cleared vegetation is to be kept to a minimum at all times.
Waste Disposal	- waste will be recycled where possible; - contractors will remove oils and tyres etc off site as required; - domestic wastes will be collected and removed from site.
Visual	- a 50 m vegetated buffer will be maintained between the site and the adjacent National Park. - the remaining vegetation occurring between the residences in Newnes Junction and the proposed mine limits will be maintained. - the mine has been designed with shallow benches which will be rehabilitated with native vegetation as soon as possible. - surface infrastructure will be coloured green to blend in with the surrounding bushland. - infill vegetation planting will be undertaken to further screen the site from local residents if required.

Table 8.1 - Summary of Mitigation Measures

Issue	Proposed Mitigation Measures
Archaeological Heritage	In the event that an item of archaeological heritage is discovered during mining, all activities will cease and the NPWS contacted so a management plan can be prepared.
Soils	A range of soil erosion controls will be implemented on site. The area of exposed soils will be kept to a minimum at all times. All topsoil will be stockpiled for later use in rehabilitation.

In this context, and provided the environmental safeguards are observed, a basis is provided for approval of the proposed kaolin mine.

8.4 Approvals Required

Schedule 2(7) of the Environmental Planning and Assessment Regulation (1994) requires that an EIS should contain a list of any approvals that must be obtained under any other Act or law before the development activity may lawfully be carried out.

The following describes the circumstance, Act or law and the approval that may be required by NKPL prior to, or during the operation of the proposed kaolin mine. The final decision as to which approvals are required will be made during detail design and construction.

The principal approval required for the project is development consent that is sought from the Minister for Infrastructure and Planning. Other approvals required include:

- ☐ **Mining Lease** - Kaolin is defined as a mineral in Regulation 1 and Schedule 4 of the *Mining (General) Regulation 1997*. Consequently, a mining lease is required under the *Mining Act* from the Department of Mineral Resources.
- ☐ **Extractive Industries License** – Apart from being a mining project under the jurisdiction of the Mining Act with its operational and rehabilitation obligations, the project is also extractive industry which may require a licence from the Department of Land and Water Conservation.
- ☐ **Environment Protection Licence** - In addition to planning approvals required under the environmental planning and mining legislation, an Environment Protection licence will be required from the Environment Protection Authority (EPA) for the ongoing operation under the *Protection of the Environment Operations Act, 1997*.

8.5 Environmental Management System

In order to facilitate an integrated management system for the environmental aspects of the project and Environmental Management System (EMS) will be developed by NKPL to ensure:

- ☐ all work complies with all relevant environmental statutes, regulations and standards;

-
-
- ☐ environmental factors are taken into account during the planning and execution of activities on site and;
 - ☐ regular audits are performed to confirm compliance with environmental policies and standards.

8.5.1 Objectives of the EMS

An EMS is a structured approach to managing the environmental aspects of a company's operations. It provides a quality assurance system that enables a company to establish, and assess the effectiveness of, environmental policy and objectives, achieve conformance with them and demonstrate that conformance to others. The aim of such a system is to support environmental protection and prevention of pollution in balance with socio-economic needs.

The EMS would be developed in accordance with ISO 14001 and would include the following core components:

- ☐ environmental policy;
- ☐ planning;
- ☐ implementation and operation;
- ☐ checking and corrective action; and
- ☐ management review.

An integral component of the EMS is the Environmental Management Plan (EMP). The EMP provides a system of reporting and monitoring that can be used to review the company's operations against established environmental performance indicators. It would also provide NKPL management with an improved view and control of the operation's environmental performance. An EMS incorporating the EMP would provide the following benefits:

- ☐ assistance in compliance with regulatory authorities;
- ☐ demonstration of due diligence;
- ☐ reduction in environmental liability; and
- ☐ effective planning for future environmental and rehabilitation costs.

The principal objectives of the EMP are to provide:

- ☐ a framework for ongoing environmental management and monitoring;
- ☐ a basis from which reporting to relevant government authorities can be made; and
- ☐ specific guidelines for the operation including environmental control systems and initiatives.

8.5.2 Outline of the EMP Components

Specifically, the EMP outlines the mining plan for each year, monitoring results, the rehabilitation program and incorporates requirements of EPA licences and approvals, and planning consent conditions.

In addition to the normal reporting requirements of the EPA and DMR, the following records and data will be held on site:

- ☐ details of all transport movements generated by the operation;
- ☐ monthly water quality sampling results;
- ☐ monthly dust deposition results;
- ☐ noise results;
- ☐ complaints protocol that will detail the nature of any complaints and procedures to deal with them. Any additional mitigation measures incorporated or changes to normal practices as a result will also be documented;
- ☐ details of areas which are rehabilitated and self sustaining. All data will include total areas to date and incremental annual areas for each given year; and
- ☐ rainfall data.

Copies of all relevant documentation will be kept on site including licenses, leases and planning consents. The EMP will report on the status of these documents and requirements and will be produced annually and submitted to the DMR and EPA.

8.6 Environmental Reporting

Environmental activities and progress will be reported through the NSW Department of Mineral Resources Mining, Rehabilitation and Environmental Management Process (MREMP). This will involve preparing a Mining Operations Plan (MOP) and an Annual Environmental Management Report (AEMR) for the project.

The MOP will outline the proposed development for a period of a number of years. It will include the mining and rehabilitation activities planned and the relevant environmental controls and requirements necessary for the operation to comply with the mining lease conditions. The MOP will be prepared to cover environmental aspects of the development from the development stage through to the operational stage.

The AEMR would provide a regular annual assessment and report of the performance of the development in terms of the requirements of the MOP and environmental activities. This process allows for regular stakeholder input and review of the activities on site.

8.7 Environmental Monitoring and Verification Process

It is proposed to undertake an environmental monitoring program for water, noise, and air quality. Environmental monitoring will provide the verification of the impact predictions made in this document. It will also allow the environmental performance

of the operation to be assessed and will give the opportunity to fine tune the development works as they proceed.

The proposed monitoring program is outlined below, while the monitoring locations are shown on **Figure 8.1**. It has been assumed that monitoring dust and noise emissions at the nearest residential receptors will provide the necessary data to accurately verify the impact predictions made in this EIS.

8.7.1 Water Quality Monitoring

Surface water – Surface water quality monitoring would be conducted at two sites along drainage lines adjacent to the site for pH, electrical conductivity, suspended solids, and selected metals, oil and grease. It is proposed to sample the background waters weekly during controlled discharge and monthly at other times.

Samples of the water quality within the sediment control dams on site will also be taken prior to discharge to ensure that the water quality is suitable before it is released.

Groundwater - A network of monitoring bores will be established during construction to monitor the potential impact of the project. It is proposed to install three monitoring boreholes to the west of the proposed pit, at increasing distances from the western boundary of the pit. These holes will be established prior to commencement of mining to enable background water quality to be determined. The holes will be sunk to a minimum depth of 50 m and fitted with 50 mm slotted PVC and gravel filter and be completed as permanent observation holes with a surface concrete block and cap fitted in the usual manner.

Water samples taken will be analysed for pH, electrical conductivity, and the major ionic constituents to establish baseline conditions for the active and post mining period. During the first few years of operation all bores will be monitored on a monthly basis. Thereafter, following discussion with authorities, sampling may be reduced to approximately twice per year.

Water level measurements will also be conducted initially on a monthly basis in each hole over time to establish seasonal trends and then at 3 monthly intervals to verify the impacts predicted.

8.7.2 Meteorology and Air Quality Monitoring

An automated meteorological station will be installed to record temperature, rainfall, evaporation, wind direction and wind speed. The data would be maintained on a database to provide information relevant to the environmental management of the site.

The air quality monitoring programme will be established to assess the compliance of the operation with air quality objectives and any relevant EPA licence conditions. Monitoring of dust is proposed at two locations and will involve measurement of dust deposition and total suspended particulates.

Dust monitoring will involve two dust gauges positioned to monitor dust deposition at nearby residences. Samples would be collected monthly and analysed for ash content, combustible matter and insoluble solids. The exact location and nature of the monitoring programme will be developed in consultation with the authorities.

8.7.3 Noise Monitoring

Based on the findings and recommendations of the specialist noise assessment undertaken as part of this EIS, noise monitoring will be conducted during initial stages of mine development to confirm the current findings and predictions, and to establish the practicability of additional noise controls where required.

Noise levels will be monitored during construction and operation at selected residences in the vicinity of the project to verify the predictions of the noise impact assessment and assess compliance with relevant noise criteria.

8.7.4 Erosion and Sediment Control

Erosion and sediment control structures will be inspected on a regular basis and following rainfall events in order to monitor the structural integrity of the structures and assess their effectiveness. The inspection will be used to identify any remediation required.

8.7.5 Rehabilitation

Routine monitoring of rehabilitation activities would be undertaken to assess the condition of the terraced benches, the growth rates and performance of the revegetation and the status of the rehabilitated areas. This monitoring will be conducted to ensure that any areas requiring additional attention are treated promptly.

8.8 Conclusions

This EIS has identified and assessed the key environmental issues relating to the proposed Newnes Kaolin Mine. As with all development projects, the proposed development will cause some environmental impacts. The purpose of this EIS is to identify and quantify these impacts and to assess their significance.

The results of the various environmental investigations have demonstrated that most of the resultant impacts are well within acceptable criteria, and the impact on the environment will be minimal. Noise impacts are anticipated to be acceptable for the first 4 stages of mining providing mitigation measures are incorporated into the project. In Stages 5 and 6 of mining noise exceedences are predicted at residential dwellings in Newnes Junction. Purchase of these residences or alternative arrangements would be required for mining to proceed beyond Stage 4.

An ongoing environmental monitoring program will allow early identification of potential problems. The proposed development is consistent with the requirements of the Department of Mineral Resources for the efficient use of the State's industrial mineral resources. The development will provide significant economic benefits to the

local and regional economy. The balance between environmental impacts and benefits resulting from the proposal clearly favours the development proceeding.

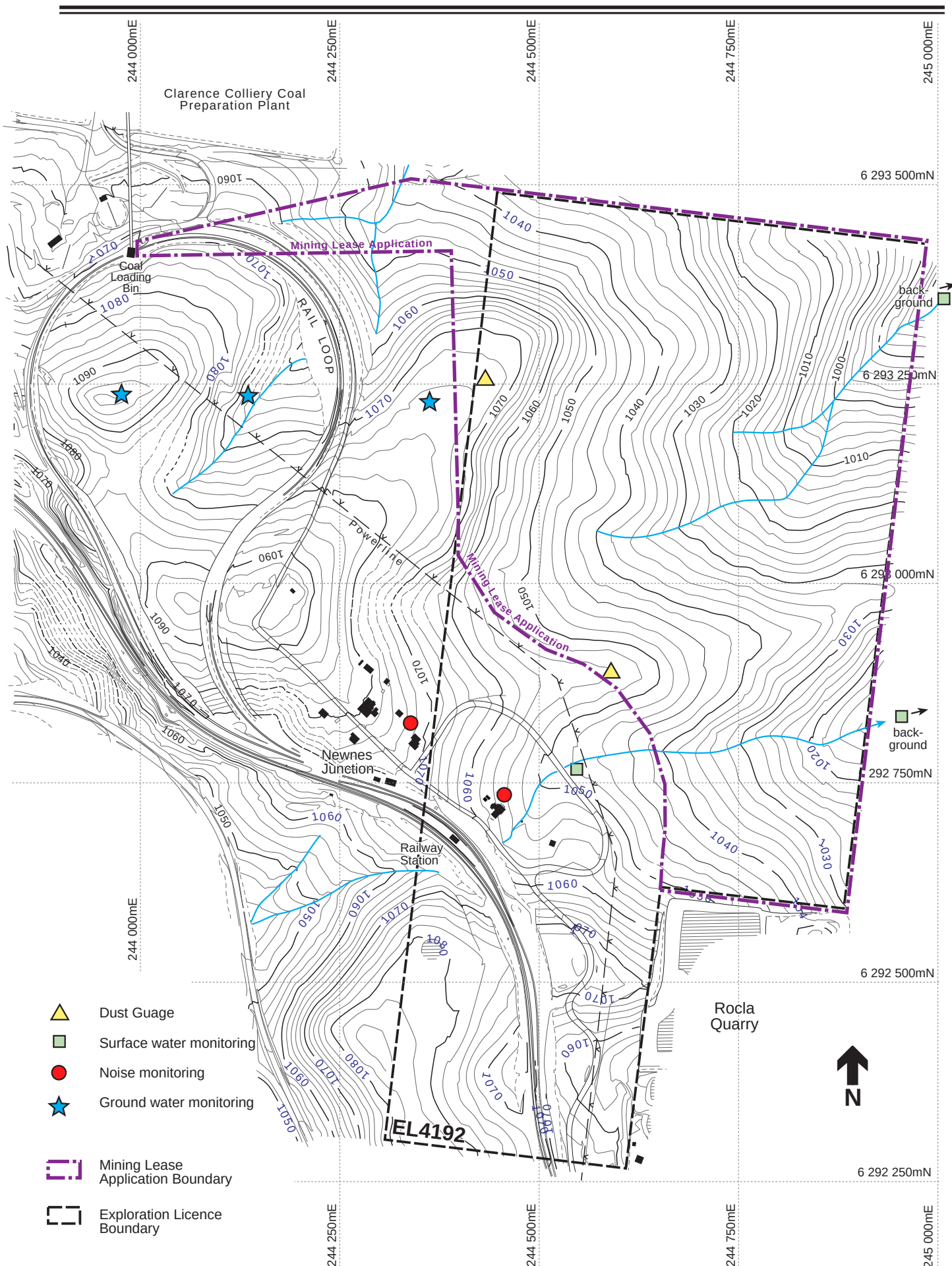


FIGURE 8.1
Newnes Kaolin - Proposed Monitoring

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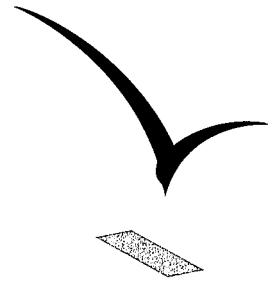
Abbreviations and Glossary

AADT	Average Annual Daily Traffic
AHD	Australian Height Datum
ANZECC	Australia and New Zealand Environment and Conservation Council
ARI	Average Recurrence Interval
AS	Australian Standards
ASD	Approaching Sight Distance
AWQG	Australian Water Quality Guidelines
Background Noise Level	the level of the ambient sound indicated on a sound level meter in the absence of the sound under investigation
BOD	Biological Oxygen Demand
COD	Chemical Oxygen Demand
DA	Development Application
DB	decibels
dB(A)	the unit of measurement of sound pressure level heard by the human ear
dB(Linear)	the measurement of sound pressure level in which the amplitudes of the sound signal, through all frequencies of the signal, are treated equally, i.e. not weighted
DCP	Development Control Plan, Developed by local Councils to control developments in the area.
DLWC	Department of Land and Water Conservation
DMR	Department of Mineral Resources
DUAP	Department of Urban Affairs and Planning
EC	Electrical Conductivity
EIA	Environmental Impact Assessment
EIS	Environmental Impact Statement
EL	Exploration Lease
EMP	Environmental Management Plan – a plan devised for developments to provide for ongoing environmental management on site.
EMS	Environmental Management System
ENCM	Environmental Noise Control Manual
EPA	Environment Protection Authority

EP&A Act	Environmental Planning and Assessment Act, 1994
EPBC Act	Environment Protection Biodiversity Conservation Act, 1999
ESD	Ecologically Sustainable Development
FC	Faecal Coliforms
FEL	front end loader
g/m²/month	grams per square metre per month. Unit of measurement for deposited dust
Ha	hectare
IEC	International Environmental Consultants Pty Ltd
IFD	Intensity frequency duration
ISO	International Organisation for Standardisation.
Kg	kilograms
km	kilometre
L	litre
L_{aeq}	the ‘equal energy’ average noise level, used in some instances for the assessment of traffic noise effects or the risk of hearing impairment due to noise exposures
L_{A10}	sound level exceeded 10 per cent of the sampling time
L_{A90}	sound level exceeded 90 per cent of the sampling time
LALC	Local Aboriginal Land Council
LEP	Local Environmental Plan - developed by local councils to control development in its area
LGA	Local Government Area
m	metre
m²	square metre
m³	cubic metre
mg/L	milligrams per litre
ML	megalitre
mm	millimetre
Mtpa	million tonnes per annum
NAASRA	National Association of Australian State Road Authorities
NES	National Environmental Significance (defined under the EPBC Act).
NHMRC	National Health and Medical Research Centre
NKPL	Newnes Kaolin Pty Ltd

NP	National Park
NPWS	National Parks and Wildlife Service
NTU	Nephelometric Turbidity Units
PFM	Planning Focus Meeting
pH	measurement indicating whether the substance is acid or alkaline, range from 1 – 14, 7 being neutral.
REP	Regional Environmental Plan - plan prepared by the State Government Department responsible for planning where controls on development are considered on a regional and statewide basis
POEO Act	Protection of the Environment Operations Act
ROM	Run of Mine
ROTAP	Rare or Threatened Australian Plants
RTA	Roads and Traffic Authority
SEPP	State Environmental Planning Policy
SIS	Species Impact Statement
SG	specific gravity - the weight of any body or substance considered with regard to the weight of an equal bulk of pure water
SS	Suspended Solids
TDS	Total Dissolved Solids
TOC	Total Organic Carbon
TSC Act	Threatened Species Conservation Act, 1995.
TSP	Total Suspended Particulates
t	tonnes
tpa	tonnes per annum
tph	tonnes per hour
uS/cm	micro Seimens per centimetre
vpd	vehicles per day

Appendix A – Director General’s Requirements



Department of
Urban Affairs and Planning

Development and Infrastructure
Assessment
Level 22, 1 Farrer Place
Sydney NSW 2000
GPO Box 3927
Sydney NSW 2001

Facsimile: 02 9391 2151

Ms Margot Jamieson
International Environmental Consultants
PO Box 555
BRIGHTON LE SANDS NSW 2216

Dear Ms Jamieson,

Proposed Kaolin Mine – EL 4192, Due North of Newnes Junction, Lithgow
Our reference: S00/00635 Pt 1

Thank you for your letter of 20 April 2000 seeking consultation with the Director-General for the preparation of an Environmental Impact Statement (EIS) for the above development. Attachment No. 1 outlines the statutory matters that must be included in any EIS under clauses 54 and 54A of the *Environmental Planning and Assessment Regulation 1994* (the Regulation). Under clause 55(1) of the Regulation, the Director-General requires the EIS to address the issues listed below. You should note however, that if the Development Application to which these requirements relate is not made within two years of the date of this letter, clause 55(7) of the Regulation requires you to consult further with the Director-General prior to lodging the application.

Specific Issues

- Details of impacts on the Blue Mountains National Park and Wollongambe Wilderness Reserve, including measures to be adopted to prevent any part of the proposed facility from intruding into the National Park particularly stormwater run off from areas denuded of vegetation direct to the National Park.
- Details of the proposed location of the Kaolin/sand processing plant. Include an outline of the transport methods proposed to be used to transport kaolin/sand between the mine and processing plant, including the rail route and/or impacts on local and regional road networks, loading and unloading facilities and any upgrades that may need to be made to the Clarence rail loop.
- Details of any Native Title claims in relation to Crown Land.
- Details of cumulative environmental impacts.
- Consideration of objectives and relevant provisions of State Environmental Planning Policies (SEPPs) and Regional Environmental Plans (REPs), in particular SEPP 58 – Protecting Sydney's Water Supply and SEPP 11 - Traffic Generating Development.

- impact on flora and fauna, particularly critical habitats; threatened species, populations or ecological communities, or their habitats. The assessment should involve the following steps:
 - i) conduct baseline surveys, and consult relevant databases and listings by the Scientific Committee
 - ii) describe the types and condition of habitats in, and adjacent to, the land to be affected by the proposal
 - iii) prepare a list of species, populations or ecological communities, or their habitats, that may occur on the site, and conduct targeted surveys for these
 - iv) apply the "8 part test" (section 5A of the EP&A Act) to species, populations or ecological communities, or their habitats, that may be affected by the proposal. The EIS must justify any decision to not apply the test to all of the species, populations or ecological communities identified in step iii)
 - v) prepare a Species Impact Statement for any critical habitats, species, populations or ecological communities, or their habitats that are likely to be significantly affected by the proposal (note: An SIS must be prepared in accordance with any requirements of the Director-General of National Parks and Wildlife Service)
- Issues raised at the Planning Focus Meeting (copy of minutes are attached).

The Director-General also requires the following for all State Significant Development Applications:

- The applicant shall nominate a contact person (and telephone number) who will be made available to answer public enquiries about the proposal.
- The applicant shall consult with the community who are likely to be affected by the proposal. A report on who was consulted must be submitted with the DA, describing how the affected community was identified, consultation methods, and key issues raised by the community. This will enable the Department to assess if the approach taken was appropriate.
- The applicant shall consult with the local Council and advise the Department on the most appropriate newspapers circulating in the area affected by the proposal.

The EIS should address the detailed requirements of the Environment Protection Authority (EPA) (see attached EPA letter). The EPA requires two copies of the EIS when a development application is submitted. These documents should be lodged at the EPA's Bathurst Office.

The Department's EIS Guideline 'Extractive Industries – Quarries' and EIS Guideline 'Coal Mines and Associated Infrastructure' should also be consulted in the preparation of the EIS. The Extractive Industry Guideline is available for purchase from the Department's Information Centre, 1 Farrer Place, Sydney or by calling (02) 9391 2222. A copy of the Coal Mines and Associated Infrastructure Guideline is attached.

Where certain licences or approvals are required from bodies other than the consent authority for the proposal, the development is "integrated development" under the *Environmental Planning and Assessment Act 1979*. You identified a number of licences or approvals that you may need if you are granted development consent. If further integrated approvals are identified before the Development Application is lodged, you must conduct your own consultation with the relevant agencies to identify their requirements for the EIS.

When lodging your Development Application, you must lodge at least one copy of the Development Application and supporting documentation (including a fee of \$250) with each of the agencies from whom you need an integrated approval.

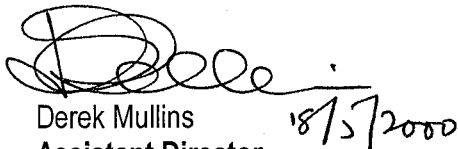
You should consult with Greater Lithgow Shire Council and take into account any comments Council may have in the preparation of the EIS. The EIS should also address other issues that emerge from consultations with relevant local, State and Commonwealth government authorities, service providers and community groups, in particular National Parks and Wildlife Service, Environment Protection Authority,

Department of Land and Water Conservation, Department of Mineral Resources, the Local Aboriginal Land Council and Local Aboriginal Tribal Council, Sydney Water Catchment Authority and Environment Australia.

Under the Commonwealth Environment Protection Biodiversity Conservation Act (EPBC Act) 1999, approval of the Commonwealth Minister for the Environment is required for actions that may have a significant impact on matters of National Environmental Significance, except in circumstances which are set out in the EPBC Act. Approval may also be required for certain actions on Commonwealth land. Approval from the Commonwealth is in addition to any approvals under NSW legislation. If you need approval under the Commonwealth Act, your EIS will be expected to assess the impacts on these matters.

Please contact David Fitzgibbon on (02) 9391 2344 if you require any further information regarding the Director-General's requirements for the EIS. For more information on the process for State Significant Development, please refer to the Department's Web site (www.duap.nsw.gov.au – look under "Projects and Services", "Development Assessment". For information on the EPBC Act, refer to Environment Australia's Web site (www.environment.gov.au).

Yours sincerely

A handwritten signature in black ink, appearing to read 'Derek Mullins', with a date '18/5/2000' written to the right.

Derek Mullins

Assistant Director

Development and Infrastructure Assessment

As Delegate for the Director-General

Note: Matters of National Environmental Significance under the EPBC Act are:

- i) World Heritage properties
- ii) RAMSAR wetlands
- iii) threatened species or ecological communities listed in the EPBC Act
- iv) migratory species listed in the EPBC Act
- v) the environment in a Commonwealth marine area
- vi) nuclear actions

DEPARTMENT OF URBAN AFFAIRS AND PLANNING

Attachment No. 1

STATUTORY REQUIREMENTS FOR THE PREPARATION OF AN ENVIRONMENTAL IMPACT STATEMENT UNDER PART 4 OF THE ENVIRONMENTAL PLANNING AND ASSESSMENT ACT 1979

In accordance with the *Environmental Planning and Assessment Act 1979* (the Act), an environmental impact statement (EIS) must meet the following requirements.

Content of EIS

Pursuant to Schedule 2 and clause 54A of the *Environmental Planning and Assessment Regulation 1994* (the Regulation), an EIS must include:

1. A summary of the environmental impact statement.
2. A statement of the objectives of the development or activity.
3. An analysis of any feasible alternatives to the carrying out of the development or activity, having regard to its objectives, including:
 - (a) the consequences of not carrying out the development or activity; and
 - (b) the reasons justifying the carrying out of the development or activity.
4. An analysis of the development or activity, including:
 - (a) a full description of the development or activity; and
 - (b) a general description of the environment likely to be affected by the development or activity, together with a detailed description of those aspects of the environment that are likely to be significantly affected; and
 - (c) the likely impact on the environment of the development or activity, having regard to:
 - (i) the nature and extent of the development or activity; and
 - (ii) the nature and extent of any building or work associated with the development or activity; and
 - (iii) the way in which any such building or work is to be designed, constructed and operated; and
 - (iv) any rehabilitation measures to be undertaken in connection with the development or activity; and
 - (d) a full description of the measures proposed to mitigate any adverse effects of the development or activity on the environment.
5. The reasons justifying the carrying out of the development or activity in the manner proposed,

having regard to biophysical, economic and social considerations and the principles of ecologically sustainable development.

6. A compilation, (in a single section of the environmental impact statement) of the measures referred to in item 4(d).
7. A list of any approvals that must be obtained under any other Act or law before the development or activity may lawfully be carried out.
8. For the purposes of Schedule 2, the principles of **ecologically sustainable development** are as follows:
 - (a) The precautionary principle - namely, that if there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation.
 - (b) Inter-generational equity - namely, that the present generation should ensure that the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations.
 - (c) Conservation of biological diversity and ecological integrity.
 - (d) Improved valuation and pricing of environmental resources.

Note

The matters to be included in item (4)(c) might include such of the following as are relevant to the development or activity:

- (a) the likelihood of soil contamination arising from the development or activity;
- (b) the impact of the development or activity on flora and fauna;
- (c) the likelihood of air, noise or water pollution arising from the development or activity;
- (d) the impact of the development or activity on the health of people in the neighbourhood of the development or activity;
- (e) any hazards arising from the development or activity;
- (f) the impact of the development or activity on traffic in the neighbourhood of the development or activity;

- (g) the effect of the development or activity on local climate;
- (h) the social and economic impact of the development or activity;
- (i) the visual impact of the development or activity on the scenic quality of land in the neighbourhood of the development or activity;
- (j) the effect of the development or activity on soil erosion and the silting up of rivers or lakes;
- (k) the effect of the development or activity on the cultural and heritage significance of the land.

An environmental impact statement referred to in Section 78A(8) of the Act shall be prepared in written form and shall be accompanied by a copy of Form 2 of the Regulation signed by the person who has prepared it.

Procedures for public exhibition of the EIS are set down in clauses 57 to 61 of the Regulation.

Attention is also drawn to clause 115 of the Regulation regarding false or misleading statements in EISs.

Note

If the development application to which the EIS relates is not exhibited within 2 years from the date of issue of the Director-General's requirements, under clause 55(7) of the Regulation the proponent is required to reconsult with the Director-General.

— ♦ —

Major Development Assessment
Level 4, 20 Lee Street
SYDNEY NSW 2000

Mr Robert Byrnes
Director
International Environmental Consultants Pty Ltd
PO Box 555
BRIGHTON-LE-SANDS NSW 2216

Dear Robert,

Re: Proposed Newnes Kaolin Mine – Greater Lithgow Local Government Area
File Ref: S00/00635

I refer to your request for further consultation with our Director-General in respect to the requirements for the preparation of the Environmental Impact Statement (EIS) for the Newnes Kaolin project.

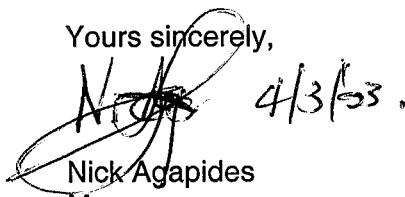
As you are aware, the Department previously issued Director-General's Requirements (DGRs) for the preparation of the EIS for this project on 18 May 2000. However, in accordance with Clause 73(6) of the *Environmental Planning and Assessment Act 2000*, as the Development Application (DA) and EIS were not lodged within two years of the date of these DGRs, you were required to reconsult the Department prior to lodging the application.

The Department has now had the opportunity to review these requirements and also to reconsult with other agencies that may have an interest in this project. Following this review and consultation, the Department is generally satisfied that the DGRs as previously issued adequately describe the matters to be addressed in the EIS, subject to the inclusion of the matters outlined in Attachment 1. Also attached is the correspondence provided by agencies following our request for their review of the original DGRs. It would be appreciated if you could ensure that all matters raised in the original correspondence are addressed along with those matters specified herein.

It is advised that you consult with the Department prior to the lodgement of the DA to establish the appropriate fees for the proposal and other administrative requirements.

Should you have any further queries regarding these requirements please contact Stacy Warren on 9762 8157.

Yours sincerely,

 4/3/03.

Nick Agapides
Manager

Mining and Extractive Industries
Major Development Assessment

ATTACHMENT NO.1 – ADDITIONAL MATTERS TO BE ADDRESSED IN THE EIS

1. Visual Impact - particular attention should be given to the visual impact of the proposal, including an assessment of the proposal from the Blue Mountains National Park, and the cumulative visual impact with other development located in the Newnes Junction and Clarence areas.
2. Access - an assessment of the proposed means of access to the site for employees and consideration of how the development will interact with the transport systems currently operating from the Clarence Rail loop.
3. Final land use - consideration of the final land use of the site, with attention to security and safety issues.
4. Environment Protection and Biodiversity Conservation Act 1999 – since the preparation of the original DGRs, Environment Australia has determined the proposal to be a controlled action under the *Environment Protection and Biodiversity Conservation Act 1999* due to potential impacts on the Blue Mountains World Heritage Area. It is noted that since the original DGRs were issued the Blue Mountains National Park and the Wollemi Wilderness Area have been declared part of the Blue Mountains World Heritage Area.

Environment Australia has also accredited the NSW assessment process. This means that even though the proposal requires Commonwealth approval, the assessment will generally be undertaken in accordance with the relevant provisions of Part 4 of the *NSW Environmental Planning and Assessment Act 1979* (the Act).

Environment Australia has indicated that the existing DGRs are adequate to address matters of Commonwealth significance. However it is requested that you provide detailed information on these matters as they relate to the Project in relevant sections throughout the EIS. You are advised to consult with Environment Australia on this matter should you require additional information on these requirements.

5. Flora and fauna - as previously advised the EIS should include a comprehensive assessment of potential direct and indirect impacts on flora and fauna and their habitats. This assessment should however be updated to address threatened species listed since the previous EIS requirements were issued and species which have since been recorded in the areas. These may include but not be limited to:
 - a. Blue Mountains water Skink; and
 - b. Bathurst Copper Butterfly.
6. Aboriginal cultural heritage assessment - in accordance with the attached NPWS guidelines: *General Guidelines for Impact Assessment* and the *Aboriginal Cultural Heritage and the Integrated Development Assessment Process*.
7. A greenhouse gas assessment - incorporating the following:
 - a. a quantitative model showing the tonnages of each greenhouse gas produced per year. These figures should be expressed as a percentage of the total national greenhouse gasses produced for that year;
 - b. a discussion of the types of greenhouse gases being emitted;
 - c. a discussion of the alternative options considered for:
 - * - the chosen fuel source used, and

- the technology adopted to reduce greenhouse gas emissions;
- d. justification for the chosen fuel source and technology in terms of greenhouse gas emissions.

8. Superseding legislation – please be aware that the *Environmental Planning and Assessment Regulation 1994* has now been superseded by the *Environmental Planning and Assessment Regulations 2000 (the Regulations)*. The current regulations have introduced a new fee structure for the lodgement of DAs. You are advised to consult with the Department prior to lodging the application to ascertain the correct fee for processing of this application.

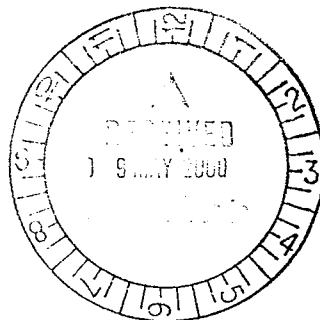
As a guide, when you lodge a DA for the proposal, you must include:

- A cheque for the DA fee and advertising (see Clauses 246 & 252 of the Regulations), made payable to the Department;
- A cheque for \$715, made payable to the Department, for designated development;
- A cheque for \$250, made payable to each of the integrated approval bodies; and
- A cheque for \$110, made payable to the Department, for integrated development administration.

Appendix B – Authority Correspondence

Your Reference : S00/00635
Our Reference : 261708 A1

5 May 2000



Central West Region

Mr G Noonan
Director
Development and Infrastructure
Department of Urban Affairs and Planning
GPO Box 3927
SYDNEY NSW 2001

Dear Mr Noonan

I refer to your request for the Environment Protection Authority's (EPA) requirements for the environmental impact statement (EIS) in regard to the proposed Kaolin Mine at Clarence received by the EPA on 26 April 2000.

The EPA has considered the details of the proposal as provided by the Department of Urban Affairs and Planning (DUAP) and the Applicant at the Planning Focus Meeting held in respect of the development and has identified the information it requires to issue its general terms of approval in Attachment A. In summary, the EPA's key information requirements for the proposal are:

- noise and vibration impacts on residential receptors;
- dust impacts on residential areas;
- the management of wet weather run off;
- the construction and operation of the facility in relation to the neighbouring National Park; and
- preventing any part of the proposed facility from intruding into the National Park particularly stormwater run off from areas denuded of vegetation direct to the National Park.

Based upon the information provided to the EPA, the applicant will require an environment protection licence to carry out scheduled development work.

The applicant will need to make a separate application to the EPA to obtain this licence.

To assist the EPA in assessing the EIS it is requested that the EIS follow the format of the specific EIS requirements as outlined in Attachment A.

The EPA requests that the applicant provide 2 copies of the EIS when lodging its application with the EPA. These documents should be lodged at the Central West Regional Office, PO Box 1388, Bathurst, NSW, 2795.

If you have any queries regarding this matter please contact Terry Knowles on 02 6332 1838.

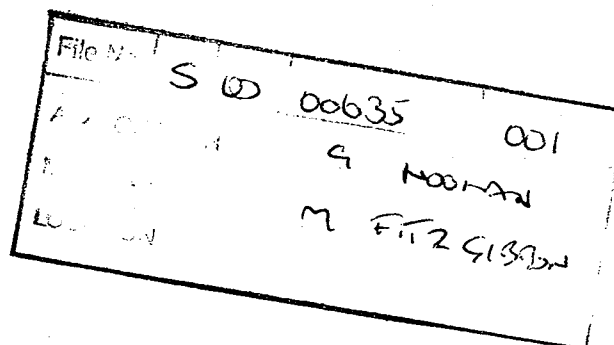
Yours sincerely



DARRYL CLIFT

Head Regional Operations Unit - Central West
for Director-General

cc Newnes Kaolin Pty Ltd
International Environmental Consultants Pty Ltd





Council of the City of Lithgow

180 Mort Street, Lithgow, NSW, 2790. Telephone: (02) 6352 1077

Your Reference:

Our Reference:

Contact:

21186:55390 MF:SRE

Environmental Services

23 March, 2000

International Environmental Consultants Pty Ltd
PO Box 555
BRIGHTON- Le-SANDS NSW 2216

Dear Sir/Madam

**RE: PLANNING FOCUS MEETING FOR A PROPOSED KAOLIN MINE AT
NEWNES JUNCTION**

Thankyou for allowing the opportunity to comment on your proposed Kaolin mine. Following the site inspection and discussions at Council Chambers, Council has identified a number of issues it would like to be discussed in any future Environmental Impact Statement. Issues to be examined should include:-

- 1) Will the Development Application incorporate access to the Clarence Colliery rail loop and will any infrastructure works be carried out on the railway line? Inclusion of these may protect the development from any future legal challenges.
- 2) A noise assessment (including both mining and loading facilities) and amenity impacts, should be undertaken on nearby residents.
- 3) Council would like to see possible scenarios for the rehabilitation of the site. This includes options for the use of the site upon completion of mining activities.
- 4) Discussions should be sought from the Gundungarra aboriginal group.
- 5) Demonstrate that resources on-site are proven to be economically viable and markets are established.

Please do not hesitate to contact Mr Mark Fowler in Council's Environmental and Planning Services Division should you require any additional information in relation to this matter.

Yours faithfully

for
Mr Stuart McPherson
GENERAL MANAGER



COUNCIL OF THE CITY OF LITHGOW

180 Mort Street, Lithgow, NSW, 2790. Telephone: (02) 6352 1077

NSW – First Learning City

Your Reference:

Our Reference:

Contact:

21186:55390 MF

Environmental Services

16 September, 2002

RECEIVED AM

19 SEP 2002

CCSU RECORDS
MANAGEMENT

PlanningNSW
GPO Box 3927
SYDNEY NSW 2001

Attention: Stacey Warren

Dear Madam

PROPOSED NEWNES KAOLIN MINE – FURTHER CONSULTATION FOR DIRECTOR-GENERAL'S REQUIREMENTS.

Thankyou for your letter dated 17th July 2002 regarding the above-mentioned matter. Please be advised that issues raised by Council at the last Planning Focus Meeting remain valid. However, since that time, there has been a considerable amount of public interest in the matter from both the local community and media. Due to its location, especially its close proximity to the Blue Mountains National Park and Newnes Junction, any application should include considerable consultation with the local community.

Key issues that would need to be addressed, but not limited to;

1. Assess the visual impact that this development will have on the surrounding area, including from the Blue Mountains National Park. The applicant should consider the cumulative visual impact of the development with other sand quarries and coal collieries located in the Newnes Junction and Clarence areas.
2. An assessment on the proposed means of access to the site for employees. Also, how will the development fit in with transport systems currently operating from Clarence Colliery, namely the rail loop.
3. Demonstrate what potential final land uses can be formulated for the site. How the site can be managed on completion of mining at the site, as well as security and safety issues.
4. Finally, any application should discuss the cumulative impacts the development will have on the surrounding environment, including cumulative impacts associated with other sand and mining activities in the surrounding area. Cumulative impacts that should be discussed include, noise, visual impact, ground and surface water and traffic.

INFP 11

19 SEP 2002

Address Correspondence to: General Manager, PO Box 19, Lithgow, 2790
Fax No.: (02) 6351 4259 • Email: glcc@lithgow.nsw.gov.au
Website: www.lithgow.com

Please do not hesitate to contact Mr M Fowler on 63 549954 in Council's Environmental and Planning Services Division should you require any additional information in relation to this matter.

Yours faithfully

A handwritten signature in black ink, appearing to read 'Mr Rufus', with a long horizontal flourish extending to the right.

Mr Ian Rufus
PLANNING & DEVELOPMENT MANAGER

For

Mr Iain Stewart
GENERAL MANAGER

NSW Department of Land and Water Conservation

FAX

To:

Margot Jamieson
IEC

Fax No: 95990338

Phone:

Date: 5 June 2000

Pages (following cover sheet): 0

From:

Matt Gray
Catchment Manager
Lithgow

Fax No: (02) 6352 2326

Phone: (02) 6351 3842

e-mail: mgray@dlwc.nsw.gov.au

Time: 13:10



Coxs River Catchment (Lithgow), P.O. Box 95 Lithgow NSW 2790

☒ Routine☐ Urgent☐ Confidential**Subject: Proposed Kaolin Mine Project at Newnes Junction**

Dear Margot,

Further to our recent discussions regarding the above project, please find below this Department's comments to assist the proponent construct a suitable EIS.

1. The proponents should prepare a comprehensive Soil and Water Management Plan for the project. This plan should address all aspects of soil disturbance, storage and movement; retention of any mobilised sediments, and how they intend to deal with water flowing onto, through and off the site.
2. The above plan should also address the impact, if any, of the project on the significant groundwater resources of the area. A hydrogeological study should be undertaken to determine this.
3. The stages of rehabilitation and final landform should, of course, form a major part of any planning document

Regards

Matt Gray

Catchment Manager

LITHGOW

[Document2]



NSW DEPARTMENT OF MINERAL RESOURCES
Minerals and Energy House, 29-57 Christie Street
St Leonards, NSW 2065, Australia
P.O. Box 536 St Leonards 1590
Phone (02) 9901 8888 · Fax (02) 9901 8777
DX 3324 St Leonards · www.slnsw.gov.au/mineral_resources

Mr Robert Byrnes
Director
International Environmental Consultants
P O Box 555
BRIGHTON-LE-SANDS NSW 2216

Dear Robert

Re: Proposed Kaolin Mine at Newnes Junction

I refer to the Planning Focus held on 14 March 2000 for the above project. As a general guide, the topics listed on Attachment "A" may need to be covered in the EIS, in addition to any other matters relevant to the proposal in its local context.

The Environmental Impact Statement should cover the following issues which are relevant to this site:

- Resource definition and feasibility
- Markets
- Cumulative impact
- Noise impact on nearby residences
- Vegetation management plan
- If threatened species are present, the management options that would be undertaken
- Sediment and erosion controls. (1 in 50 year event designs, 1:5 batters on unconsolidated slopes)
- If fuel is to be stored on site, bunding designs need to be shown including emergency responses
- Mining plan and method
- Proposed depth of workings
- The relevant dust control methods including conveyor belt system
- Progressive rehabilitation plans including topsoil management
- Final landuse options and the reason for the final choice of landuse

It is also worthy of note that the company would be required to submit a Mining Operations Plan to the Department before commencement of activities. It may be useful to provide information in the EIS that also can be consistently transferred to the Mining Operations Plan.

The following points regarding title issues are submitted.

- A mining lease is required to mine for kaolin on Crown land.
- A licence may be required from the Department of Land and Water Conservation for the sand to be recovered from the same operation.
- Any lease application should cover both the pit area and any land to be used for infrastructure, including the land which the conveyor and road to the rail loop traverse (this will require consent pursuant to Section 59 of the Mining Act 1992 for that part which conflicts with Consolidated Coal Lease No.705).
- Pursuant to Section 61 of the Mining Act 1992 the Chief Inspector of Coal Mines must be satisfied that the proposed operations will have no adverse effect on coal mining operations.
- The proposed site partly affects Authorisation No. 307.
- The proponent should check that the residences at Newnes Junction do not fall within 200 metres of the lease application area otherwise consent pursuant to Section 62 of the Mining Act 1992 will be required.
- An historic search of the title to the land should be undertaken to determine if Native Title has been extinguished otherwise the Right to Negotiate provisions of the Native Title Act will need to be complied with prior to the grant of any lease.

It would be advisable for the proponent to survey and photograph the Newnes Junction houses prior to mining to ensure that if damage occurs as a result of mining, it can be clearly identified.

Yours sincerely



Denis Casey
Senior Project Officer, Resource Development

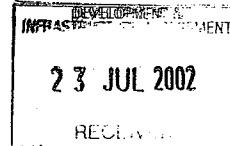




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DX 3324 St Leonards
www.minerals.nsw.gov.au
ABN: 68 040 288 347

19 July 2002

Mr C Ritchie
Acting Senior Environmental Planner
Major Development Assessment
PlanningNSW
GPO Box 3927
SYDNEY NSW 2001



Dear Chris

Newnes Kaolin Mine

Thank you for your advice re the above. There are no changed circumstances, as far as the DMR is concerned, that would require any change to the Director-General's requirements.

Yours sincerely

Denis Casey
Assistant Director
Resource Development



**NSW
NATIONAL
PARKS AND
WILDLIFE
SERVICE**

Margot Jamieson
Senior Environmental Planner
International Environmental Consultants
PO Box 555
Brighton-Le-Sands
NSW 2216

Dear Ms Jamieson

Re: Proposed Kaolin Mine- Newnes Junction

Thank-you for your recent correspondence in which you consult with the National Parks & Wildlife Service (NPWS) regarding the preparation of an Environmental Impact Statement (EIS) for the above. The NPWS apologises for the delay in responding.

The NPWS understands that Newnes Kaolin Pty Ltd propose to develop a kaolin mine on the ridgeline between the existing Rocla Quarry and Clarence Colliery pit top adjacent to Newnes Junction. The proposed extraction area is bounded to the west by the colliery rail loop, Rocla Quarry to the south, a coal reject emplacement to the north and the Blue Mountains National Park to the east.

The NPWS has reviewed the information provided in the Planning Focus document. Please find attached a copy of the NPWS guidelines for 'Developments adjoining National Park'. The NPWS has insufficient information to make detailed comment on the proposal, however, provides the following specific comments to assist you in the preparation of the EIS.

As identified in the Planning Focus report, the eastern boundary of the site is directly adjacent to Blue Mountains National Park. The site is located on a relatively steep slope which drains to the east directly into the National Park. The NPWS notes that the site is less than 2.5km from the boundary of the Wollemi Wilderness Area. The Wollemi Wilderness is the largest declared wilderness area in the state covering an area of 288 340ha. Impacts of existing mining activities in areas adjacent to the Wilderness Area have been identified as a key threat to wilderness values including associated vegetation disturbances, road construction, cliff collapse and adverse impacts on water quality.

43 Bridge Street
PO Box 1967
Hurstville NSW
2220 Australia
Tel: (02) 9585 6444
Fax: (02) 9585 6555
www.npws.nsw.gov.au

The NPWS notes that area identified for the proposed mining pit contains minor upper tributaries of the Wollangambe River which runs through the Wollemi Wilderness Area and joins the Colo River. Both rivers are regarded as having significant conservation value and have been identified as 'wild and scenic' rivers under section 61 of the *National Parks & Wildlife Act*. Both rivers also have high recreational useage. Catchment disturbance and pollution in these waterways from activities outside the Park can have serious impacts downstream on the rivers hydrology, habitat and recreational values.

Given the highly sensitive nature of the site and the high level of site disturbance associated with the proposed activity the potential impacts of this proposal on the National Park and on the Wilderness Area and high conservation value rivers therein are of concern to the NPWS.

Key areas of impact and concern that the NPWS considers would need to be comprehensively addressed in the EIS include:

- Impacts on existing native flora and fauna within the subject area

The subject area is currently contains native vegetation contiguous with the adjacent National Park. A search of the NPWS ATLAS database indicates the following threatened flora and fauna species have previously been recorded in the surrounding area and should be considered in any development proposal:

Acacia bynoeana
Persoonia acerosa
Boronia deanei

Powerful Owl
Yellow-bellied Glider

- Noise and dust impacts on adjacent areas of the Park-particularly given the highly dispersable nature of kaolin
- Impacts on the existing groundwater system within the site and adjacent areas of National Park-including the location and impact on any perched groundwater tables and swamp areas within and adjacent to the site.
- Impacts on surface hydrology including impacts on exisiting flow volumes and water quality from the site to Wallangambe River, management of mine discharge, stormwater and sedimentation controls and mine water supply requirements.
- Visual impacts of the proposed activity on the adjacent National Park including Bald Trig from which the site is visible
- Direct impacts on NPWS boundary including adequacy and longterm management of proposed buffer zones
- Rehabilitation and longterm management of the site

The Planning Focus report indicates that the final proposed landuse is the creation of a 'lake' from surface water and pit seepage. Preliminary information indicates that the lake would be surrounded by revegetated benches ranging from a total height of 30 to 75m. The NPWS is concerned about the proposal to leave a water storage body on the site after mining activities have ceased.

Reasons for this include:

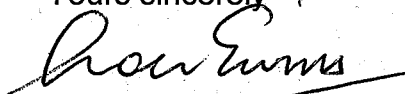
- Potential impacts on the adjacent National Park caused by this major permanent change to surface and groundwater hydrology
- Responsibility for the longterm management of such a water body including water quality and public safety
- Significant environmental implications for the National Park of any failure of water holding capacity

It is suggested in the report that the lake may offer potential for passive recreational facilities. The NPWS notes that any public use raises further questions regarding public access, safety and water quality.

The NPWS considers that should the proposal proceed the entire mining site should be revegetated progressively and immediately upon completion of mining. All water holding structures should be removed and contoured as part of the final landscape. Soil erosion and sedimentation control structures should be installed to minimise runoff from the site until complete revegetation has occurred. This work is considered essential to minimise long term impacts of sediment pollution and erosion on Blue Mountains National Park. The rehabilitation strategy should also include an ongoing monitoring strategy to monitor erosion and sedimentation control and impacts on water quality of rehabilitated mine areas.

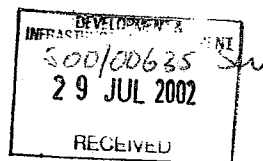
If you have any questions regarding this advice please contact Jacqueline Breakspear, Conservation Planning Officer on (02) 9585 6675.

Yours sincerely

 18/68/00

Lou Ewins

A/Manager Conservation Programs & Planning Division
Central Directorate



Mr Chris Ritchie
Acting Senior Environmental Planner
Major Development Assessment
PlanningNSW
GPO Box 3927
SYDNEY NSW 2001

**NSW
NATIONAL
PARKS AND
WILDLIFE
SERVICE**

ABN 30 841 387 271

Our Ref.: SYZ 96/46
Your Ref.: S00/00635

Dear Chris

**RE: PROPOSED NEWNES KAOLIN MINE – FURTHER
CONSULTATION FOR DIRECTOR-GENERAL'S
REQUIREMENTS**

Thank you for your letter dated 11 July 2002 in which you consulted with the National Parks and Wildlife Service (NPWS) regarding the preparation of an Environmental Impact Assessment (EIS) for the above.

The NPWS has a statutory responsibility for the protection and care of native flora, native fauna and Aboriginal objects and places, and for the management of NPWS estate. Accordingly the NPWS has an interest in ensuring that potential impacts to these attributes are appropriately assessed.

The NPWS understands from your letter that there is no change to the proposal and that new requirements are being issued to supersede requirements issued on 15 May 2000 which have now expired.

The NPWS therefore refers you to its previous submission (see copy attached).

It is recommended that the matters referred to in the attached guidelines titled "General Guidelines for Impact Assessment" be addressed in the EIS. These guidelines also provide information on any approvals that may be relevant under the National Parks and Wildlife Act and a summary of the NPWS' databases.

It is requested that any EIS forwarded to the NPWS for comment state the reasons for the referral. The NPWS typically comments on EISs where there is a statutory concurrence or approval role for the NPWS, or where there is likely to be a threat to NPWS reserves or regionally significant conservation values. The attached guidelines may be used to assist in determining whether the EIS requires referral to the NPWS for comment, concurrence or an approval.

The following additional comments are made.

Conservation Programs
& Planning Division
Central Directorate
Level 6
43 Bridge Street
P.O. Box 1967
Hurstville NSW
2220 Australia
Tel: (02) 9585 6678
Fax: (02) 9585 6442
www.npws.nsw.gov.au

Commonwealth referral

PlanningNSW would be aware that the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* may be triggered if the proposal impacts on (1) a declared World Heritage property; (2) nationally listed threatened species and ecological communities; (3) listed migratory species. It is advised that the proponent be requested to consider whether referral to the Commonwealth Environment Minister is required.

The NPWS retains concern regarding the potential impacts of the proposal on the adjoining Blue Mountains National Park and Wollemi Wilderness Area (see previous submission), both of which have since been declared part of the Blue Mountains World Heritage Area.

Flora and fauna

The EIS should include comprehensive assessment of potential direct and indirect impacts on flora and fauna and their habitats, in particular threatened species. This assessment should be updated to address threatened species listed since the previous EIS requirements were issued and species which have since been recorded in the area. These may include but not be limited to:

- Blue Mountains Water Skink
- Bathurst Copper Butterfly

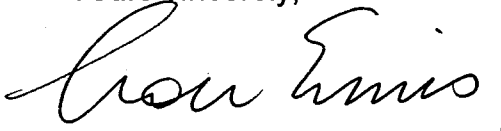
The indirect impacts of subsidence, particularly drainage of swamps which may be habitat for the Blue Mountains Water Skink should also be considered.

Aboriginal cultural heritage

The NPWS recommends that consultation with Aboriginal groups is inclusive ie more than one Aboriginal group may need to be consulted (refer to report prepared for Planning Focus Meeting, March 2000) as part of the assessment of significance of the area. Please refer to the attached guidelines for information on assessment methods. Also attached are NPWS guidelines for IDA referral should approval under the IDA process be required.

Please contact, Megan Phillips, A/ Conservation Planning Officer on (02) 9585-6007 if you have any questions concerning this matter.

Yours sincerely,



29/7/02

Lou Ewins

**Manager, Conservation Planning Unit
Central Conservation Programs and Planning Division**

258.5395 00/XX
Mr Wagg



www.rta.nsw.gov.au

**Roads and Traffic
Authority**
ABN 64 480 155 255

Western Region

51-55 Currajong Street
Parkes NSW 2870
Telephone (02) 6861 1444
Facsimile (02) 6861 1414
PO Box 334
Parkes NSW 2870
DX 20256 Parkes

Sen Environmental Planner
International Environmental Consultants Pty Ltd
PO Box 555
BRIGHTON-LE-SANDS NSW 2216

**Lithgow Council Area
Proposed Kaolin Mine
Newnes Junction, NSW**

Dear Sirs,

Attention Margot Jamieson

I refer to your letter dated 11th September 2000, and the accompanying details for the subject project and apologise for the delay of reply.

The development has been perused.

There are no special conditions that need to be included within the Environmental Impact Statement.

However if any loads are required to leave the site and travel by the arterial road system to outside markets, as required by legislation the developer is to ensure that all loads leaving the site are to be covered to prevent loose materials from falling to the roadway.

Yours faithfully

R T Wagg
For
S B Warrell
Road Safety Traffic & Development Manager
Western Region
19th October 2000.



Department of the Environment and Heritage

Mr Chris Ritchie
Acting Senior Environmental Planner
Major Development Assessment
PlanningNSW
GPO Box 3927
SYDNEY NSW 2001

Accreditation of assessment process – Newnes Kaolin Mine
Your reference: S00/00635

I am writing in regard to your letter of 16 July 2002 outlining the State process and the requirement for the company to recommence the environment assessment process under the NSW *Environmental Planning and Assessment Act 1979* as the environmental impact statement had not been lodged in the required two year period. You also invited Environment Australia (EA) to comment on the Director-General's Requirements (DGRs) which were attached.

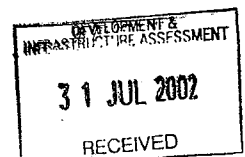
It is noted that this proposal is a controlled action under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and that EA will now be able to consider accreditation with the State, as a level of assessment, following lodgement of Preliminary Information.

EA has no detailed comment to make on the DGRs. We note that they are appropriate and are written in such a way that Commonwealth matters are likely to be properly addressed by the proponent, should accreditation of the NSW assessment process occur. However, in that event we may request that the proponent add some additional detail on the EPBC matters protected. These issues would fall under the broader topic headings in the DGRs.

Thank you for the opportunity to consider the DGRs.

Malcolm Forbes
Assistant Secretary,
Environment Assessment & Approvals Branch

26 July 2002





Department of the Environment and Heritage

Mr Chris Wilson
Director
Major Development Assessment Branch
Planning NSW
GPO Box 3927
SYDNEY NSW 2001

Dear Mr Wilson

**Newnes Kaolin Pty Limited – Newnes Kaolin Friable Sandstone Mine Project,
Newnes Junction near Lithgow, NSW (Reference: 2002/620)**

I am writing on behalf of the Minister for the Environment and Heritage,
the Hon David Kemp, MP, (the Minister) concerning the decision on assessment approach
for the assessment of the above action under Part 8 of the *Environment Protection and
Biodiversity Conservation Act 1999* (EPBC Act).

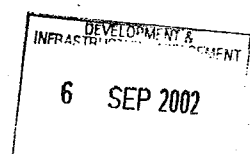
Section 91 of the EPBC Act states *inter alia* that, within 10 business days after making a
decision on the assessment approach, the Minister must give written notice of the decision to
the appropriate Minister of the State or Territory, if the action is to be taken in a State or self-
governing Territory, and a controlling provision applies.

On 20 April 2002 a delegate for the Minister made a decision that approval was required for
the above action. In July 2002 Preliminary Information for the action was received under
section 86 and following receipt of further requested information was accepted on
7 August 2002 for decision on the assessment approach under Part 8 of the EPBC Act.

The assessment approach for the action has now been considered under the EPBC Act and I
have decided, as a delegate for the Minister, that assessment by an accredited process must
be conducted, that is the Environmental Impact Statement being conducted under the New
South Wales *Environmental Planning and Assessment Act 1979*. One of the requirements of the
accredited assessment approach includes an undertaking that the New South Wales
assessment will meet Commonwealth requirements. These include all requirements set out
in Schedule 1 to the most recent draft of the bilateral agreement between the Commonwealth
and New South Wales. This includes the need for an assessment process which includes
open public review and publication of notices in a paper of national circulation.

Yours sincerely

Malcolm Forbes
Assistant Secretary
Environment Assessment & Approvals Branch
3 September 2002



Appendix C – Processing of the Kaolin Ore

APPENDIX C – Processing of the Kaolin Ore

The processing plant for the ore will be covered under a separate EIS once a site has been finalised for the operation. While approval for the processing area is not being sought in connection with this EIS, the following conceptual information is provided in order to give as complete a picture as possible of the operations.

Location

The plant will be located at a site with:

- ☐ **rail access** – to enable the ore to be brought to site by rail from Newnes Junction;
- ☐ **sufficient land area** – in order to have adequate room for stockpiles, plant buildings, thickeners and load-out facilities etc., an area of approximately 8 ha would be required;
- ☐ **considerable quantities of water** – while the plant will recirculate large quantities of water, there will be no net liquid effluent from the plant and an overall make-up of around 730 L/min of good quality, fresh water is required;
- ☐ **power** -the plant will require in the order of 2.5 MW of power. This power may be available from the NSW energy grid or from a privately owned, remote operation, co-generation gas plant; and
- ☐ **proximity to transportation routes** – the various products produced at the processing plant would be transported to market by a variety of trucks with an average capacity of around 25 t. Virtually all the markets for the products would be through Sydney. To achieve the required economic throughput in a socially responsible nominated working window, a throughput of 450 t per hour is necessary. To shift 450 t of products by 25 t truck would involve 18 trucks per hour, ie. one truck or two truck movements every 3.3 minutes.

Given the above criteria, it is considered environmentally more responsible and financially more economical to locate the processing plant in an industrial area on the outskirts of Sydney. While the exact position of the site is not known, the parameters required for the site will determine where the processing plant will be located.

Processing Plant

A processing plant for extraction of kaolin from the sandstone ore, has been designed to conceptual stage by Roger Smith & Associates Pty Ltd.

The processing plant will be required to handle two types of ore and the plant will be designed to handle initially up to half a million tonnes per annum. The plant design enables duplication of the processing lines to ultimately reach the 1.4 million tonnes per annum goal.

Some items of equipment such as pumps, cyclones etc, have little or no resident volume and can be readily swapped from off-premium to standard ore feed with little or no cross contamination. Other equipment (pug mills, attrition cells, thickeners etc.) contain large volumes of resident slurry and the costs and lost time involved with cleaning out these devices between different ore types would be prohibitive. In practice, the changeover from one ore type to the other will be automatic and remotely controlled from a control cabin by the operator. The plant will also be designed to produce a high density clay slip, a dry bagged kaolin, or a combination of both, as dictated by the market.

It is intended that the initial plant will produce a high density kaolin clay slip, a white silica sand and fine silica. When the plant is up and running, it will be extended to produce higher grades of kaolin and higher grade silica products. The fine silica produced will also be further treated to produce silica flour.

Train Unloader and Stockpile

Train unloading will occur by bottom dumping over a small bin. A simple belt feeding system will control feed onto a tripper conveyor which will elevate and stockpile material in an identical manner to that at Newnes Junction.

Pug Mills

Initial size reduction will have been completed at the mine by the crusher. At the processing site, a rolling/abrading action will be used to break up the remaining aggregates and liberate the kaolin. A high density, wet Pug Mill will be used to do this. At any one time the Pug Mill will contain several tonnes of material and it is impractical to clean it out when changing ore types. It will therefore be necessary to duplicate the mill and a simple diverter gate on the feed chute will switch feed from one circuit to the other.

Primary Screen

Coarser pebbles and grits will be screened out to produce a minus 2 mm feed to the remainder of the circuit. The Mogensen Semi-Probability type screen has been chosen. This screen has 5 cascade screens and off these two oversize fractions will be produced as required. It will also be necessary to add washwater to the screen.

Coarse Pebbles, Sandstone, Ironstone etc

Coarse material removed from the ore will be sold either as decorative gravel or as filter gravel, driveway gravel etc.

Decorative gravel is composed of white quartz pebbles which have a high value when clean. The gravels will be taken from the coarse screens and conveyed to a conventional, elevated, truck loading bin which will discharge to a stockpile if filled beyond capacity. Harder lumps of sandstone, ironstone and some pebbles will be separated out for sale as lower quality gravels.

Cyclone Desliming Circuit

Because of the high clay content of the sandstone, it is necessary to dilute the feed to achieve a satisfactory separation of the minus 75 µm clay/silt fraction from the minus 2 mm plus 75 µm sand fraction. The pulp will be relatively viscous and a high energy gravity separation device will be required. Cyclone desliming, using different sized cyclones will be used. The circuit will consist of three stages of desliming and to conserve water, dilution water for the second stage will be provided from the overflow of the final dewatering stage.

Silica Sand

The final dewatering cyclone will discharge clean sand onto a conventional drainage pad. The cyclone will be mounted on a tower and swivel arm to allow stacking onto a donut shaped drainage heap. This is a cheap and simple temporary system that allows drained sand to be loaded out from one point while wet sand is being discharged further around the heap. In the initial stages, until the process development testwork has been done, the sand would be sold as a concrete sand. As soon as practicable, the sand would be further processed to produce high quality silica sand for the glass industry and for other industries requiring a premium white silica product.

Fine Sand Circuit

Fine silica needs to be extracted from a very dilute clay slurry. The volume of slurry will be reduced by counter current washing in the final desliming stages and a hydrosizer will be used to provide initial desliming. This will remove the bulk of the water and fine clay and reduce the volume to a manageable level. Small, high pressure cyclones will be used to make the 10 µm split. The number of stages will ultimately depend on market requirements.

It is impractical to empty and clean out the hydrosizers, so a duplicate circuit will be installed to handle the off-white kaolin and associated fine silica.

Kaolin Circuit

It is anticipated that the kaolin type clay in the Newnes deposit will settle to a density of about 25-30% solids w/w under gravity in a thickener. Clays may flocculate and settle naturally and it may be feasible to run the thickener without the use of flocculants. The settling rate may be improved by the use of flocculants but the final density is unlikely to be any higher.

The thickener underflow will be dewatered to achieve the pulp density required to market the new product. A decanter type centrifuge is expected to generate densities as high as 65% solids. By the addition of suitable reagents it should be possible to make a 60% solids slurry that is about the consistency of cream. This is a common practice and kaolin slurry of this specification is standard feed for many industries. Storage for shipment is in tanks fitted with low energy, rake type agitators. The slurry is readily pumped and transported by conventional road tankers.

This circuit will be duplicated to handle off-white kaolin.

Dry Bagged Kaolin Circuit

Some markets require a high value dry bagged kaolin product, and equipment will be provided to allow this product to be made.

To produce this product, a filter press will be used to filter the kaolin. For the plant a horizontal automatic pressure filter will be used and a moving strand, tunnel drier will dry the filter cake. Dried filter cake will be milled using a multiple hammer, swing hammer mill. Product sizing will be controlled by air sizing with oversize being returned to the hammer mill feed.

A conventional bagging system incorporating a weightometer will allow the bagging of product into 25 or 50 kg paper bags or 1 tonne bulker bags.

Appendix D – Flora and Fauna Study

Appendix D1 – Fauna Survey Methodology

Appendix D2 – Floristic Species List

Appendix D3 – Fauna Species List

Appendix D4 – 8-Part Assessment

Appendix D5 – Frog Report

Appendix D1 – Fauna Survey Methodology

Appendix D1 - Fauna Survey Methodology

A number of survey techniques were employed, each targeted at a particular fauna group to provide an accurate and thorough description of the fauna species present within the areas of the kaolin mine. A detailed description of the survey techniques and survey effort are provided in the following sections.

1.1 Trapping

Trapping was conducted using small and medium sized Elliott and hair tube traps, the dimensions of each are shown in Table 1.1. All small traps were baited with a mixture of rolled oats, peanut butter and honey; all large traps were baited with raw chicken necks or wings. Each hair tube trap was fitted with “Scotch” double-sided adhesive tape (19 mm) to collect the hairs. Tapes used in the hair tube traps were analysed by Ms Barbara Triggs as either definite or probable.

Table 1.1 - Trap Specifications

Trap Type	Trap Size	Trap Dimensions
Elliott	Small	32 x 9 x 10 cm
Elliott	Medium	46 x 15 x 15 cm
Hair Tube	Small	10 cm (diameter)
Hair Tube	Medium	20 cm (diameter)

Traps were laid within the vegetation along tracks numbered 2 and 6 (refer to Figure 5.3), at intervals of approximately 15 m. These two lines were chosen for the survey as they were representative of the entire study area, and encompassed the wet area and creeklines previously referred to. Both trap lines traversed north and south facing slopes, ridge tops and gullies. The small and large sized traps were placed in a regular pattern, as described in Table 1.2.

A total of 85 traps were employed over three nights from the 20 March to 22 March 2000, with a total trapping effort of 255 trap nights.

1.2 Spotlighting

Spotlighting was used primarily to target nocturnal arboreal species including both birds and mammals in areas where canopy structure was developed sufficiently to provide fauna habitat. Much of the forest was disturbed by the 1997 fires, and while regeneration is advancing, many areas are yet unable to support a diverse or abundant faunal assemblage.

Vehicle based spotlighting was conducted during the periods of mammal trapping, and lasted for approximately 3 hours each night, with the existing tracks traversing the area being sampled. Two 50 W hand-held spotlights were used during the surveys.

Table 1.2 - Trapping Patterns

Eastern Line / Track 6 (app. 800 m)		Western Line / Track 2 (app. 600 m)	
Trap Number	Trap Type	Trap Number	Trap Type
1	Large Elliot	1	Large Hair Tube
2	Small Hair Tube	2	Medium Elliot
3	Medium Elliot	3	Medium Elliot
4	Large Hair Tube	4	Medium Elliot
5	Medium Elliot	5	Large Elliot
6	Small Hair Tube	6	Medium Elliot
7	Medium Elliot	7	Small Hair Tube
8	Large Elliot	8	Medium Elliot
9	Medium Elliot	9	Small Hair Tube
10	Small Hair Tube	10	Large Hair Tube
11	Medium Elliot	11	Small Hair Tube
12	Large Hair Tube	12	Medium Elliot
13	Medium Elliot	13	Small Hair Tube
14	Small Hair Tube	14	Large Elliot
15	Medium Elliot	15	Small Hair Tube
16	Large Elliot	16	Medium Elliot
17	Medium Elliot	17	Small Hair Tube
18	Small Hair Tube	18	Medium Elliot
19	Medium Elliot	19	Large Hair Tube
20	Large Hair Tube	20	Medium Elliot
21	Medium Elliot	21	Small Hair Tube
22	Small Hair Tube	22	Medium Elliot
23	Medium Elliot	23	Large Elliot
24	Large Elliot	24	Medium Elliot
25	Medium Elliot	25	Small Hair Tube
26	Small Hair Tube	26	Medium Elliot
27	Medium Elliot	27	Large Hair Tube
28	Large Hair Tube	28	Medium Elliot
29	Medium Elliot	29	Small Hair Tube
30	Small Hair Tube	30	Medium Elliot
31	Medium Elliot	31	Large Elliot
32	Large Elliot	32	Medium Elliot
33	Medium Elliot	33	Small Hair Tube
34	Small Hair Tube	34	Medium Elliot
35	Medium Elliot	35	Medium Elliot
36	Large Hair Tube	36	Large Hair Tube
37	Medium Elliot		
38	Small Hair Tube		
39	Medium Elliot		
40	Large Elliot		
41	Medium Elliot		
42	Small Hair Tube		
43	Medium Elliot		
44	Large Hair Tube		
45	Medium Elliot		
46	Small Hair Tube		
47	Medium Elliot		
48	Small Hair Tube		
49	Small Hair Tube		

1.3 Call Back Tapes

Nocturnal birds and mammals are often only detected when they vocalise to mark their territory or attract a mate. This behaviour can be utilised to elicit a response from species which otherwise may not be detected. The tapes consist of recordings of the species and may contain a number of different call types, which are often successful in provoking a return call from members of the species if present in the area. The broadcasting of calls may also attract members of the species to the area in search of a mate, thereby enabling them to be directly observed through subsequent spotlighting of the area.

Call back tapes were used to conduct targeted searches for rare and endangered species of mammals and nocturnal birds that have previously been found in the area. Targeted species are listed below in Table 1.3. Calls were broadcast from the ridge top in a central location, where the calls would be heard from all areas on the study site.

Upon arriving at the survey site the survey team remained still and quiet for up to ten minutes to allow natural activities of the wildlife to resume before surveys begun. Calls of each species were played individually for a period of 3 minutes, which was then followed by a 2 minute period of silence to detect any return calls from the species. Spotlighting was then conducted in the area on completion of call back surveys in a further attempt to observe the species.

Table 1.3 - Species Surveyed through Call Back Tapes

Common Name	Scientific Name
Powerful Owl	<i>Ninox strenua</i>
Barking Owl	<i>Ninox connivens</i>
Masked Owl	<i>Tyto novaehollandiae</i>
Sooty Owl	<i>Tyto tenebricosa</i>
Marbled Frogmouth	<i>Podargus ocellatus</i>
Southern Boobook	<i>Ninox novaeseelandiae</i>
Barn Owl	<i>Tyto alba</i>
Grass Owl	<i>Tyto capensis</i>
White-throated Nightjar	<i>Eurostopodus mystacalis</i>
Koala	<i>Phascolarctos cinereus</i>
Yellow-bellied Glider	<i>Petaurus australis</i>
Sugar Glider	<i>Petaurus breviceps</i>
Squirrel Glider	<i>Petaurus norfolcensis</i>

1.4 Spotlighting

Bird surveys were conducted at three locations within the study area, as shown on Figure 5.3. Bird surveys were conducted within the first 2 hours of sunrise and included the visual and aural detection of birds. Bird surveys lasted for 20 minutes at each site. Specific bird surveys were supplemented by incidental observations. Nocturnal bird species were surveyed through spotlighting and the use of specific call back tapes, as previously described.

1.5 Spotighting

Three sights were selected within the area and active searches for herpetofauna conducted during the warmest part of the day around noon. Searches lasted for 20 minutes at each site and involved inspection of tracks, large rocks and leaf litter, as well as lifting and rolling of logs and rocks. Specific surveys were supplemented by incidental observation.

1.6 Incidental Sightings

All incidental sightings of fauna while conducting fieldwork were recorded. These included direct visual sightings and indirect evidence such as scats, diggings and burrows etc.

Appendix D2 – Floristic Species List

Appendix D2 - Floristic Species List

Table 2.1 - Floristic Species List

Scientific Name	Common Name	Corkery & Co (1993)	Current Survey
<i>Acacia decora</i>	Western Golden Wattle	✓	
<i>Acacia longifolia</i>	Sydney Golden Wattle	✓	✓
<i>Acacia myrtifolia</i>	Myrtle Wattle	✓	
<i>Acacia obtusifolia</i>		✓	
<i>Acacia parramattensis</i>	Black Wattle	✓	
<i>Acacia terminalis</i>		✓	✓
<i>Acacia ulcifolia</i>	Prickly Moses		✓
<i>Amperia xiphoclada</i>	Broom Spurge	✓	✓
<i>Amphipogon strictus</i>	Greybeard Grass	✓	
<i>Anisopogon avenaceus</i>	Oat Spear Grass	✓	
<i>Aristida ramosa</i> var <i>speciosa</i>			✓
<i>Arrhenechites mixta</i>	Purple Fireweed	✓	
<i>Astrotricha longifolia</i>	Longleaf Star-hair	✓	
<i>Baeckea linifolia</i>	Swamp Baeckea	✓	
<i>Baeckea utilis</i>	Mountain Baeckea	✓	
<i>Banksia cunninghamii</i>		✓	
<i>Banksia ericifolia</i>	Heath Banksia	✓	
<i>Banksia marginata</i>	Silver Banksia	✓	
<i>Banksia oblongifolia</i>			✓
<i>Banksia spinulosa</i>	Hairpin Banksia	✓	✓
<i>Baumea nuda</i>		✓	
<i>Baumea rubiginosa</i>	Soft Twig-rush	✓	
<i>Billardiera scandens</i>	Apple Berry	✓	
<i>Blechnum cartilagineum</i>	Fishbone Water-fern		✓
<i>Blechnum nudum</i>	Fishbone Water Fern	✓	
<i>Boronia anemonifolia</i>	Sticky Boronia	✓	
<i>Boronia deanei</i>		✓	
<i>Boronia microphylla</i>	Small-leaved Boronia	✓	✓
<i>Bossiaea heterophylla</i>			✓
<i>Caladenia cucullata</i>		✓	
<i>Caladenia dimorpha</i>			✓
<i>Calytrix tetragona</i>	Fringe-myrtle	✓	
<i>Callicoma serratifolia</i>	Blackwattle	✓	
<i>Cassinia aculeata</i>	Dolly Bush	✓	
<i>Caustis flexuosa</i>	Old-mans Whiskers	✓	✓
<i>Celmisia longifolia</i>	Snow Daisy	✓	
<i>Centrolepis fascicularis</i>		✓	
<i>Chionochloa pallida</i>	Redanther Wallaby Grass	✓	
<i>Comesperma retusum</i>	Myrtle-leaf Milkwort	✓	
<i>Conyza</i> sp.	Fleabane	✓	
<i>Culcita dubia</i>	Soft Bracken		✓
<i>Dampiera stricta</i>	Blue Dampiera	✓	✓
<i>Danthonia monticola</i>	Wallaby Grass	✓	
<i>Danthonia tenuior</i>	Wallaby Grass	✓	
<i>Daviesia latifolia</i>	Gorse Bitter-pea	✓	✓
<i>Daviesia squarrosa</i>			✓
<i>Daviesia ulicifolia</i>	Gorse- Bitter-pea		✓
<i>Deyeuxia angustifolia</i>		✓	
<i>Deyeuxia decipiens</i>		✓	
<i>Deyeuxia parviseta</i>		✓	
<i>Deyeuxia quadriseta</i>		✓	

Table 2.1 - Floristic Species List

Scientific Name	Common Name	Corkery & Co (1993)	Current Survey
<i>Dianella revoluta</i>	Spreading Flax Lilly	✓	
<i>Dianella tasmanica</i>	Mountain Flax-lilly	✓	
<i>Dichelachne rara</i>	Sparse Plume Grass	✓	
<i>Dichondra repens</i>	Kidney Weed	✓	
<i>Dillwynia floribunda</i>		✓	
<i>Dillwynia phyllicoides</i>	Eggs and Bacon	✓	
<i>Diuris sulphurea</i>	Tiger Orchid		✓
<i>Drosera binata</i>	Forked Sundew	✓	
<i>Drosera peltata</i>	Pale Sundew	✓	
<i>Drosera spatulata</i>	Common Sundew	✓	
<i>Empodisma minus</i>	Tanglefoot	✓	
<i>Entolasia stricta</i>	Wiry Panic	✓	
<i>Epacris microphylla</i>	Coral Heath	✓	
<i>Epacris obtusifolia</i>		✓	
<i>Epacris paludosa</i>	Swamp Heath	✓	
<i>Epacris pulchella</i>		✓	✓
<i>Epilobium</i>	Smooth Willow-herb	✓	
<i>billardierianum</i>			
<i>Eucalyptus blaxlandii</i>	Blaxland's Stringybark	✓	✓
<i>Eucalyptus</i>	Mountain Gum	✓	
<i>dalrympleana</i>			
<i>Eucalyptus dives</i>	Broad-leaved	✓	
	Peppermint		
<i>Eucalyptus ligustrina</i>	Privet-leaved	✓	
	Stringybark		
<i>Eucalyptus mannifera</i>	Brittle Gum	✓	
<i>Eucalyptus oreades</i>	Blue Mountains Ash	✓	
<i>Eucalyptus pauciflora</i>	Snow Gum	✓	
<i>Eucalyptus piperita</i>	Sydney Peppermint	✓	✓
<i>Eucalyptus radiata</i>	Narrow-leaved	✓	✓
	Peppermint		
<i>Eucalyptus sclerophylla</i>	Hard-leaved Scribbly	✓	✓
	Gum		
<i>Eucalyptus sieberi</i>	Silvertop Ash	✓	✓
<i>Eucalyptus sparsifolia</i>			
<i>Eucalyptus stricta</i>	Blue Mountains Mallee	✓	
<i>Gahnia filifolia</i>		✓	
<i>Gahnia microstachya</i>	Slender Saw-sedge	✓	✓
<i>Gahnia sieberiana</i>	Red-fruited Saw-sedge	✓	
<i>Gahnia subaequiglumis</i>		✓	
<i>Galium binifolium</i>		✓	
<i>Gleichenia dicarpa</i>	Pouched Coral Fern	✓	
<i>Gnaphalium</i>	Star Cudweed	✓	
<i>involucratum</i>			
<i>Gompholobium</i>	Red Wedge Pea	✓	
<i>uncinatum</i>			
<i>Gonocarpus tetragynus</i>	Raspwort	✓	
<i>Gonocarpus teucrioides</i>		✓	✓
<i>Gonocarpus micranthus</i>	Creeping Raspwort	✓	
<i>Goodenia bellidifolia</i>		✓	
<i>Goodenia dimorpha</i> var.			✓
<i>dimorpha</i>			
<i>Grevillea acanthifolia</i>		✓	
<i>Grevillea laurifolia</i>		✓	✓
<i>Gymnoschoenus</i>	Button Sedge	✓	
<i>sphaerocephalus</i>			
<i>Haemodorum</i>	Rush-leaf Bloodroot		✓

Table 2.1 - Floristic Species List

Scientific Name	Common Name	Corkery & Co (1993)	Current Survey
<i>corymbosum</i>			
<i>Haemodorum</i>	Strap-leaf Bloodroot		✓
<i>planifolium</i>			
<i>Hakea dactyloides</i>	Broad-leaved Hakea	✓	
<i>Hakea propinqua</i>		✓	
<i>Helichrysum</i>	Waddell Everlasting		✓
<i>adenophorum</i> var.			
<i>waddelliae</i>			
<i>Helichrysum</i>	Satin Everlasting	✓	✓
<i>leucopsidium</i>			
<i>Helichrysum rutidolepis</i>	Pale Everlasting		✓
<i>Helichrysum scorpioides</i>	Button Everlasting	✓	
<i>Hemarthria uncinata</i>	Mat Grass	✓	
<i>Hibertia obtusifolia</i>		✓	
<i>Hibertia pedunculata</i>		✓	
<i>Hibertia serpyllifolia</i>		✓	
<i>Histiopteris incisa</i>	Batwing Fern	✓	
<i>Holcus lanatus</i>	Yorkshire Fog	✓	
<i>Hovea linearis</i>	Narrow-leaf Hovea	✓	
<i>Hybanthus monopetalus</i>	Slender Violet		✓
<i>Hydrocotyle algida</i>	Pennywort	✓	
<i>Hydrocotyle</i>	Pennywort	✓	
<i>peduncularis</i>			
<i>Hypericum gramineum</i>	Small St Johns-wort	✓	
<i>Hypericum japonicum</i>	Matted St John's Wort	✓	
<i>Hypochoeris radicata</i>	Flatweed	✓	
<i>Isolepis inundata</i>	Swamp Club-rush	✓	
<i>Isopogon anemonifolius</i>	Broad-leaf Drumsticks		✓
<i>Isopogon anethifolius</i>	Narrow-leaf Drumsticks		✓
<i>Isopogon prostratus</i>	Prostrate Drumsticks		✓
<i>Juncus planifolius</i>	Broad Rush	✓	
<i>Juncus procerus</i>		✓	
<i>Lambertia formosa</i>	Mountain Devil	✓	
<i>Lepidosperma laterale</i>	Variable Sword-sedge		✓
<i>Leptospermum</i>		✓	
<i>arachnoides</i>			
<i>Leptospermum</i>		✓	
<i>continentale</i>			
<i>Leptospermum</i>	Woolly Tea-tree	✓	
<i>grandifolium</i>			
<i>Leptospermum</i>		✓	✓
<i>marcrocarpum</i>			
<i>Leptospermum</i>	Swamp Tea-tree	✓	✓
<i>myrtifolium</i>			
<i>Leptospermum</i>	Yellow Tea-tree	✓	
<i>polygalifolium</i>			
<i>Leptospermum</i>	Round-fruited Tea-tree		✓
<i>sphaerocarpum</i>			
<i>Leptospermum</i>	Paperbark Tea-tree	✓	
<i>trinervium</i>			
<i>Lepidosperma limicola</i>	Razor Sedge	✓	
<i>Lepidosperma tortuosum</i>		✓	
<i>Leptomeria acida</i>	Native Currant	✓	
<i>Lepyrodia anarthria</i>		✓	
<i>Lepyrodia scariosa</i>	Scale-rush	✓	✓
<i>Leucochrysum</i>	Grass-leaf Sunray	✓	
<i>graminifolium</i>			

Table 2.1 - Floristic Species List

Scientific Name	Common Name	Corkery & Co (1993)	Current Survey
<i>Leucopogon lanceolatus</i>	Lance-leaf Bear-heath	✓	
<i>Leucopogon microphyllus</i>		✓	
<i>Leucopogon muticus</i>	Blunt Beard-heath	✓	
<i>Lindsaea linearis</i>	Screw Fern	✓	
<i>Lomandra filiformis</i>	Wattle Mat-rush	✓	
<i>Lomandra glauca</i>	Pale Mat-rush	✓	
<i>Lomandra longifolia</i>	Spiny Mat-rush	✓	✓
<i>Lomandra multiflora</i>	Many-flowered Mat-rush	✓	
<i>Lomatia myricoides</i>	Long-leaved Lomatia	✓	
<i>Lomatia silaifolia</i>	Crinkle Bush	✓	✓
<i>Luzula ovata</i>		✓	
<i>Lycopodium deuterodenium</i>	Bushy Club Moss	✓	
<i>Lycopodium laterale</i>	Slender Clubmoss	✓	
<i>Microlaena stipoides</i>	Weeping Grass	✓	
<i>Microtis unifolia</i>	Onion Orchid	✓	
<i>Mirbelia platyloboides</i>			✓
<i>Mitrasacme polymorpha</i>	Mitre Weed	✓	
<i>Monotoca scoparia</i>	Prickly Broom-heath	✓	✓
<i>Myriophyllum pedunculatum</i>	Mat Water-milfoil	✓	
<i>Nertera granadensis</i>		✓	
<i>Notochloe microdon</i>		✓	
<i>Olearia erubescens</i>		✓	
<i>Olearia quercifolia</i>		✓	
<i>Opercularia varia</i>	Stinkweed	✓	
<i>Pinus radiata</i>	Monterey Pine	✓	
<i>Patersonia fragilis</i>	Short Purple-flag	✓	
<i>Patersonia glabrata</i>	Leafy Purple-flag	✓	✓
<i>Persoonia laurina</i>	Laurel Geebung	✓	
<i>Persoonia levis</i>	Broad-leaf Geebung		✓
<i>Persoonia linearis</i>	Narrow-leaf Geebung		✓
<i>Persoonia mollis ssp mollis</i>	Geebung	✓	
<i>Petrophile canescens</i>		✓	
<i>Petrophile pedunculata</i>			
<i>Petrophile pulchella</i>	Conesticks	✓	✓
<i>Phebalium squamulosum</i>	Alpine Phebalium	✓	
<i>Phyllota squarrosa</i>		✓	✓
<i>Pimelea linifolia ssp. linifolia</i>	Slender Rice-flower	✓	
<i>Platysace lanceolata</i>	Lance-leaf Platysace	✓	
<i>Platysace linearifolia</i>	Narrow-leaf Platysace	✓	✓
<i>Poa labillardieri</i>	Tussock Grass	✓	
<i>Poa sieberana ssp. sieberana</i>		✓	
<i>Polyscias sambucifolia</i>	Elderberry Panax	✓	
<i>Poranthera microphylla</i>	Small Poranthera	✓	
<i>Prostanthera scutellarioides</i>			✓
<i>Pteridium esculentum</i>	Bracken Fern	✓	
<i>Pterostylis concinna</i>	Trim Greenhood		✓
<i>Pultenaea divaricata</i>		✓	
<i>Pultenaea scabra</i>	Rough Bush-pea	✓	
<i>Restio australia</i>	Mountain Cord-rush	✓	✓

Table 2.1 - Floristic Species List

Scientific Name	Common Name	Corkery & Co (1993)	Current Survey
<i>Rhytidosporum procumbens</i>		✓	
<i>Schoenus brevifolius</i>	Zig-zag Bog-rush		✓
<i>Schoenus melanostchys</i>	Black Bog-rush		✓
<i>Schoenus villosus</i>	Hairy Bog-rush	✓	
<i>Senecio minimus</i>		✓	
<i>Senecio sp. E aff. apargiifolius</i>		✓	
<i>Sowerbaea juncea</i>	Rush Lilly	✓	
<i>Sprengelia incarnata</i>		✓	
<i>Stipa pubescens</i>	Tall Speargrass	✓	
<i>Stipa rudis</i>	Speargrass	✓	
<i>Stylidium graminifolium</i>	Grass-leaf Trigger Plant	✓	
<i>Stylidium laricifolium</i>			
<i>Symphionema montanum</i>		✓	
<i>Thelionema caespitosum</i>	Tufted Blue-lily	✓	
<i>Thelymitra pauciflora</i>	Slender Sun Orchid	✓	
<i>Thysanotus tuberosus</i>	Fringed Violet	✓	
<i>Telopea speciosissima</i>	Waratah	✓	✓
<i>Utricularia dichotoma</i>	Fairy Aprons	✓	
<i>Viola betonicifolia</i>	Showy Violet	✓	
<i>Viola hederacea</i>	Ivy-leaved Violet	✓	
<i>Wahlenbergia communis</i>	Tufted Bluebell	✓	
<i>Xanthorrhoea media</i>			✓
<i>Xanthorrhoea resinosa</i>		✓	
<i>Xanthosia dissecta</i>		✓	
<i>Xanthosia pilosa</i>		✓	
<i>Xyris ustulata</i>		✓	

Note: Corkery & Co (1993) survey covered a much larger portion of the Newnes Plateau, north of the current survey site.

Appendix D3 – Fauna Species List

Appendix D3 - Fauna Species List

Table 3.1 - Fauna Species List

Scientific Name		Common Name		Previous Surveys		Current Survey
				1993	1999	
Mammals						
	<i>Antechinus stuartii</i>	Brown Antechinus			✓	
*	<i>Canis familiaris dingo</i>	Wild Dog	✓	✓		
	<i>Chalinolobus gouldii</i>	Gould's Wattled Bat	✓			
*	<i>Feline catus</i>	Cat			✓	
	<i>Isoodon macrourus</i>	Northern Brown Bandicoot	✓			
	<i>Macropus giganteus</i>	Eastern Grey Kangaroo	✓	✓		✓
	<i>Macropus robustus</i>	Common Wallaroo			✓	
	<i>Macropus rufogriseus</i>	Red-necked Wallaby	✓			
*	<i>Mus musculus</i>	House Mouse			✓	
*	<i>Oryctolagus cuniculus</i>	Rabbit	✓	✓		
	<i>Pseudocheirus peregrinus</i>	Common Ringtail Possum	✓	✓		✓
	<i>Petauroides volans</i>	Greater Glider	✓	✓		
	<i>Petaurus australis</i>	Yellow-bellied Glider			✓	
	<i>Phascolarctos cinereus</i>	Koala	✓			
	<i>Pseudomys novaehollandiae</i>	New Holland Mouse	✓			
	<i>Rattus fuscipes</i>	Southern Bush Rat	✓	✓		
	<i>Rattus lutreolus</i>	Swamp Rat	✓			
	<i>Tadarida australis</i>	White-striped Mastiff-Bat	✓			
	<i>Trichosurus vulpecula</i>	Common Brushtail Possum			✓	
	<i>Vombatus ursinus</i>	Common Wombat	✓	✓		
*	<i>Vulpes Vulpes</i>	Fox	✓	✓		
	<i>Wallabia bicolor</i>	Swamp Wallaby	✓			
Birds						
	<i>Acanthiza nana</i>	Yellow Thornbill	✓			
	<i>Acanthiza pusilla</i>	Brown Thornbill				
	<i>Acanthiza reguloides</i>	Buff-rumped Thornbill				✓
	<i>Acanthorhynchus tenuirostris</i>	Eastern Spinebill	✓	✓		
	<i>Alectura lathami</i>	Brush Turkey			✓	
	<i>Alisterus scapularis</i>	King Parrot			✓	
	<i>Anthochaera carunculata</i>	Red Wattlebird	✓	✓		
	<i>Anthochaera chrysoptera</i>	Little Wattle Bird			✓	✓
	<i>Cecropis nigricans</i>	Tree Martin	✓			
	<i>Cinlosoma punctatum</i>	Spotted quail-thrush	✓			
	<i>Climacteris leucophaea</i>	White-throated Treecreeper	✓			
	<i>Climacteris picumnus</i>	Brown Treecreeper	✓			
	<i>Colluricincla harmonica</i>	Grey Shrike-thrush				
	<i>Coracina novaehollandiae</i>	Black-faced Cuckoo-shrike	✓	✓		
	<i>Coracina tenuirostris</i>	Cicada Bird	✓			
	<i>Corcorax</i>	White-winged Chough			✓	✓

Table 3.1 - Fauna Species List

Scientific Name	Common Name	Previous Surveys 1993	1999	Current Survey
<i>melanorhamphos</i>				
<i>Cormobates leucophaeus</i>	White-throated Treecreeper		✓	✓
<i>Corvus coronoides</i>	Australian Raven		✓	
<i>Dacelo gigas</i>	Laughing Kookaburra	✓	✓	✓
<i>Eopsaltria australis</i>	Eastern Yellow Robin			✓
<i>Gymnorhina tibicen</i>	Australian Magpie		✓	
<i>Halcyon sancta</i>	Sacred Kingfisher	✓		
<i>Lichenostomus chrysops</i>	Yellow-faced Honeyeater		✓	
<i>Lichenostomus leucotis</i>	White-eared Honeyeater		✓	✓
<i>Malurus cyaneus</i>	Superb Blue Wren	✓	✓	
<i>Malurus lamberti</i>	Variegated Fairy-wren		✓	✓
<i>Manorina</i>	Noisy Miner	✓	✓	✓
<i>melanocephala</i>				
<i>Manoria melanophrys</i>	Bellbird			✓
<i>Melithreptus lunatus</i>	White-naped Honeyeater	✓		
<i>Myiagra cyanoleuca</i>	Satin Flycatcher	✓		
<i>Ninox novaeseelandiae</i>	Boobook Owl	✓		
<i>Ninox strenua</i>	Powerful Owl		✓	
<i>Pachycephala rufiventris</i>	Golden Whistler	✓	✓	
<i>Pardalotus punctatus</i>	Spotted Pardalote		✓	
<i>Pardalotus striatus</i>	Striated Pardalote	✓		
<i>Petroica multicolor</i>	Scarlet Robin	✓		
<i>Phylidonyris nigra</i>	White-cheeked Honeyeater	✓	✓	
<i>Phylidonyris</i>	New Holland Honeyeater		✓	
<i>novaehollandiae</i>				
<i>Phylidonyris pyrrhoptera</i>	Crescent Honeyeater		✓	
<i>Platycercus elegans</i>	Crimson Rosella	✓	✓	✓
<i>Platycercus eximius</i>	Eastern Rosella		✓	✓
<i>Podargus strigoides</i>	Tawny Frogmouth		✓	
<i>Rhipidura fuliginosa</i>	Grey Fantail		✓	✓
<i>Sericornis frontalis</i>	White-browed Scrubwren			✓
<i>Stipiturus malachurus</i>	Southern Emu Wren	✓		
<i>Strepera graculina</i>	Pied Currawong		✓	✓
<i>Zosterops lateralis</i>	Silvereye		✓	✓
Amphibians				
<i>Litoria citropa</i>	Blue Mountains Tree Frog	✓		
<i>Ranidella (Crinai) signifera</i>	Common Eastern Froglet	✓		✓
Reptiles				
<i>Ctenotus taeniolatus</i>	Copper-tailed Skink	✓		
<i>Lampropholis delicata</i>	Grass Skink	✓	✓	✓
<i>Tiliqua scincoides</i>	Common Bluetongue		✓	
<i>Tympanocryptis diemensis</i>	Mountain Heath-dragon		✓	

* = Introduced Species

1993 Survey reported in Corkery, 1993

1999 Survey conducted by IEC, 1999

Appendix D4 – 8-Part Assessment

Appendix D4 – 8-Part Assessment

4.1 Threatened Flora Species

The following test of significance has been prepared in accordance with Part 5A of the *Environmental Planning and Assessment Act 1979* as amended by the *Threatened Species Conservation Amendment Act 2002* (as in force at 2 October 2002), to determine whether there is likely to be a significant effect on the threatened species, populations or ecological communities or their habitats for the 8 flora species (*Acacia bynoeana*, *Acacia flocktoniae*, *Apatophyllum constablei*, *Caladenia tessellata*, *Diuris aequalis*, *Persoonia acerose*, *Persoonia marginata*, and *Thesium australe*) for which potential habitat exists in the survey area.

a) in the case of threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction,

No threatened species were identified as being present in the study area. With no local populations present in the area where impact will occur, the life cycle of rare or threatened species is not likely to be disrupted or placed at risk of extinction.

b) in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction,

No endangered populations were found within the proposed development area.

c) in the case of an endangered ecological community, whether the action proposed:

i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction,

No endangered ecological communities are present on the site.

ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,

No endangered ecological communities are present on the site.

d) In relation to the habitat of a threatened species, population or ecological community:

i) the extent to which habitat is likely to be removed or modified as a result of the action proposed,

While the site of the proposed development is not currently known to house any rare or threatened species, approximately 25.5 ha of potential habitat for *Acacia bynoeana*, *Acacia flocktoniae*, *Caladenia tessellata*, *Diuris aequalis*, *Persoonia acerose*, *Persoonia marginata* and *Thesium australe* will be removed or modified by the proposed development.

- ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action,**

The proposed action will not leave any areas of vegetation isolated or fragmented.

- iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality,**

No species of conservation significance were identified in the area of the proposed development. Potential habitat areas exist for a number of species, however since they are not currently present, the areas of potential habitat are not considered to be key or essential to the long-term survival of these species.

- e) Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly),**

There are no areas of critical habitat present in the proposed development area.

- f) Whether the action proposed is consistent with the objectives or actions or a recovery plan or threat abatement plan,**

A recovery plan has not been developed for any of the species for which potential habitat is present.

- g) Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.**

The development will require clearing of approximately 25.5 ha of native vegetation. Clearing of native vegetation has been identified as a threatening process under Schedule 3 of the TSC Act 1995. The area of vegetation that will be cleared does not contain any areas of critical habitat and the impact of the removal of vegetation is considered to be negligible on a regional scale.

Conclusion

The site of the proposed development provides potential habitat for a number of species of conservation significance. However, to date none of these species have been recorded from the site, and the resulting impact is therefore restricted to impacts on *potential* habitat. Since areas of potential habitat for these species are

extensive in the surrounding region, the impact is considered to be minor and a Species Impact Statement is therefore unnecessary.

4.2 Threatened Fauna Species

The following test of significance has been prepared in accordance with Part 5A of the *Environmental Planning and Assessment Act 1979* as amended by the *Threatened Species Conservation Amendment Act 2002* (as in force at 2 October 2002), to determine whether there is likely to be a significant effect on the threatened species, populations or ecological communities or their habitats for the Spotted Tailed Tiger Quoll.

- a) in the case of threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction,**

The proposal will involve clearing of some native vegetation, including woodland areas that may provide a potential habitat area. However, the site is not a known breeding ground for the species, and it is therefore considered highly unlikely that the life cycle of the Spotted-tailed Tiger Quoll will be disrupted with the removal of the area of forest. It is therefore considered that a local population, if present, is highly unlikely to be placed at risk of extinction as a result of the proposed project.

- b) in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction,**

The Spotted-tailed Tiger Quoll species as a whole is considered endangered. The likely impact on the life cycle of the species is discussed above.

- c) in the case of an endangered ecological community, whether the action proposed:**
- i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction,**

Not applicable.

- ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,**

Not applicable.

- d) In relation to the habitat of a threatened species, population or ecological community:**

i) the extent to which habitat is likely to be removed or modified as a result of the action proposed,

Potential habitat for the Spotted-tailed Tiger Quoll is extensive throughout the region. The proposed development will result in the loss of approximately 25.5 ha of woodland. While no Spotted-tailed Tiger Quolls were observed during the entire survey, this area might provide potential habitat. The removal of this patch of vegetation however, is considered negligible, given the large continuous tracts of potential habitat areas that will remain in dedicated conservation areas in the immediately surrounding area.

ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action,

The proposed development will not leave any areas of native vegetation isolated from other areas of potential habitat for the Spotted-tailed Tiger Quoll.

iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality,

The Spotted-tailed Tiger Quoll was not observed at the time of the survey, however the areas of forest could provide a potential habitat. Approximately 25.5 ha will be removed as part of the mine proposal, however larger areas of forest containing potential habitat are available in the area.

e) Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly),

Critical habitat has not been declared for this species.

f) Whether the action proposed is consistent with the objectives or actions or a recovery plan or threat abatement plan,

A recovery plan has not been developed for the Spotted-tailed Tiger Quoll.

g) Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

The proposed open cut development will require clearing of approximately 25.5 ha of native vegetation. Clearing of native vegetation has been identified as a threatening process under Schedule 3 of the TSC Act 1995. The area of vegetation that will be cleared does not contain any areas of critical habitat, however does involve removal of forest which may provide potential habitat for the species. The impact of the removal of vegetation is considered to be negligible on a regional scale.

Conclusion

Forest areas provide important potential habitat areas for a range of species, including the Spotted-tailed Tiger Quoll. However, only a small area will be removed as part of the open cut proposal, and other larger areas will remain in the immediate area. Furthermore, no population of Spotted-tailed Tiger Quolls were observed during the field surveys.

It is therefore considered that the overall impact on the Spotted-tailed Tiger Quoll as a species, as a result of the proposed development will be negligible, and a Species Impact Statement is not required.

Appendix D5 – Frog Report

Surveys for the Giant Burrowing Frog

Heleioporus australiacus

Newnes Kaolin Site

Introduction

The Giant Burrowing Frog *Heleioporus australiacus* is a large frog that inhabits several habitats. In the northern end of its range, in the Sydney Basin, it utilises sandstone escarpments and decomposing sandstone layers as shelter and foraging areas. This frog is listed as “vulnerable” and is included in Schedule 2 Part 1 of the *New South Wales’ Threatened Species Conservation Act 1995*.

A Development Application (DA) has been prepared by the Newnes Kaolin Pty Ltd for the extraction of sand and kaolin from a site near Newnes Junction. The site borders the Blue Mountains National Park, a World Heritage Area. In May 2002, Biosphere Environmental Consultants Pty Ltd were engaged to:

1. determine whether habitat for Giant Burrowing Frogs occurs on the project site,
2. if habitat is present, to map the extent of the habitat areas, and
3. to conduct initial surveys for the frogs.

Project Site

The Project Site is approximately 32 Ha and lies immediately north-east of the township of Newnes Junction (Figure 1). The northern boundary of the site is 500 metres long while the eastern boundary is 850 metres long. The site occupies part of the upper western slope of Wollangambe River valley (the river lies just over 1 kilometer to the east). A thin sand layer lies over a heavily decomposing sandstone layer. In a few places the underlying sandstone is visible but there are no escarpment or obvious outcrops on the site.

The site is almost completely wooded. Silver-top Ash *Eucalyptus sieberi* is the dominant tree type present. Ash forest covers over 90% of the site, only the northern portion of the site is dominated by Scribbly Gum *E. sclerophylla*. There is a well-developed shrub layer containing a mixture of species, most notably Waratah, Drumsticks, Geebung and Wattles. Smaller shrubs contain a high proportion of epacrids.

Two ephemeral water courses drain the site. The northern water course has two primary feeder channels that unite on site and flow out through the north-eastern corner of the site. The southern water course originates off site (near Newnes Junction) and passes eastwards towards the Wollangambe River. Both watercourses remain ephemeral until they reach the Wollangambe River. At the time of the survey, neither water courses was flowing but both contained wet seepage areas; for the northern water course a wet area existed at the 990 m contour while a diffuse wet area soil area existed at the 1020 m contour.

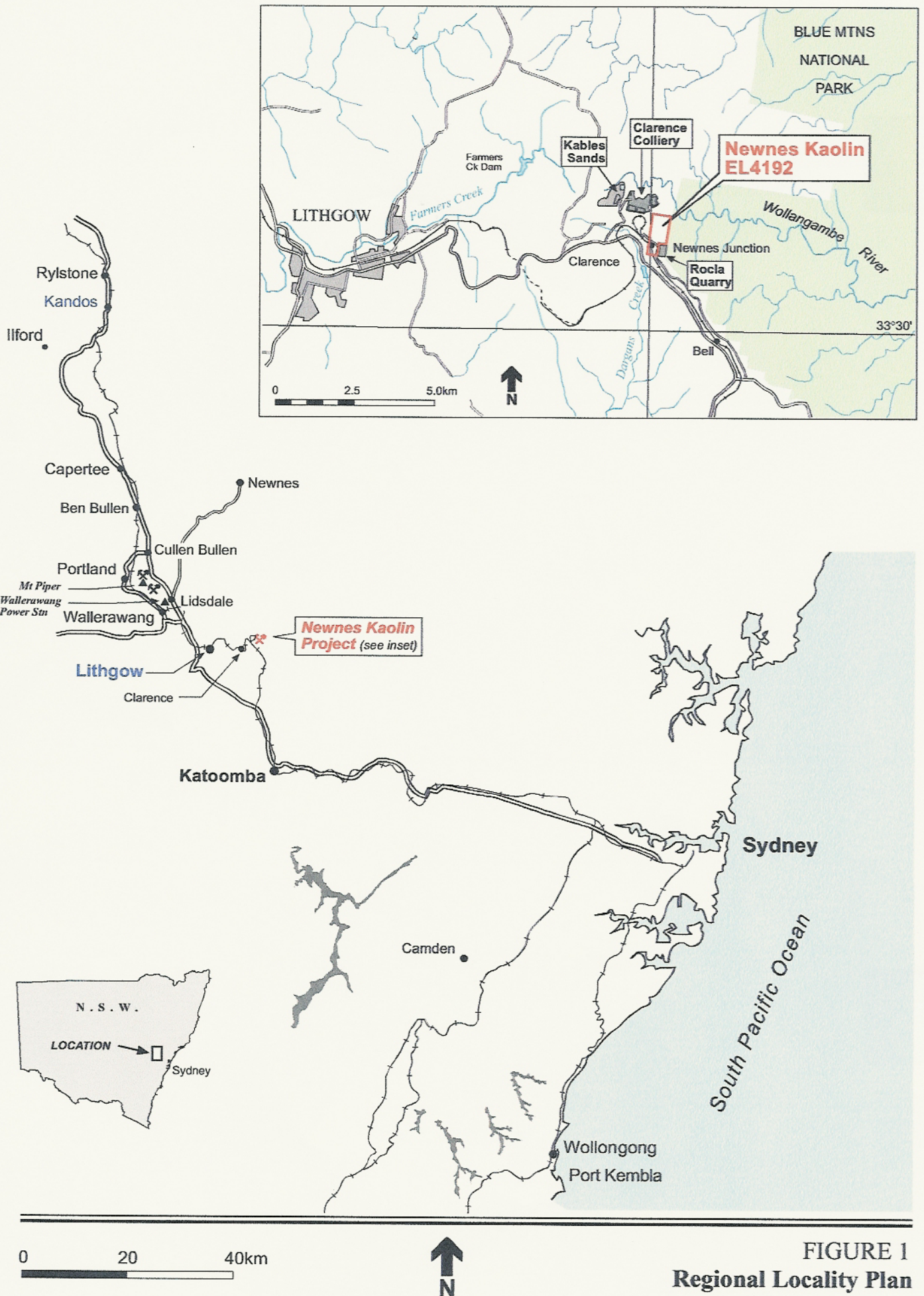


FIGURE 1
Regional Locality Plan

The wet area on the northern water courses consist of a narrow seepage area (located at 244950; 6293320). The shrub and tree layer give way to Saw Sedges *Ghania radula*, Ferns *Blechnum sp.*, and Black Wattle *Callicoma serratifolium*. Fringing the area is an encircling zone of Parramatta Green Wattle *Acacia parramattensis*. Small pools of water had formed in vehicle tyre ruts across this area.

The wet area on the southern water course consists of a broad area dominated by the Paperbark Tea-tree *Leptospermum trinervium*. Saw sedges and other sedges such as Scale Sedge *Lepyroidia gracilis* and Cord Rush *Restio complanatus* form the ground cover between the Tea-trees. No pools of water were present in this area but the ground was soft and sodden underfoot in places.

There are no buildings or artificial structures on the site. A well-formed dirt track crosses the site from west to east ("Ridge Track"). The site contains a series of informal tracks running from north to south along the longest axis of the site. These tracks are 100 metres apart and were created for the survey and drilling teams.

Proposed Development

It is proposed that a staged development of the site take place whereby a large open pit is created for the extraction of sand and clay. No processing of the excavated material will take place on the site. Instead, the crushed sandstone will be transported off site, via the nearby rail loop, for processing. As processing is not taking place on site, large tailing dams are not required on site.

In Stage 1 of the project, pit excavation will commence in the north-eastern portion of the mining area. A temporary crusher and works office will be constructed on the northern boundary and a conveyor will be constructed that will run along the northern boundary of the site to a loading bin on the rail loop. Surface water from the site will be diverted northwards, towards Clarence Colliery.

In the later stages of the development, the pit will be sequentially expanded and deepened. A permanent crusher will be constructed near the north-eastern corner of the pit and the conveyor extended along the northern boundary line. A Water Treatment Plant will be constructed inside the pit. Surface water will still be diverted northwards, away from the northern watercourse.

By the final stage of the project, the pit will reach its maximum depth of 993 metres RL (about 40 m below the ground level on the southern side of the pit). Several sediment control dams will collect water from within the pit and dirty water will be treated by the expanded water Treatment Plant inside the pit. The expansion of the pit southwards, will result in some surface water being directed southwards, into the southern watercourse. Most storm water will continue to be directed northwards. The northern watercourse will be truncated but will still receive some surface run-off.

Methods

Document Research

A review of the available documentation was carried out. This included an examination of the proposed development plan for the site, including the developmental stages of the project.

A data search was carried out of the New South Wales' National Parks and Wildlife Services' Wildlife Atlas for locations of Giant Burrowing Frogs. A similar search was carried out of the herpetological records of the Australian Museum.

Field Survey

Weather conditions

Weather conditions during the survey were fine and mild. The days were sunny, reaching a maximum air temperature of 22 ° C. Nights were quite cool, dropping to 8°C in the early morning of the 4th of May.

Although the weather was fine and dry during the survey the ground moisture on site was quite high. This was due to the regular rain that fell during the early autumn. There were boggy areas associated with the two main watercourses on the site as well as a wet slope area where ground water trickled over an exposed sandstone area.

Survey Methods

A field survey of the site was carried out in early May 2002. The site was visited during daylight hours on the 3rd of May 2002. Dr Ron Goldbery (from Newnes Kaolin Pty Ltd) escorted the field team around the site, highlighting the location of the pit, drilling roads, mining lease boundaries and infrastructure locations.

Later that day, the site was traversed on foot and potential habitat for Giant Burrowing Frogs was searched for. In particular, the search followed the northern and southern watercourses along their lengths on site and for another 300-500 metres off site.

Sites where free water was available was netted and tadpoles that were collected were identified and released.

On the evening of the 3rd of May, the site was again re-traversed on foot. Spot lights and head-lamps were used to search the ground and along the water courses for active frogs. At several sites along the northern and southern water courses, play-back calls of the mating calls of Giant Burrowing Frogs were broadcast from a small, portable amplifier. Calls were played for 2 minutes, this was followed by a 2 minute listening period. The tape was again played for 2 minutes and another two minute listening period followed. If there was no frog response, the team moved on to the next location. Seven locations were chosen as sites to play the calls (see Table 1 below).

Table 1

Sites where Play-back Calls were Broadcast for the
Giant Burrowing Frog

Location No.	Description of Location
1	Head of northern arm of Northern Water Course
2	Head of southern arm of Northern Water Course
3	Junction of arms of Northern water Course
4	Off Site. 200 m downstream of arm junction on Northern Water Course
5	Head of Southern Water Course (near Rocla Site)
6	Tea-tree Flat. Southern Water Course crossing of Mining Lease Area
7	Off site. 250 m downstream of southern crossing site.

Assessment of Habitat for Giant Burrowing Frogs

Habitat was assessed using the criteria cited in Recsei (1997). Habitat consists of three components, breeding sites, foraging areas and shelter areas. Only potential breeding sites and shelter habitats were searched for.

Breeding Sites: Typically consists of wet heath areas associated with primary watercourses. Watercourses may be ephemeral or permanent. If they are permanent, flow must not be constant and small pools should be present for at least two months during the year.

Shelter Sites: Hanging sandstone shelves associated with the headwaters of primary creeks that do not flood. Often seepage areas form along the edges of sandstone layers creating a zone of decomposing sandstone and talus. The sand and decomposing sandstone layer should retain a relatively high ground moisture content (as indicated by the presence of indicator plant species such as Saw-sedges *Ghania sp.*, Tea tree thickets *Leptospermum sp.* and sedges such as *Carex apressa*.

In the Upper Blue Mountains area, Giant Burrowing Frogs have also been found to use button grass swamps (LeBreton 1994).

Foraging Habitat: Giant Burrowing Frogs will range widely when foraging and hence have been found in a range of foraging habitats that include both dry and wet sclerophyll forest, montane riparian forest, wet and dry heath and button grass plains. For this reason, foraging habitat is not considered to be an indicator of the presence of Giant Burrowing Frogs. Shelter habitats and breeding sites are more specific and more likely to give an accurate indication of the presence of the frogs in an area.

Results:

Frog Surveys

Two frog species were located during the surveys. Table 2 gives the location and species details.

Table 2

Frogs found During Survey

Frog Species	Location	How Detected	AMG
Crinia signifera	Northern Water Course, near eastern site boundary	Males calling Tadpoles Present	244950 6293320
Crinia signifera	Southern Water Course, 50 m downstream of Eastern Site Boundary	Males Calling	244905 6292786
Limnodynastes dumerilii	Northern Water Course, near eastern site boundary	Tadpoles present	244950 6293320

Giant Burrowing Frog Habitat Assessment

Shelter habitat for Giant Burrowing Frogs occurs in one small area in the south-eastern corner of the site. The area consists of a small Tea-tree flat, dominated by *Leptospermum trinervium*. A small seepage zone occurs on the southern slope of the valley which brings ground water to the surface in this area. The water does not remain on the surface but soaks quickly into the deep sands that lie immediately downstream.

Breeding Sites are not present on the site or immediately downstream from either water courses. Particular survey attention was given to locating breeding habitat on the southern water course (as shelter habitat appears to be present). The downstream areas were not suitable for Giant Burrowing Frogs as the water course becomes drier and much less well defined. Eventually, the water course approaches the Wollangambe River and crosses rocky terrain before plunging into the Wollangambe valley.

Discussion**Distribution of Giant Burrowing Frogs**

Giant Burrowing Frogs occur along the eastern sea board of Australia, from the Watagan Mountains south to north-eastern Victoria (Cogger 2000). In the northern end of their range, the species occurs near the coast (in the Watagan Mountains), west through parts of Marramarra National Parks to the Blue Mountains and Wollemi National Park.

The closest areas to Newnes where the frogs have been found is Blackheath in the Blue Mountains, a distance of only 15 kilometres away. Records in the Wollemi National Park are scarce as the park has not been intensively surveyed but the frogs have been found as far north as the Culoul Range (about 25 kilometres north of Newnes).

In the northern end of its range, Giant Burrowing Frogs have been found mainly on Hawkesbury Sandstone but some areas containing Narrabeen Group sandstones have also contained these frogs.

Newnes Junction appears to be geologically continuous with sites where the frog has been recorded, but to date, no Giant Burrowing Frogs have been found there (or in any site this far west).

Giant Burrowing Frog Habitat

Habitat for the Giant Burrowing Frogs is mostly absent from the site. The presence of shelter habitat alone on site cannot be taken as evidence for the likely presence of the frogs. Stronger evidence includes the absence of breeding habitat on site and in the immediate local area. Without breeding sites, the species cannot sustain itself in an area.

From the assessment of habitat, it is very unlikely that Giant Burrowing Frogs would be able to survive on the project site or in the immediate local area.

Conclusion

Frog surveys revealed the presence of two frog species on site, the Common Eastern Froglet *Crinia signifera* and the Eastern Pobblebonk *Limnodynastes dumerilii*. No evidence was found of the presence of Giant Burrowing Frogs.

Shelter habitat that could be used by Giant Burrowing Frogs was present in one small area in the south-eastern corner of the site. Other important components of habitat were not present, most notably breeding habitat. Given the absence of critical habitat components, it is unlikely that Giant Burrowing Frogs occur on the project site or in the immediate local area.

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Dr Arthur White
8 May 2002.

Appendix E – Aboriginal Heritage Study

**An Archaeological Survey for the
Proposed Kaolin Mine near Newnes Junction.**

**Commissioned by International Environmental
Consultants Pty Ltd for Newnes Kaolin Pty Ltd**

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August, 2000

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- Map 3: Topography of the impact/surveyed area
- Map 4: Area covered by vehicle and “on foot” surveys
- Map 5: Location of the Newnes Junction to Newnes Railway Line.

2. Photographs

- Photo 1: Existing sand Mine
- Photo 2: Hill crest at northern end of the survey area
(Clarence Coal loader and coal stockpile in the background)
- Photo 3: Typical vehicle tracks through the survey area
- Photo 4: Ephemeral gully

3. Copy of Statement of Involvement of Aboriginal Community and record of consultation with LALC.

4. Gazetteer of previously recorded sites and associated reports from NPWS Sites register

5. Results of Non-indigenous Heritage Archival Searches.

Executive Summary

International Environmental Consultants Pty Ltd commissioned Robynne Mills, Archaeological and Heritage Services, to conduct an archaeological survey of the proposed Newnes Kaolin Mine. The archaeological study was designed to identify potential impacts of the proposed development on Aboriginal relics ('relics' as defined by the *New South Wales National Parks and Wildlife Act 1974* and non-indigenous heritage items as defined by the *NSW Heritage Act 1977* (amended) and the *Environmental Planning and Assessment Acts 1975*.

The field component of the study was conducted by Robynne Mills and Jim Kelton, archaeological consultants on Friday 3rd December, 1999. Bathurst Local Aboriginal Land Council (LALC) was represented by Richard Peters, LALC Sites Officer. Details of LALC consultation and LALC *Statement of Involvement in the field survey* are included as Appendix 3.

This report provides details of local environmental observations relevant to the archaeological sensitivity of the study area. It identifies all known archaeological sites in the vicinity of the study area as recorded in the site registers of the Australian Heritage Commission, NSW Heritage Council, NSW National Trust, NSW National Parks and Wildlife Service (NPWS) and the Heritage Schedules of Lithgow City Council. Survey methods and significance assessments are in accordance with NPWS and Heritage Council guidelines. Where appropriate, the report recommends site management options to minimise impact on areas of heritage sensitivity and items within the study area.

No indigenous or non-indigenous sites or areas of potential archaeological sensitivity were identified in the survey area. Newnes Junction Railway is listed on the Lithgow Council LEP schedules. The Newnes Junction relics and those of the Wolgan Valley Railway are outside the impact area of this project.

It is concluded that there are no archaeological constraints to the project proceeding as proposed.

1. Details of the Development Proposal and Consultancy Brief.

1.1 Development Proposal

Newnes Kaolin Pty Ltd proposes to develop a Kaolin Mine near Newnes Junction (Maps 1, 2)

1.2 Consultancy Brief

The consultant was commissioned to:

- consult with Bathurst LALC prior to the survey, to identify any areas of special significance to the Aboriginal community and issues of community concern.
- arrange for a representative of LALC to participate in the field work to ensure Aboriginal community representation in discussions relating to the significance, protection and management of all relics identified in the archaeological survey.
- examine the proposed development area for indigenous and non-indigenous heritage items, sites and places which could be impacted upon, either directly or indirectly by the proposed development.
- assess the potential impact of the development on cultural heritage items
- assess the significance of heritage sites/items/places recorded and make recommendations for the protection and management of these items.
- prepare a report on the heritage investigation which meets the requirements of the NPWS and Heritage Office.

1.3 Impacts

There have been few impacts to the proposed mine area. The northern boundary abuts the Clarence Colliery and the coal stockpile area extends along the boundary. A powerline easement forms the eastern extent of the survey area. The area has been cleared of old growth timber and a series of parallel tracks associated with drill sampling have been cut through the area.

The current proposal will remove the kaolin ore from the total mine area.

Part 1: Indigenous Heritage

2. Aboriginal Community Consultation

The survey area is on the boundary of the Deerubbin, Gandangara and Bathurst LALCs. The mining lease was confirmed to be within the Bathurst LALC after consultation with the State LALC and Deerubbin LALC, Gandangara LALC, through Mr Lenny Malone CEO and Mr Warwick Peckham of Bathurst LALC. Following these discussions, a fax which formally advised the LALC of the pending field survey and requested LALC involvement was sent to Bathurst LALC. LALC was asked to provide survey, a *Statement of Involvement* and to detail any concerns that the LALC might have regarding the development proposal. The LALC statement is provided as Appendix 3. After the completion of the field survey, a summary document was sent to the LALC on 12th December, 1999 confirming the results of the archaeological survey. The LALC was advised that it would be provided with a copy of the final report.

3. Study Area.

3.1 Location

The proposed development is located approximately 2km north of Newnes Junction, between the existing sand Mine and Clarence Colliery (Map 1).

3.2 Environmental Observations.

The proposed mine site is located on a steep, east facing hill slope which is crossed from east to west by two narrow ephemeral creeklines which drain into the Wollangambe River (Map 3). The soil is very sandy and well drained and supports open woodland with regrowth timber in the gully areas. There is also a substantial understorey of a variety of native plants.

The sub-strata across the site is predominantly weathered, medium grained, cream to white sandstone. A characteristic of this Triassic Bank Wall Sandstone is that it forms a thin hardened surface crust, rarely exceeds a few millimetres which mantles a friable, crumbly sandstone with a clay matrix of kaolin. There is an overall absence of ironstone crusts.

There were no outcrops of sandstone visible in the proposed mine area.

4. Ethnographic Evidence for Aboriginal occupation of the Newnes Plateau

One of the earliest reports of Aboriginal people in the Blue Mountains was made in 1791 by Governor Phillip who recorded evidence of Aboriginal camp sites on the banks of the Nepean River. His coastal guides indicated that these camps belonged to people of a different tribe to themselves, “mountain people”.

Settlement of the coastal plain brought the first white settlers to the Blue Mountains in the early 1800s. Evidence of Aboriginal reaction to this advance into their territory is limited but suggests that there were two contemporaneous responses to white settlement: active resistance and passive acceptance. Skirmishing at the frontier of white appropriation of land was a regular occurrence in eastern Australia. (Bowdler, 1981) A third response to white encroachment on Aboriginal lands could have been withdrawal to the mountains. Whether or not this strategy was adopted is unclear, however explorers to the mountains did report an Aboriginal presence in the area. Blaxland (1814) reported hearing people calling in the valleys. In 1804 Caley saw camp fires in the Jamison Valley. Barrallier (1804) met and observed Aborigines in the Wollondilly Valley. Despite these reports of early contact with mountain people, contemporary opinion suggests that the people in the mountains adjacent to the Cumberland Plain were the Dharug. As late as the 1890s, there were a few Dharug people who retained the traditional knowledge and language.

McCarthy (1974) concludes from the historical record that “the native did live on the mountain ridges and in the deep narrow gorges, a rugged area that probably formed a neutral territory between natives east and west of the range”. He also notes that the Burraborang Valley was permanently occupied and that it was probable that local groups lived in the Kanimbla and Jamison Valleys. McCarthy sees these larger valleys being exploited by people based in the open country east and west of the range. (Gollan 1989 p:33).

It has been noted that the Newnes Plateau is the western margin of the Dharug Territory (Tindale 1974). Bowdler (1984, p8) describes the area as a zone of interaction between the western Wiradjuri, the Dharug and the southern upland peoples, the Gangangarra and Ngarigo. She references the cultural similarities between Dharug and Wiradjuri, and implicitly the division between these groups and the coastal plains people.

5. Archaeological Background

5.1 Sites identified in the area from NPWS Sites Register.

A search of NPWS records was conducted prior to commencement of the field survey. This search identified a total of 63 sites in the vicinity of the development area. No sites are within the survey area (Map 2. Appendix 4).

5.2 Native Title Searches

A search of the Native Title Register for the Greater Lithgow Local Government Area identified 8 Native Title Claims. None of these claims apply to the proposed Kaolin Mine area.

5.3 Existing Archaeological Evidence

5.3.1 Academic Research in the Upper Blue Mountains

Several theories of Aboriginal use of highland areas have been inferred from archaeological evidence. McCarthy (1964) claimed that occupation was restricted to the valley floors and the higher regions were visited only for sporadic hunting trips. Stockton (1970) and Johnson (1979) considered that the low density of sites and surface artefacts combined with the presence of numerous art sites and stone arrangements in the Blue Mountains indicated that the highlands were used for ceremonial activities. Historical records for the area record that the Aboriginal population numbers were low and that food resources were in short supply. However historical records are often unreliable when reporting population numbers as Aboriginal people had no wish to reveal their presence to Europeans. Additionally, the lack of understanding by early explorers and government representative of Australian flora and fauna and the Aboriginal diet may make statements about food resources inaccurate.

In recent years, as more survey work has been carried out in the area, more sites have been identified (Brayshaw 1981, 1983, 1989; Gorecki 1982, 1983, McIntyre 1990, Rich 1988, Silcox 1988, Gorman 1991, Mills 1995). It is likely, therefore, that the low density of sites is to some extent a reflection of the amount of surveying carried out. The interpretation of site data appears to be influenced by the size of the study area. If statements about Aboriginal use of mountain areas are deduced from a regional data base of site locations, the data appear to support sporadic or specific use. However, once in depth assessments of specific sites are made, the data appears to support a model of more permanent use of these mountain areas. For example Gollan (1983) argued that the Newnes Plateau swamp area provided year round resources.

Archaeological evidence identified by Brayshaw (1983, 1989, 1990, 1991), Brayshaw and Dallas (1993), Brayshaw and Haglund (1992), Rich (1980, 1985), Rich and Gorman (1992) and Silcox (1988) supports the thesis that there was an increase in the number of sites on the western side of the Blue Mountains from 3000BP and this increase in site density has been interpreted as representative of an increase in population. Many sites lack diagnostic components. However at two sites where sub-surface investigations have been carried out, Ivanhoe and Lamberts Creek artefacts which were consistent with those of the Small Tool Tradition were identified. Therefore it can be assumed that these sites were occupied within the last 3-4000years.

Similar patterns of site distribution and interpretation have emerged for the mountainous areas of Northern NSW. McBryde (1972), from an assessment of data gathered on a regional scale, proposed that Aboriginal people moved through the landscape on a seasonal basis with a prior knowledge of the fruiting and seeding patterns of plants and the feeding patterns of animals. The best documented account of this movement of large numbers of people for ceremonial activities is that of the triennial nut feasts in the Bunya and Blackall Range (Bundock 1898, Petrie 1904). Other researchers who have concentrated their studies in specific locations refute this model. Godwin (1985), researching in the Apsley and Upper Macleay Gorges, presents a model of Aboriginal people living in this alpine ecosystem on a permanent basis (cited Mills and Wilkinson 1994).

5.3.2 Previous Archaeological Surveys within the immediate vicinity of the proposed Kaolin Mine.

Most of the archaeological investigations on the Newnes Plateau have been conducted as a direct response to development related activity (eg mine developments, power line installations, road construction etc). Such surveys were conducted by Gorecki, (1983), Brayshaw (1981, 1983), Sullivan (1981), Stockton (1983), MacIntyre (1990), Kohen (1992a, 1992b) and Rich (1992). However the most comprehensive non-development specific investigation of the Newnes Plateau was conducted by Klim Gollan for NPWS in 1987.

Gollan's project titled the *Newnes Plateau Research Project* was initiated by NPWS in response to pressures to open up the plateau to uses other than forestry and the perceived need for NPWS to identify the potential cultural heritage significance of the Newnes Plateau. Although this study was conducted in the 1980s, it remains the only comprehensive study conducted across the Plateau. Its conclusions, comparative data and discussion remain a useful tool for site prediction and interpretation. In his report, Gollan presents an overview of the geological formation of the plateau; land system classification; flora and fauna and hydrology as they relate to Aboriginal occupation of the Plateau. Comparative site type and distribution data was collected by surveying 13 sample areas across the Plateau. These sample areas tested three land systems: swamp environments, local peaks and their associated high-level ridges and the talus slopes on the Plateau escarpment. Included in Gollan's survey sample were areas to the north of the proposed Kaolin Mine. These were Paddy's Creek, Farmers Creek, Happy Springs, Bald Hill Trig, Waratah Ridge and Mount Horne (Gollan 1987 p54-99). Gollan concluded that:

- open camp sites, marked by artefactual materials were located on the surfaces of sandy fan deposits subtending swamp margins
- there appeared to be an observable association between extant stands of useable plant foods (*Lomandra* and *Ghania*) on the swamp margins and sites marked by artefact assemblages.
- the primary determinants of the location of site exposures are the surface characteristic and the aspect of the site location.
- Open sites were characterised by diffuse distributions of utilised and unutilised flakes made on a range of locally and regionally available lithic, materials. There was considerable variation in the artefact assemblages in terms of predominant raw materials, the main division being between quartz sites and sites with a range of stone materials.

Brayshaw's 1981 survey of the Downcast Shaft and 3.5km of transmission line near Clarence Colliery identified no cultural heritage sites. MacIntyre's 1990 study of the Kariwara Project Area for the Electricity Commission of NSW involved an extensive survey of cliff lines and test excavation of several shelters. A total of 41 shelters were identified and one scarred tree. Three major site complexes were recorded at Mt Horne, the upper reaches of the Wolgan River and Blackfellow's Hands. From data collected, MacIntyre draws the following conclusions. Major site complexes were located at the head of open gullies where there was relatively easy access from ridge tops to the

resources provided by major creeks and rivers. Such complexes were also located on the plateau at locations where vantage points were combined with localised resources. Large sites were located along the western flank of the plateau where streams entered the Cox's River Valley. Smaller sites, representing sporadic visits, were found at the end of long ridges. Macintyre notes that art on the Plateau is "drawing" whereas sites in easy walking distance from the major rivers tend to be predominantly hand stencils.

In 1992 Kohen conducted two surveys within the Clarence Colliery area. No cultural material was located in either survey. Kohen concluded that the absence of sites was a reflection of the fact that none of the favoured landform units was present within the survey area (ie exposed sandstone, cliff lines, hanging swamps or creeklines).

5.4 Development of a predictive model for site type and distribution within the study area.

It is reasonable to expect that site types represented in the development area will be similar in type and distribution patterns to those identified in studies carried out by Gollan and MacIntyre. The most likely site types will be:

- open camp sites which are most likely to be associated with creeklines
- sites associated with sandstone landform areas (ie rock shelters, art sites, grinding grooves etc) Rockshelters are most likely to be located at the base of sandstone outcrops or within eroded sandstone outliers below cliff lines where there is easy access to swamps and creeklines. Grinding grooves would be anticipated in association with water courses.
- scarred trees may occur across the survey area where old growth timber remains
- isolated artefacts may occur across the survey area but are most likely to be located on the ridge lines which were most likely used as transport routes through the area.

5.5 Predicted Archaeological Sensitivity

Based on the results of previous archaeological investigations in the region and a study of the topography within the study area, it was predicted that the most archaeologically sensitive micro-landform units in the study area will be ephemeral creek lines and any exposed areas of sandstone. This assessment is supported Gollan (1987), MacIntyre (1990) and Kohen (1992).

6. Field Survey Methods

6.1 Pre-field Survey Investigation

Initial investigations carried out prior to commencement of the field survey included site and archival searches of the NPWS site data base, and the Register of the National Estate, Canberra. Consultation also took place with Bathurst LALC.

6.2 Pre-Field Survey Assessment

Prior to the commencement of the field survey, a desk top study of the survey area landform and archaeological land systems was conducted. As a result of this assessment, a model of site prediction and sensitivity was developed (Section 5.4) in conjunction with a strategy for survey area coverage (Section 6.4).

6.3 Landscape Classification

Archaeological land systems correspond with landform units (Section 3.2). These differing landform units within the study area include the ephemeral creeklines, gullies and moderate to steep hill slope areas.

6.4 Field Survey Strategy

Initial reconnaissance of the survey area was conducted by vehicle. During this reconnaissance, the boundaries of the survey area and the extent of the two ephemeral creeklines and gullies were established (Map 4) and a strategy for a combined vehicle and on foot survey was designed.

This survey strategy included a full on foot survey of both ephemeral gullies and a series of east/west and north-south transects along tracks across hill slope areas where visibility was high. As destruction of the site will be total, it was important to cover as much ground as possible. Visibility off the tracks was poor. However the eroded shoulders of the gullies and the vehicle tracks gave access to high visibility samples of all landform units in the survey area (Map 4).

6.5 Field Recording Methods

The field survey was conducted using the Lithgow 1:25000 topographic map and maps and aerial photographs of the proposed development supplied by International Environmental Consultants (IEC). The Director of EIC took the consultants on a tour of the proposed Mine site and identified tracks and access lines which could be used in the survey.

6.6 Field Survey Methods and Coverage Data

It is important to attempt to quantify the effectiveness of coverage of these varying impact zones. 'Effective coverage' for the areas surveyed using a total coverage strategy, a sample coverage strategy and a vehicle reconnaissance strategy is set out in Table 1.

Table 1: Effective Coverage tables

Landform Units	Sampled area in metres	Sample Area in ha	Coverage method Foot/ Vehicle	% visibility	Effective Coverage ha	% area effect surveyed
Steep hill slope	620 x 530	32.9	Foot 30% Veh. 70%	30%	9.9	26.3
Hill crest	200 x 100	2.0	100% foot	30%	0.6	1.6
Ephemeral creeklines and gullies	400 x 70	2.8	100% foot	40%	1.1	2.9
Total		37.7ha			11.6	30.8

Site detectability varied over the survey area and was determined by factors such as surface visibility (see Table 2), geomorphology, the size of the survey team and the type of sites present (whether present ie whether the sites are obtrusive or unobtrusive). The measurement of site detectability is difficult given the range of factors which may influence site detection, some of which are mentioned above. Effective coverage assessment can be determined by the interpreted accuracy of a field investigation (Witter 1990b). For the current study, a method of coverage analysis where effective coverage can be reasonably accurately calculated, was adapted from Witter (cited Bonhomme 1993:50) where the following applies:

Survey Coverage Assessment formula (Boot 1996 pers Com)

$L \times W \times \% \text{ of visible ground surface} = \text{effective survey coverage}$

where L is the length of the of the survey area/unit/transect in metres, W is the width of the survey unit/area/transect in metres. Therefore of the total survey area of approximately 37.7 ha, of which 11.6 ha or 30.8% was effectively surveyed.

6.7 Surface visibility

Surface visibility within an archaeological context generally refers to the degree of impediments on the surface which might obstruct surface observation of archaeological material. The main factor to affect visibility is vegetation cover, although features such as rock outcrops and other natural or man-made obstructions on the landscape can also affect surface visibility. Surface visibility can be expressed as a percentage of the surface which is visible (Bonhomme 1986:11). Table 2 provides a basis for surface visibility assessment.

During this survey, 100% visibility conditions prevailed on a network of tracks cut through the area. This network of tracks extended through all landform units and provided a representative sample of all archaeological units within the development area. There were also extensive areas of high visibility associated with areas of surface erosion along the shoulders of ephemeral gullies. As a result of the skeletal soils and absence of dense vegetation cover general visibility was greater than 30%.

Table 2: Surface Visibility Criteria

a	Nil soil visibility	0-5%
b	Occasional glimpses of bare ground	5-19%
c	Frequent patches of bare ground	20-49%
d	Approximately 50% bare surface	50-69%
e	>70% bare surface	70-100%

Surface visibility varies within and between different landform areas and these differences are shown in Table 1. The generally low levels of surface visibility prevailing during this archaeological survey allowed for only a limited level of archaeological assessment of some landscape areas.

6.8 Surface Exposure

Surface exposure of archaeological sites is linked with visibility but should not be confused with surface visibility, in that exposure usually refers to the results or the effects of geomorphic processes on archaeological deposits. The major cause of surface exposure at this site was water erosion.

7. Overview of Survey Results and Discussion

No sites or areas of potential archaeological deposit were identified in the survey. The absence of sites may be the result of the following physical characteristics of the survey area. The closest permanent sources of water are in Dargan Creek to the south where camp sites have been recorded (Mills 1999) and the Wollangambe River to the east. Although two ephemeral creeklines, upper tributaries of the Wollangambe River, cross the survey area, the steep, sandy nature of the soil may decrease the retention rate of water in the creek beds. The sandy soil would provide a comfortable camping area but the general terrain is steep and unsuitable for large camp sites.

Part 2 Non-indigenous Heritage

8. Non-indigenous Heritage Assessment

8.1. Archival Searches and results

Heritage registers and schedules of the Australian Heritage Commission, NSW Heritage Council and Lithgow City Council were reviewed.

8.1.1 Australian Heritage Commission (AHC)

The Australian Heritage Commission maintains the Register of the National Estate. This register lists both indigenous and non-indigenous heritage sites and is organised by both Local Government Area and Locality. Places on this list are classified as:

“Indicative Places”: not on the register, but identified as important

“Interim Places”: currently being evaluated for inclusion on the Register

“Registered Places”: listed

There are a total of 45 registered sites listed by the AHC in the Lithgow Local Government Area (LGA). None of these sites is in the vicinity of the proposed sands quarry.

8.1.2 State Heritage Register of the NSW Heritage Council.

The Heritage Council of NSW maintains the State Heritage Register. The Register was created in April 1999 by amendments to the Heritage Act 1977. Only those items which are of state significance in NSW are listed on the Register. The Register replaces the old system of permanent conservation orders as a means of listing items of state significance. Listing on the State Heritage Register controls activities such as alteration, damage, demolition and development. The focus of heritage protection has changed considerably since the Heritage Act (1977) when the Heritage Council was the principal body involved in the statutory listing of heritage items to the present time when local government has a major role and responsibility for managing heritage in NSW. The principal tools which guide local government decisions are the heritage study and the Local Environmental Plan (LEP) which is prepared in accordance with principles laid down in the Environmental Planning & Assessment Act, 1979.

There are twenty registered items in the Lithgow LGA. None of these items is in the vicinity of the proposed development.

8.1.3 National Trust

The National Trust of Australia (NSW) is a non-government, community organisation which promotes the conservation of both built and natural heritage. The Trust maintains a register of landscapes, townscape, buildings, industrial sites, cemeteries and other items or places which the Trust determines have heritage significance and are worthy of conservation. Items listed in the Trust's Register are said to be "classified". The listing of a place in the Trust's Register has no legal force, however the Trust does encourage owners of listed places to respect their heritage significance. The Trust often helps local councils in the preparation of Local Environmental Plans and encourages local councils to refer development applications affecting properties listed on the Register for advice and comment by the Trust's Architectural Advisory Committee.

There are a total of 33 items listed in Lithgow LGA. Of these one is in the vicinity of the proposed development. This item is described as:

- All Railway bridges, buildings, tunnels etc on the Main West Line: Newnes Junction to Sodwells.

These items are located to the south-west of the proposed site and will not be impacted either directly or indirectly by the proposed development.

8.1.4 Lithgow City Council Heritage Schedules

Under the NSW Environmental Planning and Assessment Act (1979) local Councils and Planning NSW are required to prepare local and regional environmental planning instruments (LEPs and REPs), to give statutory force to planning controls. These plans incorporate provisions for the conservation and management of archaeological sites and heritage items.

There are 98 items listed in the S170 LEP Schedules of Lithgow City Council. Of the listed items two are in the immediate vicinity of the proposed development. These items are both located at Newnes Junction and include:

- Main West Railway line: Railway items Newnes Junction-Sodwalls
- Main West Railway Line: Wolgan Valley Railway.

8.2 Historical Background to Newnes Junction (Extract from Shale Railways of NSW p 119-203)

The line from Newnes Junction to Newnes Shale Mine was one of the great "Shale Railways of New South Wales". The line was essential for the transporting products from the Kerosene Shale Mine at Newnes in the Wolgan Valley, to the Main Railway Line at Newnes Junction. It also provided supplies and transport for the residents of this isolated area. In April 1906 Mr D.A. Sutherland, Consulting Engineer and Manager of the Commonwealth Oil Corporation, engaged Mr Henry Deane, former chief engineer for Railway Construction to the NSW Government, to take charge of the survey and construction of the proposed railway. The site for the connection to the Great Western Railway was determined by Mr Deane at a point 86 miles 70 chains from Sydney and about 1.5 miles on the Sydney side of Clarence, in the locality known as Dargans. Wolgan Valley Railway was one of the most ambitious railway construction works undertaken by private enterprise in the State of NSW, if not the whole of Australasia. The Wolgan Valley line was outstanding having regard to length and difficulty of terrain for the servicing of a single industrial undertaking.

The Railway terminated in a dead end runaway siding adjacent to the Great Western Railway of the NSW Government System to which it had access by a staff locked connection in the Dargans/Clarence electric staff section. The junction faced Down trains from Sydney at an elevation of 3611 feet above sea level. A passenger platform of small dimensions was located on the Government Line, in the angle formed by the junction and was officially named Newnes Junction

from the 17th November 1906.

After passing through the boundary gate and a deep cutting, the exchange sidings were reached at a distance of twenty chains. These sidings consisted of two loops and had catch points at their junction end. A chain or so further on was an engine siding, with ash pit and shed to house one engine, and a coal stage and water tank, accessible from both sidings and main line. The water was obtained by pumping from a small dam in a nearby swamp. Further on was the triangle for turning the locomotives and the station limits ended at an “Up Home” signal, situated at a little over half a mile from Newnes Junction (Map 5).

After the opening of the Zig Zag deviation in 1910, the new Newnes Junction Station was relocated about twenty chains nearer to Sydney, a section of the old Government line being retained to provide a connection with the Wolgan Railway. The new junction, sited 85 miles 39 chains from Sydney, was furnished with a Branch loop and Engine release loop, together with a pair of “Full” and “Empty” dead-end sidings at each end of the station yard, thus giving adequate exchange and shunting facilities for both railway systems. The new “Down” main platform was single-faced, whilst the “Up” main platform was of the “island” type, with the Newnes Branch line and its adjacent engine release loop, on the opposite side. This latter branch at its Sydney end had a direct cross over connection with the “Up” main, and at the Clarence end another crossover led to the “Down” main, a single slip inserted in the crossover gave a connection from the latter track to the “Up” main. The signal box controlling all yard movements was placed about midway in the length of the “island” platform.

The first recorded passenger working over the Wolgan Railways appears to have been made on December 27th 1907 when a train left Newnes on the Saturday morning in time to catch the Government excursion train. A passenger service with some degree of comfort commence officially on the 4th February, 1910. For a brief period in 1909 the traffic required the working of two trains per day between Newnes and Newnes Junction. At this time it was custom to take loads of 400 tons from Newnes to Deane, using double-headed Shay locomotives up the 1 in 25 grades and through the two tunnels. One engine would cut off at Deane and return light to Constance, the single engine completing the haul to Newnes Junction. As C.J. O’Sullivan has expressed.... “You can imagine the music those two Shays would make in heavy action up the 1 in 25...coming home from Newnes Junction was a string of empties, the crews would let the train roll down the grade- you could hear the Shays clanking and the locomotive bells ringing when they were five miles away from Newnes Township, a sign for the womenfolk to give thought to the preparation of the evening meal and for the hotel keeper to start setting out the glasses on the bar for the boys coming in”.

8.3. Field Assessment

The survey for indigenous and non-indigenous sites was carried out concurrently (see Section 5 of this report for details).

8.3.1 Survey Methods and Strategies

This survey was designed to identify areas of possible heritage significance within the study area, make a brief assessment of the heritage significance of sites where possible and recommend additional investigation if required.

8.4 Site Prediction Model

A model for the site type and distribution patterns for heritage items in the survey area was developed from a review of the records of the Australian Heritage Commission, NSW Heritage Council and the Lithgow Council LEP Heritage Schedules. It was considered that the following heritage items and places may be located within the survey area: remains of early farm buildings, machinery, wells, fencing. These remains could include both standing structures and archaeological sites. Although the

only listed items are associated with the Newnes Junction Railway, it is unlikely that any rail-associated items would be located as the railway alignment is well outside the survey area.

8.5. Results of non-indigenous heritage survey.

No non-indigenous heritage sites or relics were identified in the field assessment.

9. Site Management Recommendations

Newnes Kaolin Pty Ltd, as a developer, has an obligation under the National Parks and Wildlife Act 1974, NSW Heritage Act and the Environmental Planning and Assessment Act to determine if their proposed mine extension will impact upon indigenous heritage and where required, take ameliorative action. The following recommendations have been developed to minimise the potential impact of the mining development on heritage items and places and to ensure that the proposed development is accommodated within a management framework that is endorsed by NPWS and includes consultation with Bathurst LALC.

As no indigenous or non-indigenous sites or areas of potential archaeological sensitivity were identified in the survey, it is concluded that there is no archaeological impediment to the project proceeding as planned.

Recommendation 1:

In the unlikely event that cultural heritage items should be located during mining, all activity should cease in the vicinity of the heritage item and a representative of NPWS and/ or Lithgow City Council should be contacted so that a plan of management can be prepared for the heritage material.

10. Legal Requirements and Obligations

All non-indigenous heritage items are protected by the NSW Heritage Act (1975 and the EP & A Act (1979). All indigenous relics (sites and objects), other than those made for sale, are protected under the New South Wales National Parks and Wildlife Act 1967 (amended 1974). Archaeological sites are a non-renewable resource, valued for the information they can provide on the lifestyles of people in the past, and are also valued by local communities who maintain cultural links with the past through these sites and places.

It is illegal to damage or destroy a site or relic without the prior consent of the Director of NSW NPWS and/or Planning NSW. Any such disturbance requires a permit from the Director. The NPW Act requires that the relics recovered under such a permit come under the custody of the Australian Museum in Sydney or the LALC, if a Care and Control Permit has been issued.

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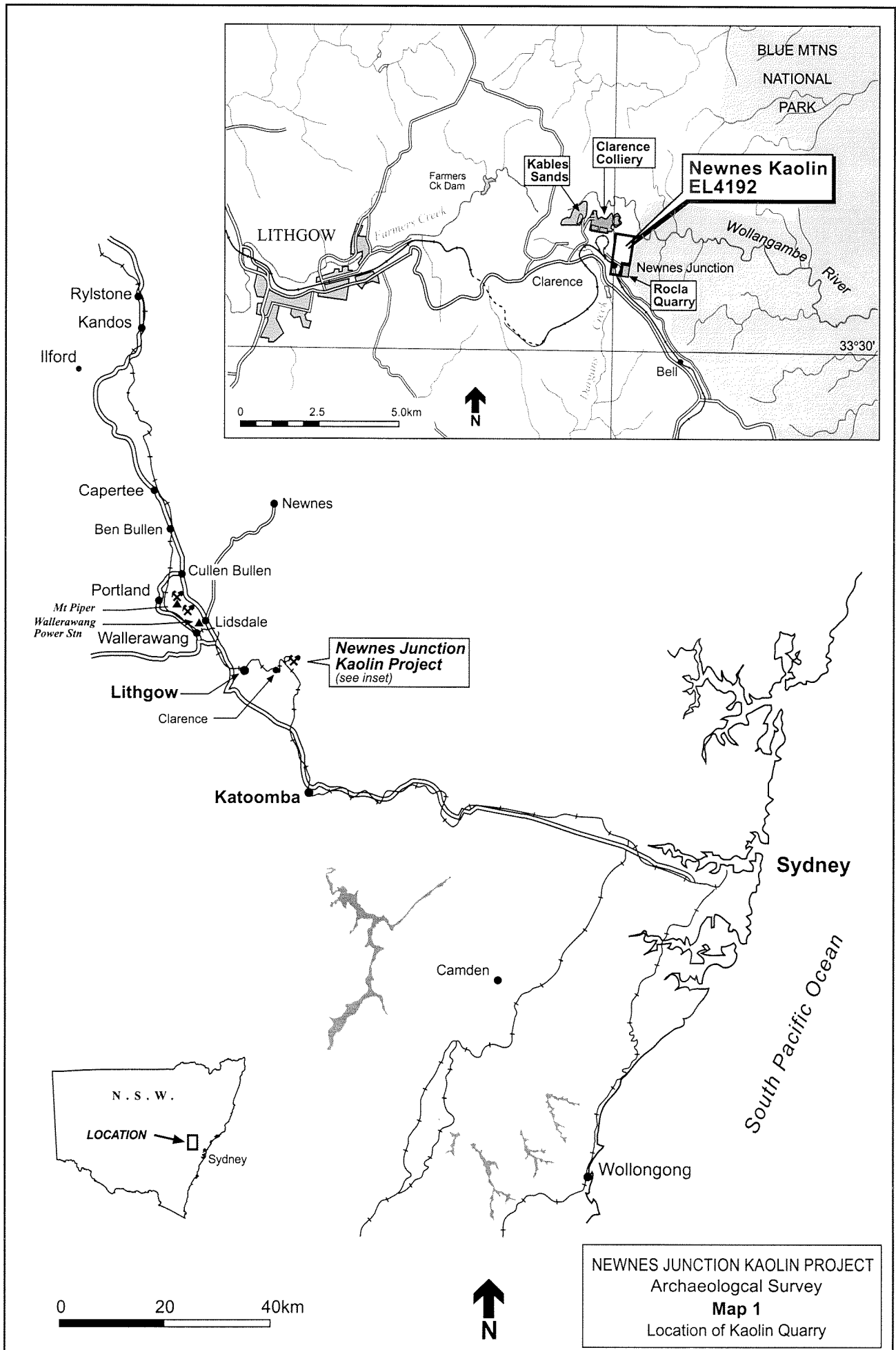
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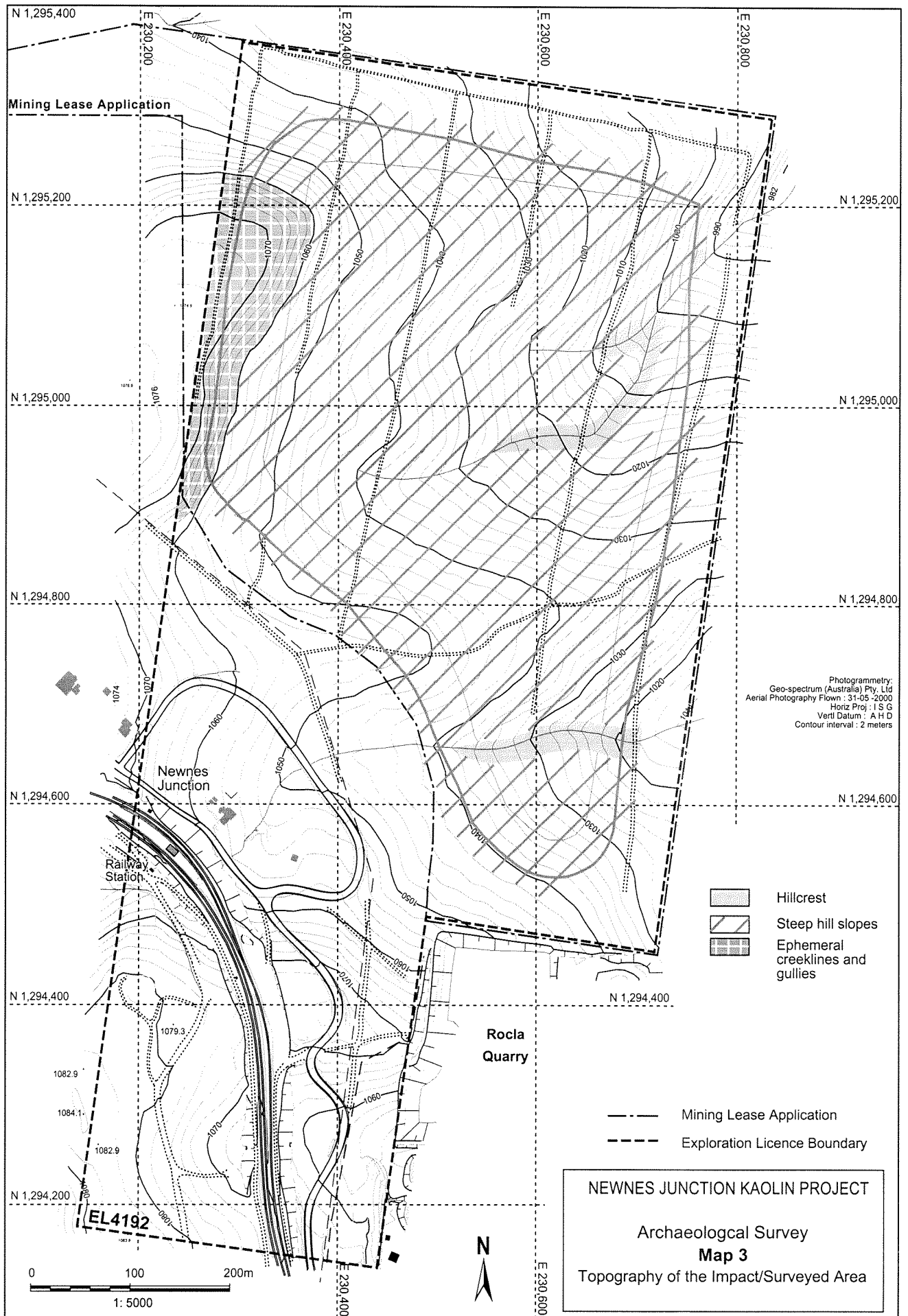
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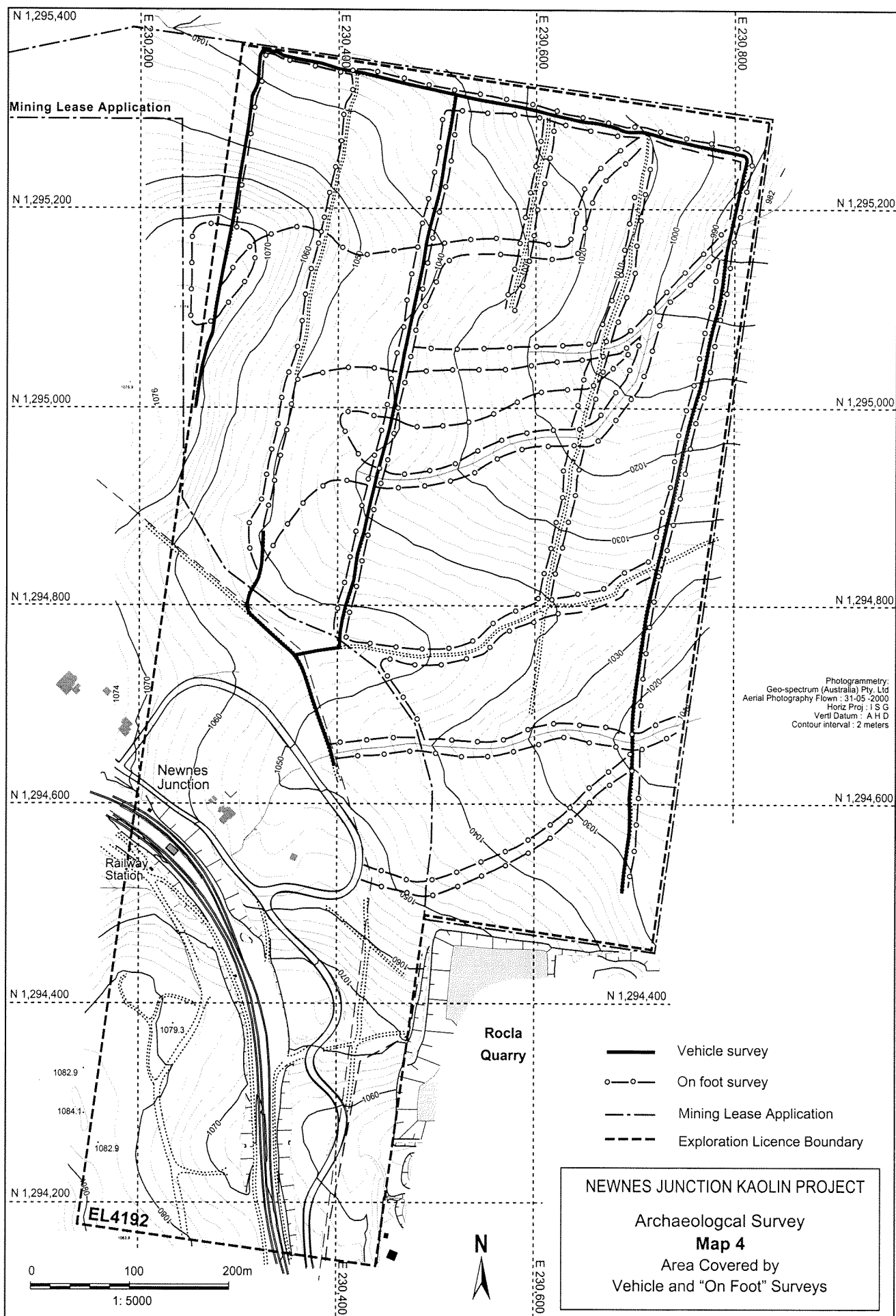
Appendix 1: Maps



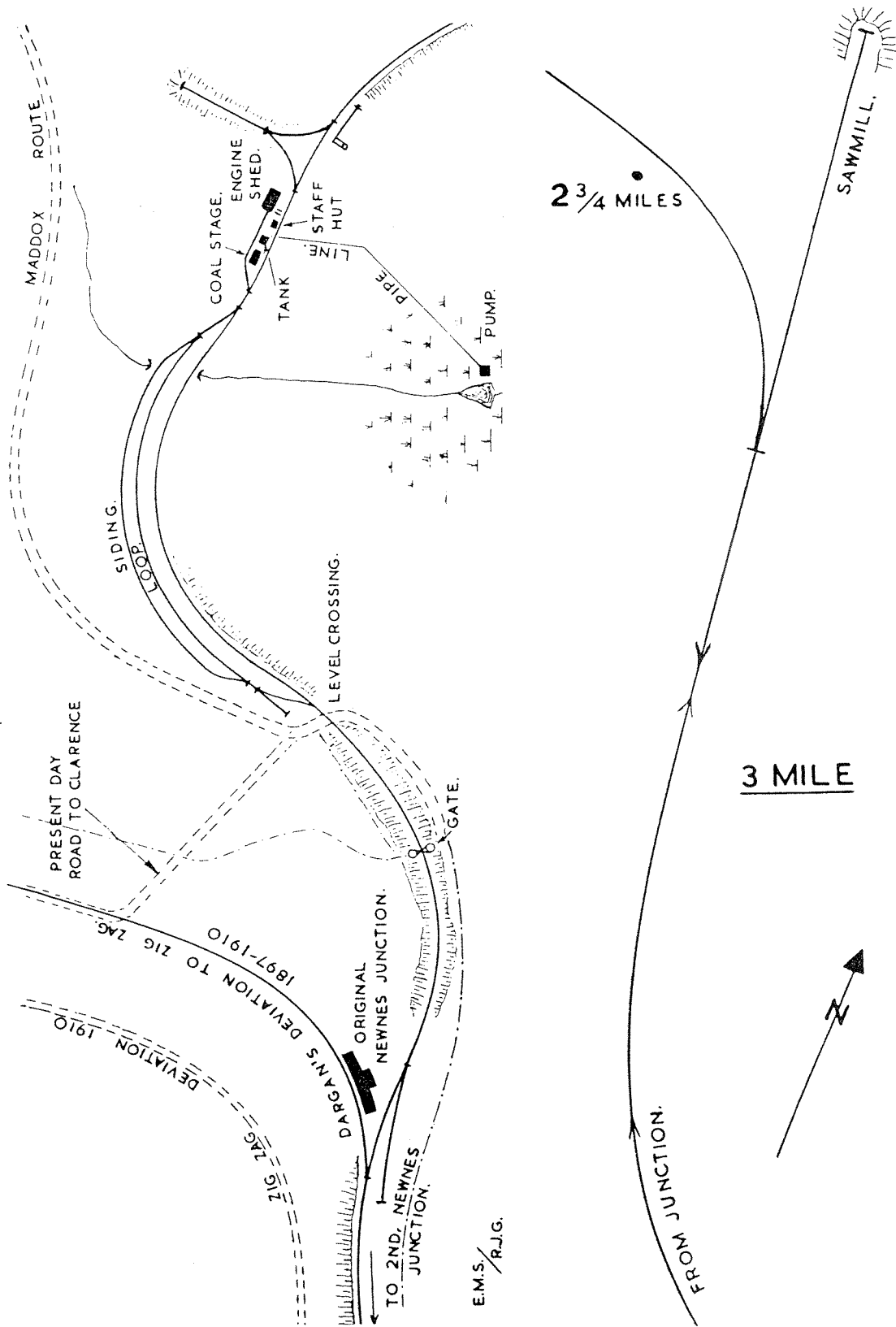


Map 2: Known sites and sites identified in this survey





NEWNES JUNCTION. (1906-1910.)



Map 5: Location of the Newnes Junction to Newnes Railway Line.

Appendix 2: Photographs

Appendix 3:
Statement from Bathurst LALC



**BATHURST
LOCAL ABORIGINAL LAND COUNCIL**
133 Howick Street, Bathurst, NSW 2795
Phone: 063 - 32 6835
Fax: 063 - 32 3623

CLARENCE SAND EXTRACTION

7 DECEMBER 1999

A survey was conducted on Saturday 4 December 1999 for the proposed Opencut Sand Extraction Quarry at Clarence near Lithgow New South Wales.

The proposed area that was surveyed had no potential for Aboriginal occupancy

Ground visibility was nil as the area was covered by thick dense bushland

Therefor I can find no reason for the proposed project not to proceed.

Present at this survey were:

Robynne Mills	Archaeologist	Archaeological and Heritage Services
James Kelton	Archaeologist	
Richard Peters	Sites Officer	Bathurst Local Aboriginal Land Council

Richard J. Peters

Richard J Peters
Sites Officer
Bathurst Local Aboriginal Land Council

FAX

Robynne Mills
Archaeological and Heritage Services
60 Watkin Street
Newtown 2042
Ph: (02) 95171413
Fax: (02) 95179860
Email robynemills@ozemail.com.au

To: Deerubbin LALC
Attention: Chairperson
Fax No:
Date: 23rd November, 1999

Message: Re our phone call of 22nd November regarding the survey of Clarence Colliery

International Environmental Consultants have commissioned me to carry out a survey of the area of Clarence Colliery as shown on the accompanying map. I contacted Bathurst LALC who have confirmed that the survey area is within their LALC area however it does appear that the land is close to the Deerubbin boundary. If this is the case and Deerubbin LALC have an interest in the survey area, could you please contact me immediately so that I can arrange for the Deerubbin LALC to be represented in the survey.

The survey is scheduled for Tuesday 30th November and will take at least 4 days to complete. If you could let me know any requirements LALC may have in regard to the survey I would be most grateful.

Regards,



Robynne.

FAX

Robynne Mills
Archaeological and Heritage Services
60 Watkin Street
Newtown 2042
Ph: (02) 95171413
Fax: (02) 95179860
Email robynemills@ozemail.com.au

To: Gandangarra LALC
Attention: Lenny Malone
Fax No:
Date: 23rd November, 1999

Message: Re our phone call of 22nd November regarding the survey of Clarence Colliery

Dear Len,

I spoke with Murray at the LALC office yesterday about a proposed survey at Clarence Colliery which is situated near Lithgow (Map attached).

I contacted Bathurst LALC who have confirmed that the survey area is within their LALC area. However in discussions it came to light that there may be some Native Title issues which related to the Gandangarra LALC.

Could you please confirm if the LALC has an interest in the survey area. The survey is scheduled for Tuesday 30th November. If you could let me know any requirements LALC may have in regard to the survey I would be most grateful.

If I do not receive a response to this fax I will assume that there are no issues of concern to the LALC.

Regards,



Robynne.

FAX

Robynne Mills
Archaeological and Heritage Services
60 Watkin Street
Newtown 2042
Ph: (02) 95171413
Fax: (02) 95179860
Email robynne@mills@ozemail.com.au

To: Gandangarra LALC
Attention: Lenny Malone
Fax No:

Date: 23rd November, 1999

Message: Re our phone call of 22nd November regarding the survey of Clarence Colliery

Dear Len,

I spoke with Murray at the LALC office yesterday about a proposed survey at Clarence Colliery which is situated near Lithgow (Map attached).

I contacted Bathurst LALC who have confirmed that the survey area is within their LALC area. However in discussions it came to light that there may be some Native Title issues which related to the Gandangarra LALC.

Could you please confirm if the LALC has an interest in the survey area. The survey is scheduled for Tuesday 30th November. If you could let me know any requirements LALC may have in regard to the survey I would be most grateful.

If I do not receive a response to this fax I will assume that there are no issues of concern to the LALC.

Regards,

Robynne

Robynne

Robynne.

① The Gandangarra LALC has no native title interest in the area in question.

② However you may wish to contact the Gundungarra Tribal Council at Katumba who may have Native title interests.

I do not have a tact No for them but you contact the Native title unit at NSWRC on 9.689.4444 they should also be help.

Regards Len.

98
 92335413
 J. Levine

Appendix 4:

Gazetteer of previously recorded sites

ASR Site Search Criteria

SiteID (like):		Zone:	56
AMGE:	236000	to	245000
AMGN:	6290000	to	6303000
Name(like):			
Recorder:			
Date from:		to	
LGA:			
Local ALC:			
District:			
Site Type1:			
Site Type2:			
Site Type3:			
Contact:			
Date Modified:			to

ASR Standard Site List - 6822(a)

15/11/99 12:10:15

SiteID:	SiteName:	Location:	Zone:	AMGE:	AMGN:	Check Method:	Site Type:	Recorder:	Record Date:	Assoc. Report:
45-1-0002	Bungleboori;Old Bells		56	239300	6300400		Axe Grinding Groov	Jelinek, A.	31/05/77	
45-1-0003	Waratah Ridge;Mt Home;Mt Home Engravings;		56	243420	6301180		Axe Grinding Groove	Jelinek, A.	31/05/77	?
45-1-0003	Waratah Ridge;Mt Home;Mt Home Engravings;		56	243420	6301180		Rock Engraving grinding grooves	Jelinek, A.	31/05/77	?
45-1-0003	Waratah Ridge;Mt Home;Mt Home Engravings;		56	243420	6301180		Shelter with Deposit	Jelinek, A.	31/05/77	?
45-1-0004	Mt Horne;Newnes State Forest;1/Mt Horne;		56	242600	6301200		Axe Grinding Groove	Sullivan, S.	24/06/86	C-2016 C-339 ✓
45-1-0004	Mt Horne;Newnes State Forest;1/Mt Horne;		56	242600	6301200		Shelter with Art	Sullivan, S.	24/06/86	C-2016 C-339 ✓
45-1-0005	Old Bells Line Track;		56	239960	6301000		Axe Grinding Groov	Jelinek, A.	31/05/77	A-1474 bp
45-1-0051	Nine Mile Pine Plantation;Came Creek;		56	240250	6302850		Open Camp Site	Bostock	1/01/81	
45-1-0052	Cairne Creek;Bird Rock;Nine Mile Pine Plantation;		56	241000	6303000		Open Camp Site	Lichacz, W.	1/01/81	

ASR Standard Site List - 6822(a)

15/11/99 12:10:15

SiteID:	SiteName:	Location:	Zone:	AMGE:	AMGN:	Check Method:	Site Type:	Recorder:	Record Date:	Assoc. Report:
45-1-0055	Wollangambe Creek 1; Newnes Junction 1;		56	244870	6294550		Shelter with Art			
45-1-0055	Wollangambe Creek 1; Newnes Junction 1;		56	244870	6294550		Shelter with Deposit			
45-1-0056	Bald Hill / Bald Trig	Newnes Junction	56	243250	6295720		Not-an-Aboriginal Site	Litchacz, W.	6/04/81	
45-1-0057	Newnes Junction; Bald Hill; Bald Trig;		56	243220	6295730		Shelter with Art		1/01/80	
45-1-0057	Newnes Junction; Bald Hill; Bald Trig;		56	243220	6295730		Shelter with Deposit		1/01/80	
45-1-0058	Bungleboori;		56	244800	6297650		Shelter with Art	Bostock	1/01/81	
45-1-0058	Bungleboori;		56	244800	6297650		Shelter with Deposit	Bostock	1/01/81	
45-1-0059	Brown's Gap; Clarence Trig; Blackman's Creek 1;		56	240400	6290560		Shelter with Art	Bostock	1/01/81	C-1333
45-1-0059	Brown's Gap; Clarence Trig; Blackman's Creek 1;		56	240400	6290560		Shelter with Deposit	Bostock	1/01/81	C-1333
45-1-0060	Brown's Gap; Clarence Trig; Blackman's Creek 2;		56	240420	6290550		Shelter with Art	Bostock	1/01/81	C-1333
45-1-0060	Brown's Gap; Clarence Trig; Blackman's Creek 2;		56	240420	6290550		Shelter with Deposit	Bostock	1/01/81	C-1333
45-1-0061	Brown's Gap; Clarence Trig; Blackman's Creek 3;		56	240390	6290540		Shelter with Art	Bostock	1/01/81	C-1333

ASR Standard Site List - 6822(a)

15/11/99 12:10:15

SiteID:	SiteName:	Location:	Zone:	AMGE:	AMGN:	Check Method:	Site Type:	Recorder:	Record Date:	Assoc. Report:
45-1-0061	Brown's Gap;Clarence Trig;Blackman's Creek 3;		56	240390	6290540		Shelter with Deposit	Bostock	1/01/81	C-1333
45-1-0063	Newnes Junction;Bald		56	243380	6295800		Axe Grinding Groov	Brayshaw, H.	1/01/81	
45-1-0064	Newnes Junction;Bald Trig;		56	243180	6295750		Shelter with Deposit	Brayshaw, H.	1/01/81	
45-1-0065	Mt Horne;Paddys Creek;		56	241100	6299220		Axe Grinding Groove			
45-1-0065	Mt Horne;Paddys Creek;		56	241100	6299220		Shelter with Deposit			
45-1-0085	Old Bells Line of Road 2;Newnes Plateau;		56	241600	6294500		Open Camp Site	Stockton	1/01/83	
45-1-0103	Newnes Junction;Lithgow;		56	243120	6294940		Open Camp Site	Smith, Lorna	27/05/86	
45-1-0128	2;Newnes State Forest;		56	242200	6301100		Shelter with Art	McIntyre, S.	25/07/86	C-2016_C-339
45-1-0129	3;Newnes State Forest;		56	241950	6300950		Scarred Tree	McIntyre, S.	23/06/86	C-2016_C-339
45-1-0130	4;Newnes State Forest;		56	243300	6300800		Shelter with Deposit	McIntyre, S.	23/06/86	C-2016_C-339
45-1-0179	CC 5;NEWNES SF;		56	242100	6301750		Open Camp Site	Gollan, K.	1/09/83	?
45-1-0181	Mt Horne_1;NEWNES SF;		56	242350	6301200		Axe Grinding Groove	Gollan, K.	1/09/83	?
45-1-0181	Mt Horne_1;NEWNES SF;		56	242350	6301200		Shelter with Art	Gollan, K.	1/09/83	?
45-1-0182	Mt Horne_2;NEWNES SF;		56	242350	6301150		Shelter with Deposit	Gollan, K.	1/09/83	?
45-1-0183	Mt Horne_3;NEWNES SF;		56	243400	6300350		Shelter with Deposit	Gollan, K.	1/09/83	?

ASR Standard Site List - 6822(a)

15/11/99 12:10:15

SiteID:	SiteName:	Location:	Zone:	AMGE:	AMGN:	Check Method:	Site Type:	Recorder:	Record Date:	Assoc. Report:
45-1-0184	PC 1;NEWNES SF;		56	240750	6298400		Open Camp Site	Gollan, K.	1/09/83	?
45-1-0185	PC 2;NEWNES SF;		56	241200	6298500		Open Camp Site	Gollan, K.	1/09/83	?
45-1-0186	PC 3;NEWNES SF;		56	241600	6299000		Shelter with Art	Gollan, K.	1/09/83	?
45-1-0187	PC 4;NEWNES SF;		56	241650	6298800		Open Camp Site	Gollan, K.	1/09/83	?
45-1-0188	PC 5;NEWNES SF;		56	241800	6299150		Open Camp Site	Gollan, K.	1/09/83	?
45-1-0189	PC 6;NEWNES SF;		56	242400	6298950		Shelter with Art	Gollan, K.	1/09/83	?
45-1-0190	PC 7;NEWNES SF;		56	242950	6298600		Open Camp Site	Gollan, K.	1/09/83	?
45-1-0191	PC 8;NEWNES SF;		56	242950	6298500		Open Camp Site	Gollan, K.	1/09/83	?
45-1-0192	HVS 1;NEWNES SF;		56	241550	6296900		Open Camp Site	Gollan, K.	1/09/83	?
45-1-0193	FC 4;NEWNES SF;		56	241450	6296000		Open Camp Site	Gollan, K.	1/09/83	?
45-1-0194	FC 3;NEWNES SF;		56	241150	6295800		Open Camp Site	Gollan, K.	1/09/83	1185
45-1-0195	FC 2;NEWNES SF;		56	241200	6296500		Open Camp Site	Gollan, K.	1/09/83	1185
45-1-0196	FC 1;NEWNES SF;		56	241100	6296600		Open Camp Site	Gollan, K.	1/09/83	?
45-1-0197	CC 1;NEWNES SF;		56	242080	6302950		Open Camp Site	Gollan, K.	1/09/83	?
45-1-0199	MC 1;NEWNES SF;		56	236200	6298400		Shelter with Deposit	Gollan, K.	1/09/83	?
45-1-0200	SMC 1;NEWNES SF;		56	236450	6294000		Shelter with Deposit	Gollan, K.	1/09/83	?
45-1-0201	BHT 2;NEWNES SF;		56	243100	6295850		Shelter with Deposit	Gollan, K.	1/09/83	?
45-1-0202	BHT 1;NEWNES SF;		56	243250	6295800		Shelter with Deposit	Gollan, K.	1/09/83	?
45-1-0204	S11;Newnes Plateau;		56	236120	6300900		Shelter with Art	Rich, E.	1/01/92	C-2300
45-1-0205	S10;Newnes Plateau;		56	236200	6301020		Shelter with Art	Rich, E.	1/01/92	C-2300
45-1-0246	Blackmans Ck;		56	240350	6290450		Shelter with Deposit	Bluff, W.T.	8/05/96	C-1333 x(lost)

*** End of Report *** Site Count: 46

NSW National Parks and Wildlife Service

Appendix 5:

Results of Non-indigenous Archival Searches



NSW
Heritage
Office

About the Heritage Office
About the Heritage Council
Listing Heritage Items
Researching Heritage Items
Conserving Heritage Places

Heritage Funding
State Government Resources
Local Government Resources
For Students
Aboriginal Heritage

Historical
Maritime
Movable
Multicultural
Natural

Listing Heritage Items

State Heritage Inventory Search Results

Statutory Listed Items

Information and items listed in the State Heritage Inventory come from a number of sources. This means that there are several entries for the same heritage item in the database. For clarity, the search results have been divided into two sections.

- The first section contains items listed on the State Heritage Register, covered by an Interim Heritage Order under section 130 of the NSW Heritage Act. This information is provided by the NSW Heritage Office.
- The second section contains items listed by Local Councils & Shires and State Government Agencies. This section contains additional information on some of the items listed in the first section.

Section 1. Items listed under the NSW Heritage Act.

The search results can be resorted by clicking on the **(sort)** option at the top of each column.

Item Name (sort)	Address (sort)	Suburb (sort)	LGA (sort)	Statutory Listed
Bowenfels Presbyterian cemetery	Great Western Highway	South Bowenfels	Lithgow	No
Collits Inn	Hartley Vale Road	Hartley Vale	Lithgow	Yes
Coerwull	Great Western Highway	Bowenfels	Lithgow	No
Emoh and stone Culvert	Great Western Highway	Old Bowenfels	Lithgow	No
Fernhill	Great Western Highway	Bowenfels	Lithgow	Yes
Great Zig Zag Railway and Reserves	Brewery Lane	Lithgow	Lithgow	Yes
Hermitage Colliery Managers Cottage	8 Coalbrook Street	Lithgow	Lithgow	No
Lidsdale House Gardens	Mudgee Road	Lidsdale	Lithgow	No
Lithgow Blast Furnace	Inch Street	Lithgow	Lithgow	Yes
Lithgow Valley Colliery & Pottery Site	Bent Street	Lithgow	Lithgow	Yes
Sweet Briars, Old Bowenfels	Great Western Highway	Old Bowenfels	Lithgow	No
Victoria Pass	Great Western Highway	Mount Victoria	Lithgow	No

There were **12** records in this section matching your search criteria.

Section 2. Items listed by Local Government and State agencies.

Item Name (sort)	Address (sort)	Suburb (sort)	LGA (sort)	In State Inventory
Airdrie	Kirkley Street	South Bowenfels	Lithgow	LG
Ambermere	Great Western Highway	Little Hartley	Lithgow	LG
Andrew Brown's Private Cemetery	Coerwull Road (off)	Lithgow	Lithgow	LG

Anglican Church	Cartwright Street	Rydal	Lithgow	LG
ANZ Bank	30 Main Street (cnr)	Lithgow	Lithgow	LG
Bank	156 Main Street	Lithgow	Lithgow	LG
Ben Avon	Great Western Highway	South Bowenfels	Lithgow	LG
Blackman and Merrick family cemetery	Gap Road	Hartley Vale	Lithgow	LG
Blast Furnace Site	Inch Street	Lithgow	Lithgow	LG
Bowenfels Presbyterian cemetery	Great Western Highway	South Bowenfels	Lithgow	LG
Bowenfels Railway Station Group	Main Western Line	Bowenfels	Lithgow	LG
Braemar House	50 Tweed Road	Bowenfels	Lithgow	LG
Caddies Restaurant	1 Coorwull Road	Bowenfels	Lithgow	LG
Cemetery	Mead Street	Meadow Flat	Lithgow	LG
Collits Inn	Hartley Vale Road	Hartley Vale	Lithgow	LG
Collitt's / Mt.York burial ground	Hartley Vale Road	Hartley Vale	Lithgow	LG
Coorwull House	Great Western Highway	Bowenfels	Lithgow	LG
Coorwull Presbyterian Church	Great Western Highway	Lithgow	Lithgow	LG
Cottage (duplex)	16 & 18 Lithgow Street	Lithgow	Lithgow	LG
Eliza Rodd Grave	Jenolan Caves Road (off)	Hartley	Lithgow	LG
Emoh	Great Western Highway	South Bowenfels	Lithgow	LG
Eskbank House	Bennett Street	Lithgow	Lithgow	LG
Fernhill	Great Western Highway	South Bowenfels	Lithgow	LG
Forty Bends	Great Western Highway	South Bowenfels	Lithgow	LG
Forty Bends Cemetery	Old Forty Bends Road	South Bowenfels	Lithgow	LG
Forty Bends Cottage	Old Forty Bends Road	South Bowenfels	Lithgow	LG
General Cemetery	Capertee Road	Dark Corner	Lithgow	LG
General Store (former)	Bathurst Street (0.5km N of town)	Rydal	Lithgow	LG
Great Zig Zag	Lithgow Valley Reserve	Lithgow	Lithgow	LG
Gymnasium	Railway Parade	Lithgow	Lithgow	LG
Harp of Erin	Great Western Highway	Little Hartley	Lithgow	LG
Hartley Court House	Old Bathurst Road	Hartley	Lithgow	LG
Hermitage Colliery Managers Cottage	8 Coalbrook Street	Lithgow	Lithgow	LG
Hoskins Memorial Presbyterian Church	Bridge Street	Lithgow	Lithgow	LG
House	22-24 Lithgow Street	Lithgow	Lithgow	LG
House	20 Lithgow Street	Lithgow	Lithgow	LG
House group	1-13 & 2-12 Brisbane Street	Lithgow	Lithgow	LG
La Salle Academy South Bowenfels	Rabaul Street (off)	Lithgow	Lithgow	LG
Lidsdale House Gardens	Mudgee Road	Lidsdale	Lithgow	LG
Lithgow Court House	Bridge Street	Lithgow	Lithgow	LG

Lithgow general cemetery	Great Western Highway	Lithgow	Lithgow	LG
Lithgow No. 2 Dam	Farmers Creek	Lithgow	Lithgow	LG
Lithgow Primary School Residence	Mort Street	Lithgow	Lithgow	LG
Lithgow Valley Colliery and Pottery Office Building	69 Bent Street	Lithgow	Lithgow	LG
Lockyers Pass	Hartley Vale Road	Hartley Vale	Lithgow	LG
Lowther Park	Jenolan Caves Road	Lowther	Lithgow	LG
Lowther Park and Cemetery	Jenolan Caves Road	Lowther	Lithgow	LG
Marrangaroo Prayer Chapel	Great Western Highway	Marrangaroo	Lithgow	LG
Meades Farm	Great Western Highway	Little Hartley	Lithgow	LG
Methven	1 Evans Place	Bowenfels	Lithgow	LG
Moyne	Coxs River Road	Kanimbla	Lithgow	LG
Moyne Farm and Cemetery	Coxs River Road (off)	Little Hartley	Lithgow	LG
National School Group (former)	Great Western Highway	South Bowenfels	Lithgow	LG
Newnes		Wolgan Valley	Lithgow	LG
Office	31 Main Street	Lithgow	Lithgow	LG
Oil Shale Works and Refinery		Glen Davis	Lithgow	LG
Old Roman Catholic Cemetery	Great Western Highway	Hartley	Lithgow	LG
Portland Cement Group	Williwa Street	Portland	Lithgow	LG
Presbyterian Church and Sessions Hall	Great Western Highway	South Bowenfels	Lithgow	LG
Railway Cottage	Portland Road	Pipers Flat	Lithgow	LG
Railway Items Newnes Junction - Sodwalls	Main Street	Wallerawang	Lithgow	LG
Railway Items Newnes Junction - Sodwalls	Main West Line	Sodwalls	Lithgow	LG
Railway Items Newnes Junction - Sodwalls	Main West Line	Newnes Junction	Lithgow	LG
Railway Items Newnes Junction - Sodwalls	Main West Line	Rydal	Lithgow	LG
Railway Items Newnes Junction - Sodwalls	Main West Line	Marrangaroo	Lithgow	LG
Railway Items Newnes Junction - Sodwalls	Main West Line	Clarence	Lithgow	LG
Repco Store	Railway Parade	Lithgow	Lithgow	LG
Rosedale	Great Western Highway	Little Hartley	Lithgow	LG
Royal Hotel	Great Western Highway	South Bowenfels	Lithgow	LG
Royal Hotel (former)	Old Bathurst Road	Hartley Historic Site	Lithgow	LG
Rydal General Cemetery		Rydal	Lithgow	LG
Rydal Railway Station	Bathurst Street	Rydal	Lithgow	LG
School and Residence	Main Street	Wallerawang	Lithgow	LG
School Residence	Rydal Road	Tarana	Lithgow	LG

Six Foot Track		Megalong Valley	Lithgow	LG
Sodwalls Inn	Sodwalls Road	Sodwalls	Lithgow	LG
Somerset House	Great Western Highway	South Bowenfels	Lithgow	LG
St Bernard's Roman Catholic Church Group	Old Bathurst Road	Hartley Historic Site	Lithgow	LG
St John the Evangelist Church	Main Street	Wallerawang	Lithgow	LG
St John the Evangelist's Anglican Church	Great Western Highway	Hartley	Lithgow	LG
St Thomas Anglican Church	Wicketty War Road	Hampton	Lithgow	LG
Staff Cottages for Small Arms Factory	1,2,3 Commonwealth Avenue	Lithgow	Lithgow	LG
State Mine Site	State Mine Gully	Lithgow	Lithgow	LG
Sunny Corner General Cemetery	Dark Corner Road	Sunny Corner	Lithgow	LG
Sunny Corner Smelter Ruins	Sunny Corner PO 1km North/East	Sunny Corner	Lithgow	LG
Sweet Briars	Great Western Highway	South Bowenfels	Lithgow	LG
Terrace	8,10,12,14 Lithgow Street	Lithgow	Lithgow	LG
Timber slab cottage	Mid Hartley Road	Hartley Vale	Lithgow	LG
Umera	Great Western Highway	South Bowenfels	Lithgow	LG
Union Theatre / Outbuilding	65 Bridge Street	Lithgow	Lithgow	LG
Victoria Pass	Great Western Highway	Mount Victoria	Lithgow	LG
Walker-Barton private cemetery		Wallerawang	Lithgow	LG
West Fund; King's Chinese Restaurant	Railway Parade	Lithgow	Lithgow	LG
Willowvale	Portland Road	Wallerawang	Lithgow	LG
Wolgan Valley Railway	Main West Line	Newnes Junction	Lithgow	LG
Wolgan Valley Station	Wolgan Road	Wallerawang	Lithgow	LG
Zig Zag Brewery (former)	Brewery Lane	Lithgow	Lithgow	LG

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There was a total of **110** records matching your search criteria.

Key:

LGA = Local Government Area

GAZ = NSW Government Gazette (statutory listings prior to 1997), HGA = Heritage Grant Application, HS = Heritage Study, LGOV = Local Government Agency.

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Appendix F – Air Quality Study

**AIR QUALITY IMPACT ASSESSMENT:
PROPOSED KAOLIN MINE AT NEWNES JUNCTION, NSW**

14 April 2003

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1. INTRODUCTION

This report has been prepared by Holmes Air Sciences for International Environmental Consultants Pty Ltd who are in turn acting on behalf of Newnes Kaolin Pty Ltd. The purpose of this report is to assess any air quality impacts that may be associated with a proposed kaolin mine near Lithgow in New South Wales (NSW).

The assessment is based on the use of a computer dispersion model to predict ground-level dust concentrations and deposition levels in the vicinity of the site. To assess the effect that the dust emissions would have on existing air quality, the dispersion model predictions have been compared to relevant air quality goals.

Predictions of dust concentration and deposition levels have been made using the US EPA's short-term industrial source complex dispersion model known as ISCST3 (**US EPA, 1995A**).

2. BACKGROUND TO THE STUDY

2.1 The Study Area

Newnes Kaolin Pty Ltd propose to develop and operate a kaolin mine near Newnes Junction, west of Sydney in NSW. The site is located approximately 10 km to the east of Lithgow on the northern side of Bells Line of Road and is situated amongst quite undulating terrain. **Figures 1 and 2** show the site location and a three-dimensional representation of the local terrain respectively. Also shown are the nearest residences to the project area. Local landuse within the study area is considered be rural.

2.2 Description of Proposed Activities

The total reserves of the mine are estimated to be 23.7 Mt. These reserves consist mainly of construction and industrial sands with smaller proportions of pea gravel, kaolin and silt. Mining life is anticipated to be 21 years. Over the life of the mine approximately 119,000 tonnes per annum (tpa) of kaolin and up to 1.281 million tpa of high grade sand would be produced. Maximum production per year would total approximately 1.4 Mt.

Key mining activities would include:

- Removal and stockpiling of topsoil using bulldozers,
- Extraction of kaolin ore by ripping and/or digging,
- Loading ore to haul trucks for transport to processing area,
- Crushing the Run-of-Mine (ROM) ore at the crusher station,
- Conveying material to covered stockpiles before removal offsite via train for further processing of the ore.

Figure 3 shows the proposed layout of the mine pit and associated infrastructure. Mining would be conducted in stages with the activities progressing in a north to south direction. Rehabilitation of the mine walls would be carried out with the completion of each stage of mining.

Since the processing of the ore would be conducted offsite, large stockpiles of material would not be required on the site. There would, however, be temporary stockpiling of material in-pit before transportation to the processing site.

Hours of operation are expected to be 10 hours per day for 5.5 days per week and for 50 weeks per year.

3. AIR QUALITY ASSESSMENT METHODS AND CRITERIA

Table 1 and **Table 2** summarise the air quality goals that are relevant to this study. The air quality goals relate to the total dust burden in the air and not just the dust from the project. In other words, some consideration of background levels needs to be made when using these goals to assess impacts. This will be discussed later.

Table 1. Air quality standards/goals for particulate matter concentrations

POLLUTANT	STANDARD / GOAL	AVERAGING PERIOD	AGENCY
Total suspended particulate matter (TSP)	90 µg/m ³	Annual mean	NHMRC
Particulate matter < 10 µm (PM ₁₀)	50 µg/m ³	24-hour maximum	NSW EPA
	30 µg/m ³	Annual mean	NSW EPA long-term reporting goal
	50 µg/m ³	(24-hour average, 5 exceedances permitted per year)	NEPM
Particulate matter < 2.5 µm (PM _{2.5})	15 µg/m ³	Annual mean	US EPA ¹
	65 µg/m ³	24-hour maximum ²	US EPA

Also included in **Table 1** are the US EPA goals for the fine fraction of PM₁₀ namely PM_{2.5}. Epidemiological studies (**Dockery et al, 1993** for example) indicate that it is the finer particles, that is those below 2.5 µm in diameter and referred to as PM_{2.5}, that cause health impacts as they are taken deeper into the lung.

In addition to health impacts, airborne dust also has the potential to cause nuisance impacts by depositing on surfaces. **Table 2** shows the maximum acceptable increase in dust deposition over the existing dust levels. These criteria for dust fallout levels are set to protect against nuisance impacts (**NSW EPA 2001**).

Table 2. NSW EPA criteria for dust fallout

Pollutant	Averaging period	Maximum increase in deposited dust level	Maximum total deposited dust level
Deposited dust	Annual	2 g/m ² /month	4 g/m ² /month

¹ Australian standard under development

² 99th percentile averaged over three years

4. EXISTING ENVIRONMENT

This section describes the dispersion meteorology and existing dust levels in the area.

4.1 Dispersion Meteorology

The Gaussian dispersion model used for this assessment, ISCST3, requires information about the dispersion characteristics of the area. In particular, data are required on wind speed, wind direction, atmospheric stability class³ and mixing height⁴.

The closest known meteorological station with data suitable for dispersion modelling purposes is at Mount Piper (collected by Mount Piper Power Station). This site is located approximately 20 km to the WNW of the proposed kaolin mine site and the data contains one year of hourly records for 1997. Windroses prepared from these data are shown in **Figure 4**.

On an annual basis, it can be seen that most winds at Mount Piper were from the SW and WSW in 1997. This pattern is evident in all seasons except summer, where there is a significant contribution of winds from the ESE. To determine if the Mount Piper data would be representative of the wind patterns at Newnes Junction, these data have been compared with data collected at Lithgow by the Bureau of Meteorology and also with data generated for the site by The Air Pollution Model (TAPM).

Figure 5 shows annual and seasonal windroses for Lithgow based on spot observations made at 9 am and 3 pm by the Bureau of Meteorology. These data differ from the 1997 data in that they present a long term picture of the wind patterns over the life of the meteorological station.

Annually, the Lithgow data show that the most common winds are from the west. This is similar to the annual pattern of winds at Mount Piper, albeit a slight shift clockwise to the wind direction. Some seasonal similarities between the Lithgow and Mount Piper data are also evident.

Annual and seasonal windroses created from data generated by TAPM are shown in **Figure 6**. These data show strong similarities to the Mount Piper data with the most common winds from the WSW on an annual basis. Seasonal patterns from the TAPM data also show similar patterns to the Mount Piper data.

Given similarities between three datasets for the area it is considered that the Mount Piper data would give a reasonable indication of the likely frequency and pattern of winds in the Newnes Junction site. These data have therefore been adopted for the purposes of this assessment.

To use the wind data to assess dispersion it is necessary to also have available data on atmospheric stability. A stability class was assigned to each hour of the meteorological data using sigma-theta according to the method recommended by the US EPA (**US EPA, 1986**). **Table**

³ In dispersion modelling stability class is used to categorise the rate at which a plume will disperse. In the Pasquill-Gifford stability class assignment scheme, as used in this study, there are six stability classes A through to F. Class A relates to unstable conditions such as might be found on a sunny day with light winds. In such conditions plumes will spread rapidly. Class F relates to stable conditions, such as occur when the sky is clear, the winds are light and an inversion is present. Plume spreading is slow in these circumstances. The intermediate classes B, C, D and E relate to intermediate dispersion conditions.

⁴ The term mixing height refers to the height of the turbulent layer of air near the earth's surface into which ground-level emissions will be rapidly mixed. A plume emitted above the mixed-layer will remain isolated from the ground until such time as the mixed-layer reaches the height of the plume. The height of the mixed-layer is controlled mainly by convection (resulting from solar heating of the ground) and by mechanically generated turbulence as the wind blows over the rough ground.

3 shows the frequency of occurrence of the different stability categories expected in the area. The high frequency of D class stabilities indicates that dispersion conditions will be such that dust will disperse rapidly for a significant proportion of the time (35 per cent D-class). Mixing height was determined using a scheme defined by Powell (**Powell, 1976**) for daytime conditions and an approach described by Venkatram (**Venkatram, 1980**) for night time conditions. These two methods provide the best estimate of mixing height in the absence of upper air data.

Joint wind speed, wind direction and stability class frequency tables for the Mount Piper data are presented in **Appendix A**.

Table 3. Frequency of occurrence of stability classes at Mount Piper

Stability Class	1997
A	13.3
B	7.1
C	11.5
D	34.8
E	13.0
F	20.3
Total	100

4.2 Existing air quality

No site specific monitoring of existing ambient dust concentrations and dust deposition levels are available for this project. Existing dust concentrations and deposition levels would be highly influenced by all existing dust generating activities in the area. The major dust sources would be the Clarence Colliery to the north of the proposed site and the Rocla sand quarry to the south. It will be seen later (**Section 8**) that the proposed kaolin mining operations would contribute very little to existing dust levels in the area.

5. ASSESSMENT CRITERIA

One of the main reasons for analysing monitoring data is to determine existing air quality so that the assessment criteria can be determined in accordance with the EPA's modelling guidelines (**NSW EPA, 2001**).

When monitoring data are not available it becomes difficult to quantify the existing air quality and to undertake a robust air quality assessment. In this study, no dust deposition or dust concentration data are available. There is an approximate relationship between annual dust deposition and annual TSP concentrations that applies in areas where particulate matter is dominated by mining/quarry dust. Areas experiencing 4 g/m²/month typically experience annual TSP concentrations of 90 µg/m³. Further, in mining areas, typically 40% of TSP will be in the PM₁₀ size range. In the absence of dust concentration and deposition measurements a conservative estimate of dust deposition levels has been made for the purposes of this assessment. It has been assumed that the annual average dust deposition levels in the study area is 2 g/m²/month. Thus in an area where measured annual average dust deposition rates are 2 g/m²/month (from) the annual TSP concentration would be 45 µg/m³ and annual average PM₁₀ concentrations would be 18 µg/m³.

Assuming the background concentrations and deposition levels are reasonable and conservative, then, using the EPA's modelling guidelines the following criteria would be applicable:

- Acceptable increase in annual average PM₁₀ is **12** µg/m³ (30 – 18 µg/m³)
- Acceptable increase in annual average TSP is **45** µg/m³ (90 – 45 µg/m³)
- Acceptable increase in annual deposition (insoluble solids) **2** g/m²/month

It will be seen later (**Section 8**) that the contribution of dust emissions from the proposed operations to the existing levels and that selection of more conservative estimates of background concentrations and deposition levels would not result in exceedances of relevant air quality goals.

In addition, the EPA guideline requires an assessment against 24-hour PM₁₀ concentrations. The preferred approach is to add model predictions of predicted PM₁₀ to measured PM₁₀ concentrations for the same meteorological conditions. To do this requires contemporaneous monitoring and meteorological data so that the predicted concentrations for particular meteorological conditions can be matched to ambient concentrations that occur with those meteorological conditions.

The objective then is that the sum of the predicted concentration from the project being assessed and the background should not exceed the criterion. Alternatively the assessment criterion can be that the project should not cause additional exceedances.

The requirement to match ambient concentrations with corresponding meteorological conditions used for the model prediction is based on the assumption that meteorological conditions and background concentrations are correlated. In some cases this may be the case, but in the presence of bushfires or other unpredictable emissions this is not the case. A further requirement is that a database of continuous 24-hour PM₁₀ concentrations is available along with the corresponding meteorological data. This is not the case for this study.

The above approach can be unworkable when background 24-hour concentrations occasionally exceed the 50 µg/m³ concentration criterion. In this case, there is no way that the emission source can comply with the criteria, when added to the background. For example one exceedance in the pre-project background concentrations could lead to the conclusion that the air shed could not accept additional emissions. Frequent exceedances of the 24-hour criterion indicate a polluted environment and therefore additional emissions would be undesirable. However, a generally unpolluted air shed that occasionally experiences high PM₁₀ concentrations, for example due to bushfires, would not require that a project should not be approved. Thus the assessment process needs to take these issues into account.

In view of the above the EPA also allows the assessment test to be that the predicted 24-hour average PM₁₀ concentration from the development should be less than 50 µg/m³. This is the approach that has been adopted here. This goal is only applicable when the mine is operating with best practice industry standards for dust control.

6. ESTIMATED DUST EMISSIONS

Estimated dust emission totals are presented in **Table 4**, and details of the calculations are presented in **Appendix B**. These estimates assume some control of dust emissions is achievable through the use of watering carts on all unsealed haul roads and by enclosing some of the processing areas.

For the air quality impact assessment, two stages of the mines operation have been considered. These two stages are identified as Stage 2 and Stage 5. Maximum production in any one year has been assumed to be 1.4 Mt.

Stage 2 has been modelled to represent the mining operations in its early development. During this stage there would be significant activities taking place in the pit but the total exposed working area of the pit would be small. Stage 5 operations represent the maximum exposed working areas and mining activities. The latter stage is considered to present the worst case in terms of air quality impacts associated with the proposal.

Table 4. Estimated dust emissions per year for kaolin mining operations

Mining Activities	TSP emission rate (kg/yr)	
	Stage 2	Stage 5
Dozer ripping material in the pit	11,385	11,385
Loading ripped material to trucks	635	635
Hauling material to crushing station	37,333	74,667
Dumping loaded material to hopper	635	635
Primary crushing of material	6,300	6,300
Hauling topsoil material to stockpiles	613	1,664
Dumping material to stockpiles	10	47
Wind erosion from the exposed working area	9,110	38,544
Wind erosion from stockpiles	1,051	5,256
TOTAL	67,072	139,133

Dust emissions have been estimated by analysing the mining operations for each stage of development. The fraction of fine, inhalable and coarse particles for each activity has been taken into account for the dispersion modelling.

The operations which apply in each case have been combined with emission factors developed, both locally and by the US EPA, to estimate the amount of dust produced by each activity. These emission factors applied are considered to be the most up to date methods for determining dust generation rates.

7. APPROACH TO ASSESSMENT

The short-term industrial source complex model (ISC3-ST - Version 02035) has been used in this study. The model is an advanced Gaussian dispersion model approved by the US EPA for use in regulatory assessments undertaken within the US. It is one of the most widely used regulatory models in the world. The model is accepted by the NSW EPA for assessing the dispersion of dust. A complete description of the model is provided in US EPA publications (**US EPA 1995A**). These two volumes provide user instructions (Volume 1) and a comprehensive technical description of the algorithms used in the model (Volume 2). For convenience, a brief description of the model is provided below.

The model uses the Gaussian dispersion equation to simulate the dispersion of a plume from either point, area or volume sources. The model also includes mechanisms for determining the effect of terrain on plume dispersion. The model works on an hourly time step which means that

it requires a meteorological file that provides wind speed, wind direction and other dispersion parameters on an hourly basis. For each hour the dispersion of plumes is determined using the conventional Gaussian model assumptions. These model assumptions have some limitations and it is worth noting some of these at this point.

One of the most significant limitations of the Gaussian model is that it assumes that steady state dispersion conditions are reached instantaneously. That is, if one were to imagine that the plume is simulating for a particular hour, one would see each source of dust producing a plume that extends indefinitely in the downwind direction to the edge of the prediction grid. In reality, under very light wind conditions, this is an inappropriate assumption.

Consider for example a condition where the wind speed is 0.5 m/s. At the end of one hour any emission that occurred at the beginning of the hour will have travelled approximately 1.8 km from the source ($0.5 \text{ m/s} \times 3,600 \text{ s}$). Thus, under these light wind conditions, the dust will have travelled 1.8 km from the source. The model assumes the dust will have travelled to the edge of the prediction grid that in this case may be up to 10 km from the source. In the next hour the meteorological conditions may remain the same or, more likely, the wind direction will change and the light wind condition may still persist. The model then assumes that a new equilibrium is established instantaneously and the plume travels in the new downwind direction at the new wind speed.

Because for surface sources the worst-case dispersion conditions are associated with light winds, the model has the potential to significantly overstate impacts at long distances downwind from the source. Since this problem leads to an overstatement of impacts rather than an understatement of impacts, this does not create a significant problem for environmental impact assessment. However, it should be borne in mind that there is a potential to overstate impacts at more distant receptors.

The ISC model also has the capacity to take into account emissions that vary in time, or with meteorological conditions. This has proved particularly useful for simulating emissions on mining operations where wind speed is an important factor in determining the rate at which dust is generated.

For the current study, the mine was represented by a collection of volume sources. Each volume source may comprise dust emissions from a variety of activities. Estimates of emissions for each volume source were developed on an hourly time step. Thus, for each source, for each hour, an emission rate was determined which depended upon the level of mining activity and the wind speed. It is important to do this in the ISC model to ensure that long-term average emission rates are not combined with worst-case dispersion conditions which are associated with light winds. Light winds in a mining area correspond with low dust generation (because wind erosion and other wind dependent emissions rates will be low) and poor dispersion. If these measures are not taken then the model has the potential to significantly overstate impacts.

The modelling has been based on the use of three particle-size categories (0 to $2.5 \mu\text{m}$ - referred to as FP ($\text{PM}_{2.5}$), 2.5 to $10 \mu\text{m}$ - referred to as CM (coarse matter) and 10 to $30 \mu\text{m}$ - referred to as the Rest). Mass emission rates in each of these size ranges have been determined using the factors derived from the **SPCC (1986)** study and TSP emission rates calculated using emission factors derived from **US EPA (1985)** and **NERDDC (1988)** work. The distribution of particles in each particle size range is as follows:

- $\text{PM}_{2.5}$ (FP) is 0.0468 of the TSP

-
- PM_{2.5-10} (CM) is 0.3440 of TSP
 - PM₁₀₋₃₀ (Rest) is 0.6090 of TSP.

Modelling was done using three ISC source groups. Each group corresponded to a particle size category. Each source in the group was assumed to emit at the full TSP emission rate and to deposit from the plume in accordance with the deposition rate appropriate for particles with an aerodynamic diameter equal to the geometric mean of the limits of the particle size range, except for the PM_{2.5} group, which was assumed to have a particle size of 1 µm. The predicted concentration in the three plot output files for each group were then combined according to the weightings above to determine the concentration of PM₁₀ and TSP. As an example the input file is provided in **Appendix C**. The mining activities have been assumed to be in operation for ten hours per day.

8. ASSESSMENT OF IMPACTS

8.1 Preamble

This section provides an interpretation of the predicted dust concentrations and deposition levels. The model runs were undertaken using the meteorological data described in **Section 4.1** (from Mount Piper) and the emissions data described in **Section 6**.

Simulations were undertaken for two stages in the life of the mine (Stage 2 and Stage 5). For each stage assessed, four isopleth diagrams have been produced showing the following:

1. Predicted maximum 24-hour average PM₁₀ concentration;
2. Predicted annual average PM₁₀ concentration;
3. Predicted annual average TSP concentration; and
4. Predicted annual average dust deposition.

The maximum 24-hour average contour plots do not represent the dispersion pattern at any particular instant in time, but show the highest predicted 24-hour average concentration that occurred at each location. The maxima are used to show concentrations which can possibly be reached under the modelled conditions.

Model predictions are presented in **Figures 7 to 14** and are discussed below. Dispersion modelling has also been undertaken using meteorological data generated by TAPM. Results from modelling using the TAPM data are presented in **Appendix D**. Analysis of the model results using both meteorological data sets indicate that a similar level of impact is predicted.

8.2 Stage 2 Operations

Figures 7 to 10 present predictions for PM₁₀, TSP and dust deposition levels due to the mining operations in Stage 2 of the proposal.

From **Figure 7** it can be seen that predicted maximum 24-hour concentrations do not exceed 50 µg/m³ beyond the exploration lease boundary. Concentrations at the nearest residence are predicted to be below 20 µg/m³ averaged over 24-hours. This is below to NSW EPA 50 µg/m³ goal.

Predicted annual average PM₁₀ concentrations due to the proposed mine are presented in **Figure 8**. This figure shows that the contribution to existing PM₁₀ concentrations from the mining activities would be very low beyond the boundary of the exploration lease. The most affected residence is predicted to experience annual average PM₁₀ concentrations less than 2 µg/m³. It would be unlikely that the proposed Stage 2 mining operations would cause exceedances of the annual average PM₁₀ goal of 30 µg/m³ at any sensitive receptor.

Similarly, for TSP the annual average predictions (see **Figure 9**) at all sensitive receptors are expected to be low. No exceedances of the 90 µg/m³ NHMRC goal would be expected. The predicted TSP concentration due to the mining operations in Stage 2 being around 2 to 3 µg/m³ at the nearest residence (to the south-west of the site).

Figure 10 shows the predicted dust deposition levels due to the mine in Stage 2. Dust deposition levels at the nearest residence are predicted to be less than 0.2 g/m²/month. This level is well below the maximum permissible increase allowed by EPA (2 g/m²/month) and compliance with this goal in Stage 2 would be anticipated. Also, it is unlikely that the total deposited dust level would exceed 4 g/m²/month due to Stage 2 mining operations.

Predicted concentrations and deposition levels at the nearest residences due to Stage 2 mining operations are summarised below.

- Predicted maximum 24-hour PM₁₀ average concentration less than 20 µg/m³
- Predicted annual average PM₁₀ concentration less than 2 µg/m³
- Predicted annual average TSP concentration less than 3 µg/m³
- Predicted increase in annual average dust deposition less than 0.2 g/m²/month

8.3 Stage 5 Operations

Modelling results for Stage 5 of the kaolin mining operations are presented in **Figures 11 to 14**. Predicted dust concentrations and deposition levels during Stage 5 operations are of similar magnitude to the Stage 2 predictions. The major difference between Stage 2 and Stage 5 being that maximum concentrations and deposition levels would shift further to the south-east. This would be expected with a shift in the activities to the south-east during Stage 5.

Examination of the predicted concentration and deposition levels due to the proposed operations during Stage 5 leads to similar conclusions to those drawn from Stage 2 predictions. That is, the maximum 24-hour PM₁₀, annual average PM₁₀ and TSP and annual average dust deposition levels due to the proposed operations during this stage are unlikely to cause exceedances of their respective air quality goals. Predictions at the nearest residence are low and it is unlikely that the proposed operations would be the cause of exceedances of air quality goals.

Predicted concentrations and deposition levels at the nearest residences due to Stage 5 mining operations are summarised below.

- Predicted maximum 24-hour PM₁₀ average concentration less than 30 µg/m³
- Predicted annual average PM₁₀ concentration 2 µg/m³ or less
- Predicted annual average TSP concentration less than 5 µg/m³
- Predicted increase in annual average dust deposition 0.2 g/m²/month or less

9. GREENHOUSE ISSUES

Mining results in the emission of carbon dioxide (CO₂) during the combustion of diesel fuel (used primarily in diesel-powered equipment) and indirectly in the use of electricity to power mining equipment. These are the only significant sources of greenhouse gases involved in the Project. The electrical and fuel requirements for these sources have been used to estimate CO₂ emission rates for the proposed mining operations. In doing this it has been assumed that each MWh of electrical energy used results in the release of 1.06 t of CO₂ and that the cost of electricity is 13 cents per kWh.

Table 5 summarises the estimated CO₂ emissions from the Project for each year of operation. It is estimated that over the life of the mine \$2.6 Million will be spent on electricity to power the conveyors, offices and signaling on site. This would equate to 21,200 t of CO₂, assuming the cost of electricity is 13 cents per kWh.

Table 5. Summary of estimated CO₂ emissions from Project

Year	Diesel equipment					CO ₂ from electricity (t)	Total CO ₂ emission (t)	CO ₂ emission as % of 2000
	Diesel usage (t/y)	Carbon content (%)	Percent combusted (%)	Carbon left in fuel (%)	CO ₂ emissions (t)			
1	99	86	99	1	308	1,010	1,318	0.00025
2	124	86	99	1	387	1,010	1,397	0.00026
3	151	86	99	1	472	1,010	1,482	0.00028
4	178	86	99	1	557	1,010	1,567	0.00029
5	261	86	99	1	815	1,010	1,825	0.00034
6	289	86	99	1	902	1,010	1,912	0.00036
7	318	86	99	1	992	1,010	2,002	0.00037
8	348	86	99	1	1,088	1,010	2,098	0.00039
9	380	86	99	1	1,186	1,010	2,196	0.00041
10	436	86	99	1	1,361	1,010	2,371	0.00044
11*	507	86	99	1	1,582	1,010	2,592	0.00048
12	507	86	99	1	1,582	1,010	2,592	0.00048
13	507	86	99	1	1,582	1,010	2,592	0.00048
14	507	86	99	1	1,582	1,010	2,592	0.00048
15	507	86	99	1	1,582	1,010	2,592	0.00048
16	507	86	99	1	1,582	1,010	2,592	0.00048
17	507	86	99	1	1,582	1,010	2,592	0.00048
18	507	86	99	1	1,582	1,010	2,592	0.00048
19	507	86	99	1	1,582	1,010	2,592	0.00048
20	507	86	99	1	1,582	1,010	2,592	0.00048
21	507	86	99	1	1,582	1,010	2,592	0.00048
Total	8,159	-	-	-	25,471	21,200	46,671	0.00872

* From Year 11 it has been assumed that peak production is maintained through until Year 21 and that the total diesel usage over life of mine is 9.6 million litres.

These figures can be compared with the CO₂ equivalent emission estimates from Australia's National Greenhouse Gas Inventory (**Australian Greenhouse Office, 2002**). There are two widely accepted methods for estimating greenhouse gas emissions (1) the United Nations Framework Convention on Climate Change (UNFCCC) and (2) the Kyoto protocol method. The differences between the two methods relate to the way in which forest sinks are treated. The estimated CO₂-equivalent emission for the two methods for all sectors are:

- UNFCCC – 535.3 Mt
- Kyoto – 503.3 Mt

For the purposes of this discussion we will only reference the UNFCCC figure. The 1990 emission using the UNFCCC methodology is 503.3 Mt.

There are no practical alternative fuels for a mining project of this type. However, alternative mining methods can lead to greater efficiency in the use of fuels and electricity. These include:

- Minimising haul distances for waste and ore
- Minimising double handling of materials
- Using the most practical and efficient machinery

10. CONCLUSIONS

This study has assessed air quality impacts due to the proposed kaolin mine at Newnes Junction. Potential air quality impacts examined are those due to emissions of PM₁₀, TSP and deposition of insoluble solids. Dispersion modelling has been used for assessment purposes.

Two stages of the mine's life have been assessed. These stages have been chosen to cover a range of dust emission conditions due to the proposed operations.

Results from the dispersion modelling have indicated that off-site dust impacts would be minimal. Although site specific air quality monitoring has not been carried out for this project, the dispersion modelling study has indicated that the proposed operations would contribute very little to existing dust levels in the area. Compliance with air quality goals would be expected during all stages of the proposed mining operations.

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APPENDIX A
JOINT WIND SPEED, WIND DIRECTION AND STABILITY CLASS
FREQUENCY TABLES

FROM 97. 1. 3 TO 97.12.31

PASQUILL STABILITY CLASS "A"

WIND SPEED CLASS (MPS)

WIND SECTOR	.51 TO 1.50	1.51 TO 3.00	3.01 TO 4.50	4.51 TO 6.00	6.01 TO 7.50	7.51 TO 9.00	9.01 TO 10.50	GREATER THAN 10.50	TOTAL	MEAN SPEED
NNE	.002869	.003142	.000820	.000000	.000000	.000000	.000000	.000000	.006831	1.91
NE	.001503	.003279	.000956	.000000	.000000	.000000	.000000	.000000	.005738	2.20
ENE	.001230	.001503	.001230	.000000	.000000	.000000	.000000	.000000	.003962	2.30
E	.001230	.002732	.000410	.000000	.000000	.000000	.000000	.000000	.004372	1.95
ESE	.001366	.001913	.000956	.000000	.000000	.000000	.000000	.000000	.004235	2.15
SE	.000410	.003415	.001776	.000000	.000000	.000000	.000000	.000000	.005601	2.53
SSE	.000683	.004645	.000956	.000000	.000000	.000000	.000000	.000000	.006284	2.35
S	.002596	.003689	.001093	.000000	.000000	.000000	.000000	.000000	.007377	2.11
SSW	.001913	.003415	.002186	.000000	.000000	.000000	.000000	.000000	.007514	2.36
SW	.000820	.003825	.001639	.000137	.000000	.000000	.000000	.000000	.006421	2.51
WSW	.001093	.002869	.002459	.000273	.000000	.000000	.000000	.000000	.006694	2.79
W	.001503	.004645	.003142	.000546	.000000	.000000	.000000	.000000	.009836	2.79
WNW	.000546	.004645	.002322	.000410	.000000	.000000	.000000	.000000	.007923	2.68
NW	.002732	.005328	.001639	.000000	.000000	.000000	.000000	.000000	.009699	2.13
NNW	.003689	.011612	.002869	.000000	.000000	.000000	.000000	.000000	.018169	2.24
N	.003142	.005738	.001639	.000000	.000000	.000000	.000000	.000000	.010519	2.10
CALM									.011749	
TOTAL	.027322	.066393	.026093	.001366	.000000	.000000	.000000	.000000	.132923	2.14

NUMBERS BELOW BASED ON ALL OBSERVATIONS

NUMBER OF INVALID OBSERVATIONS = 0

NUMBER OF VALID STABILITY DEPENDENT OBSERVATIONS = 7320

PASQUILL STABILITY CLASS "B"

WIND SPEED CLASS (MPS)

WIND SECTOR	.51 TO 1.50	1.51 TO 3.00	3.01 TO 4.50	4.51 TO 6.00	6.01 TO 7.50	7.51 TO 9.00	9.01 TO 10.50	GREATER THAN 10.50	TOTAL	MEAN SPEED
NNE	.000683	.002596	.002186	.000000	.000000	.000000	.000000	.000000	.005464	2.66
NE	.000273	.001503	.001230	.000000	.000000	.000000	.000000	.000000	.003005	2.96
ENE	.000273	.000820	.001093	.000137	.000000	.000000	.000000	.000000	.002322	2.91
E	.000137	.000410	.000683	.000137	.000000	.000000	.000000	.000000	.001366	3.08
ESE	.000000	.001366	.001776	.000137	.000000	.000000	.000000	.000000	.003279	3.16
SE	.000137	.001503	.001093	.000000	.000000	.000000	.000000	.000000	.002732	2.90
SSE	.000137	.001776	.000956	.000137	.000000	.000000	.000000	.000000	.003005	2.95
S	.000137	.001093	.001913	.000000	.000000	.000000	.000000	.000000	.003142	3.00
SSW	.000137	.000546	.001230	.000273	.000000	.000000	.000000	.000000	.002186	3.30
SW	.000000	.001503	.002459	.000956	.000000	.000000	.000000	.000000	.004918	3.76
WSW	.000000	.000956	.003142	.001503	.000000	.000000	.000000	.000000	.005601	3.90
W	.000000	.001093	.002596	.001913	.000000	.000000	.000000	.000000	.005601	4.10
WNW	.000137	.001776	.004235	.001913	.000000	.000000	.000000	.000000	.008060	3.87
NW	.000410	.001366	.002732	.000410	.000000	.000000	.000000	.000000	.004918	3.18
NNW	.000273	.005328	.002732	.000137	.000000	.000000	.000000	.000000	.008470	2.81
N	.000956	.002869	.002049	.000000	.000000	.000000	.000000	.000000	.005874	2.57
CALM									.001366	
TOTAL	.003689	.026503	.032104	.007650	.000000	.000000	.000000	.000000	.071311	3.19

NUMBERS BELOW BASED ON ALL OBSERVATIONS

NUMBER OF INVALID OBSERVATIONS = 0

NUMBER OF VALID STABILITY DEPENDENT OBSERVATIONS = 7320

PASQUILL STABILITY CLASS "C"

WIND SPEED CLASS (MPS)

WIND SECTOR	.51 TO 1.50	1.51 TO 3.00	3.01 TO 4.50	4.51 TO 6.00	6.01 TO 7.50	7.51 TO 9.00	9.01 TO 10.50	GREATER THAN 10.50	TOTAL	MEAN SPEED
NNE	.001093	.001230	.004098	.000546	.000000	.000000	.000000	.000000	.006967	3.18
NE	.000273	.000273	.001503	.000000	.000000	.000000	.000000	.000000	.002049	3.19
ENE	.000000	.000546	.000956	.000137	.000000	.000000	.000000	.000000	.001639	3.44
E	.000546	.001230	.002186	.000820	.000000	.000000	.000000	.000000	.004781	3.32
ESE	.000137	.001503	.003689	.001230	.000000	.000000	.000000	.000000	.006557	3.72
SE	.000000	.001913	.005874	.001230	.000000	.000000	.000000	.000000	.009016	3.68
SSE	.000000	.002869	.004372	.000410	.000000	.000000	.000000	.000000	.007650	3.42
S	.000000	.001366	.001230	.000137	.000000	.000000	.000000	.000000	.002732	3.08
SSW	.000137	.001503	.001913	.001503	.000000	.000000	.000000	.000000	.005055	3.59
SW	.000546	.001503	.005464	.004508	.000000	.000000	.000000	.000000	.012022	4.09
WSW	.000000	.000956	.003552	.005055	.000000	.000000	.000000	.000000	.009563	4.45
W	.000273	.000820	.004645	.005328	.000000	.000000	.000000	.000000	.011066	4.41
WNW	.000273	.001639	.003279	.005328	.000000	.000000	.000000	.000000	.010519	4.17
NW	.000137	.003279	.003825	.001776	.000000	.000000	.000000	.000000	.009016	3.60
NNW	.000273	.006421	.004235	.001230	.000000	.000000	.000000	.000000	.012158	3.07
N	.000546	.001913	.000410	.000137	.000000	.000000	.000000	.000000	.003005	2.45
CALM									.001639	
TOTAL	.004235	.028962	.051230	.029372	.000000	.000000	.000000	.000000	.115437	3.66
NUMBERS BELOW BASED ON ALL OBSERVATIONS										
NUMBER OF INVALID OBSERVATIONS = 0										
NUMBER OF VALID STABILITY DEPENDENT OBSERVATIONS = 7320										

PASQUILL STABILITY CLASS "D"

WIND SPEED CLASS (MPS)

WIND SECTOR	.51 TO 1.50	1.51 TO 3.00	3.01 TO 4.50	4.51 TO 6.00	6.01 TO 7.50	7.51 TO 9.00	9.01 TO 10.50	GREATER THAN 10.50	TOTAL	MEAN SPEED
NNE	.001776	.006557	.007514	.000273	.000000	.000000	.000000	.000000	.016120	2.95
NE	.000410	.002322	.001913	.000000	.000137	.000000	.000000	.000000	.004781	3.01
ENE	.000000	.001366	.001366	.000410	.000000	.000000	.000000	.000000	.003142	3.43
E	.000273	.005738	.008607	.004645	.000273	.000000	.000000	.000000	.019536	3.69
ESE	.000137	.004645	.017760	.009290	.000410	.000000	.000000	.000000	.032240	4.05
SE	.000000	.011066	.014754	.001913	.000137	.000000	.000000	.000000	.027869	3.32
SSE	.000273	.014071	.010109	.004918	.001366	.000410	.000000	.000000	.031148	3.51
S	.000410	.008470	.003415	.001093	.001639	.000000	.000000	.000000	.015027	3.33
SSW	.001776	.009563	.004508	.003279	.001503	.000000	.000000	.000000	.020628	3.27
SW	.019126	.015164	.006831	.007377	.002869	.000820	.000000	.000000	.052186	2.81
WSW	.015984	.008880	.012158	.007514	.004918	.001776	.000137	.000000	.051366	3.39
W	.000820	.005464	.005328	.003005	.004781	.000546	.000000	.000000	.019945	4.40
WNW	.000820	.004781	.004781	.001230	.001366	.000000	.000000	.000000	.012978	3.48
NW	.000683	.009016	.005464	.001230	.000683	.000000	.000000	.000000	.017077	3.08
NNW	.001366	.010383	.002869	.001230	.000956	.000273	.000000	.000000	.017077	3.00
N	.000683	.002049	.000956	.000273	.000137	.000000	.000000	.000000	.004098	2.82
CALM									.002869	
TOTAL	.044536	.119536	.108333	.047678	.021175	.003825	.000137	.000000	.348087	3.34
NUMBERS BELOW BASED ON ALL OBSERVATIONS										
NUMBER OF INVALID OBSERVATIONS = 0										
NUMBER OF VALID STABILITY DEPENDENT OBSERVATIONS = 7320										

PASQUILL STABILITY CLASS "E"

WIND SPEED CLASS (MPS)

WIND SECTOR	.51 TO 1.50	1.51 TO 3.00	3.01 TO 4.50	4.51 TO 6.00	6.01 TO 7.50	7.51 TO 9.00	9.01 TO 10.50	GREATER THAN 10.50	TOTAL	MEAN SPEED
NNE	.000410	.003279	.000820	.000000	.000000	.000000	.000000	.000000	.004508	2.46
NE	.000000	.001776	.000683	.000000	.000000	.000000	.000000	.000000	.002459	2.83
ENE	.000137	.002186	.000546	.000000	.000000	.000000	.000000	.000000	.002869	2.53
E	.000137	.000683	.000546	.000137	.000000	.000000	.000000	.000000	.001503	2.73
ESE	.000410	.001366	.000820	.000000	.000000	.000000	.000000	.000000	.002596	2.46
SE	.000410	.002596	.000683	.000000	.000000	.000000	.000000	.000000	.003689	2.53
SSE	.000410	.004645	.000273	.000000	.000000	.000000	.000000	.000000	.005328	2.28
S	.000546	.005464	.001093	.000273	.000000	.000000	.000000	.000000	.007377	2.46
SSW	.002596	.005328	.001230	.000000	.000000	.000000	.000000	.000000	.009153	2.07
SW	.018579	.011202	.002732	.000683	.000000	.000000	.000000	.000000	.033197	1.70
WSW	.017486	.006557	.000820	.000137	.000000	.000000	.000000	.000000	.025000	1.49
W	.003142	.002049	.000820	.000000	.000000	.000000	.000000	.000000	.006011	1.81
WNW	.001366	.001639	.000546	.000000	.000000	.000000	.000000	.000000	.003552	1.92
NW	.001366	.004372	.000000	.000000	.000000	.000000	.000000	.000000	.005738	1.85
NNW	.002596	.007377	.000137	.000000	.000000	.000000	.000000	.000000	.010109	1.82
N	.001913	.002186	.000137	.000000	.000000	.000000	.000000	.000000	.004235	1.73
CALM									.002322	
TOTAL	.051503	.062705	.011885	.001230	.000000	.000000	.000000	.000000	.129645	1.87

NUMBERS BELOW BASED ON ALL OBSERVATIONS

NUMBER OF INVALID OBSERVATIONS = 0

NUMBER OF VALID STABILITY DEPENDENT OBSERVATIONS = 7320

PASQUILL STABILITY CLASS "F"

WIND SPEED CLASS (MPS)

WIND SECTOR	.51 TO 1.50	1.51 TO 3.00	3.01 TO 4.50	4.51 TO 6.00	6.01 TO 7.50	7.51 TO 9.00	9.01 TO 10.50	GREATER THAN 10.50	TOTAL	MEAN SPEED
NNE	.002596	.001503	.000000	.000000	.000000	.000000	.000000	.000000	.004098	1.42
NE	.001913	.001366	.000000	.000000	.000000	.000000	.000000	.000000	.003279	1.53
ENE	.002186	.001503	.000000	.000000	.000000	.000000	.000000	.000000	.003689	1.47
E	.000683	.000820	.000000	.000000	.000000	.000000	.000000	.000000	.001503	1.53
ESE	.003415	.000683	.000000	.000000	.000000	.000000	.000000	.000000	.004098	1.19
SE	.002869	.000820	.000000	.000000	.000000	.000000	.000000	.000000	.003689	1.21
SSE	.004645	.001913	.000000	.000000	.000000	.000000	.000000	.000000	.006557	1.32
S	.004098	.002869	.000000	.000000	.000000	.000000	.000000	.000000	.006967	1.44
SSW	.005874	.002322	.000000	.000000	.000000	.000000	.000000	.000000	.008197	1.30
SW	.020082	.002049	.000000	.000000	.000000	.000000	.000000	.000000	.022131	1.10
WSW	.025956	.002459	.000000	.000000	.000000	.000000	.000000	.000000	.028415	.99
W	.011339	.001639	.000000	.000000	.000000	.000000	.000000	.000000	.012978	1.01
WNW	.004508	.002049	.000000	.000000	.000000	.000000	.000000	.000000	.006557	1.36
NW	.006011	.002186	.000000	.000000	.000000	.000000	.000000	.000000	.008197	1.29
NNW	.008060	.004508	.000000	.000000	.000000	.000000	.000000	.000000	.012568	1.39
N	.007240	.003825	.000000	.000000	.000000	.000000	.000000	.000000	.011066	1.38
CALM									.058607	
TOTAL	.111475	.032514	.000000	.000000	.000000	.000000	.000000	.000000	.202596	.94

NUMBERS BELOW BASED ON ALL OBSERVATIONS

NUMBER OF INVALID OBSERVATIONS = 0

NUMBER OF VALID STABILITY DEPENDENT OBSERVATIONS = 7320

ALL PASQUILL STABILITY CLASSES

WIND SPEED CLASS (MPS)

WIND SECTOR	.51 TO 1.50	1.51 TO 3.00	3.01 TO 4.50	4.51 TO 6.00	6.01 TO 7.50	7.51 TO 9.00	9.01 TO 10.50	GREATER THAN 10.50	TOTAL	MEAN SPEED
NNE	.009426	.018306	.015437	.000820	.000000	.000000	.000000	.000000	.043989	2.59
NE	.004372	.010519	.006284	.000000	.000137	.000000	.000000	.000000	.021311	2.55
ENE	.003825	.007923	.005191	.000683	.000000	.000000	.000000	.000000	.017623	2.55
E	.003005	.011612	.012432	.005738	.000273	.000000	.000000	.000000	.033060	3.24
ESE	.005464	.011475	.025000	.010656	.000410	.000000	.000000	.000000	.053005	3.50
SE	.003825	.021311	.024180	.003142	.000137	.000000	.000000	.000000	.052596	3.07
SSE	.006148	.029918	.016667	.005464	.001366	.000410	.000000	.000000	.059973	3.00
S	.007787	.022951	.008743	.001503	.001639	.000000	.000000	.000000	.042623	2.62
SSW	.012432	.022678	.011066	.005055	.001503	.000000	.000000	.000000	.052732	2.66
SW	.059153	.035246	.019126	.013661	.002869	.000820	.000000	.000000	.130874	2.38
WSW	.060519	.022678	.022131	.014481	.004918	.001776	.000137	.000000	.126639	2.55
W	.017077	.015710	.016530	.010792	.004781	.000546	.000000	.000000	.065437	3.22
WNW	.007650	.016530	.015164	.008880	.001366	.000000	.000000	.000000	.049590	3.17
NW	.011339	.025546	.013661	.003415	.000683	.000000	.000000	.000000	.054645	2.61
NNW	.016257	.045628	.012842	.002596	.000956	.000273	.000000	.000000	.078552	2.41
N	.014481	.018579	.005191	.000410	.000137	.000000	.000000	.000000	.038798	2.03
CALM									.078552	
TOTAL	.242760	.336612	.229645	.087295	.021175	.003825	.000137	.000000	1.000000	2.53

NUMBERS BELOW BASED ON ALL OBSERVATIONS

NUMBER OF INVALID OBSERVATIONS = 0

NUMBER OF VALID OBSERVATIONS = 7320

APPENDIX B
ESTIMATED DUST EMISSIONS FROM KAOLIN MINE

STAGE 2 OPERATION DUST EMISSIONS KAOLIN MINE - NEWNES JUNCTION

Introduction

The dust emission inventory has been estimated using the emission factors and the mine plan information provided. Emission factors have been developed using emission factor equations provided in the **US EPA (1985)** (and subsequent updates) publication referred to as AP-42 and from factors determined by **NERDDC (1988)**.

Estimated emissions are presented for all significant dust generating activities associated with the development of the mine.

It has been assumed (as a worst case assessment) that mining activities occur 10 hours per day, 7 days per week. Dust from wind erosion is assumed to occur over 24 hours per day, but wind erosion is also assumed to be proportional to the third power of wind speed. Generally, this will mean that most wind erosion occurs in the day when wind speeds are highest.

Dozer ripping material in pit

In normal operation two dozers will be working in the pit. The rate at which dust will be generated by a dozer working is calculated using Equation 1.

Equation 1

$$E_{TSP} = \frac{2.6 \times s^{1.2}}{M^{1.3}} \quad \text{kg/hour}$$

where,

s = silt content (%), and

M = moisture content (%)

Taking M to be 10% and s to be 10%, the emission factor is estimated to be approximately 2.07 kg/hour. Assuming that each dozer is working for approximately 2,750 hours/y, the total dust emissions would be approximately 11,385 kg/y [2 dozers x 2,750 h/y x 2.07 kg/h].

Loading ripped material to trucks

In a typical year of operation, approximately 1,400,000 t/y of material will be loaded into trucks through the use of a front end loader (FEL) for haulage to the crusher station. Each tonne of material loaded will generate a certain amount of dust, depending on the wind speed and the moisture content. Equation 2 (**US EPA, 1995B, 13.2.4-3**) shows the relationship between these variables.

Equation 2

$$E_{TSP} = k \times 0.0016 \times \left(\frac{\left(\frac{U}{2.2} \right)^{1.3}}{\left(\frac{M}{2} \right)^{1.4}} \right) \quad \text{kg/t}$$

where,

k = 0.74

U = wind speed (m/s)

M = moisture content (%)

[where $0.25 \leq M \leq 4.8$]

Assuming a moisture content of 4.8% (maximum that Equation 2 has been tested for), the total emission for a typical year is therefore given by;

$$E_{TSP} = 1,400,000 \times 0.00035 \times \left(\frac{U}{2.2} \right)^{1.3}$$

A "wind speed factor", [that is the $(U/2.2)^{1.3}$ part of Equation 2], will vary from hour to hour. This factor has been calculated for each hour in the meteorological data file and an annual average determined to be approximately 1.295. The total emissions from loading ripped material to trucks will therefore be approximately 635 kg/y [1,400,000 x 0.00035 x 1.295].

Hauling material to crushing station

Approximately 1,400,000 t/y of material will be hauled using 75 t trucks. Assuming a return travel distance of 1 km, dust generation rate of 4 kg/VKT and 50% control of dust by watering of the haul road, the total dust generated is expected to be 37,333 kg/y [(1,400,000 t / 75 t) x 1 km x 4 kg/km x 50/100].

Dumping material to hopper

Approximately 1,400,000 t of material will be unloaded from trucks to the hopper. Each tonne dumped will generate dust at the rate determined by Equation 2.

The total emission is therefore given by;

$$E_{TSP} = 1,400,000 \times 0.00035 \times \left(\frac{U}{2.2} \right)^{1.3}$$

The emissions from this process will vary from hour to hour depending on the wind speed and in the model this is how the emission is represented. However, the annual emission is also of interest. Using the annual average "wind speed factor" of 1.295 (as determined previously), the total emissions from unloading the material from trucks will be approximately 635 kg/y [1,400,000 x 0.00035 x 1.295].

Primary crushing of material

It has been assumed that all material passes through primary crushing, generating dust at the rate of 0.009 kg/t (**US EPA, 1985**). Partial enclosure can reduce this emission by 50%. The total dust generated from crushing is therefore approximately, 6,300 kg/y [1,400,000 t/y x 0.009 kg/t x 50/100].

Hauling topsoil material to stockpiles

Approximately 23,000 t/y of topsoil will be hauled using 75 t trucks. Assuming a return travel distance of 1 km to the stockpiles, dust generation rate of 4 kg/VKT and 50% control of dust by watering of the haul road, the total dust generated is expected to be 613 kg/y [(23,000 t / 75 t) x 1 km x 4 kg/km x 50/100].

Dumping material to stockpiles

Approximately 23,000 t of topsoil will be unloaded from trucks to the stockpiles in the early mining stages. Each tonne dumped will generate dust at the rate determined by Equation 2.

The total emission for is therefore given by;

$$E_{TSP} = 23,000 \times 0.00035 \times \left(\frac{U}{2.2} \right)^{1.3}$$

Using the annual average "wind speed factor" of 1.295 (as determined previously), the total emissions from unloading the material from trucks will be approximately 10 kg/y [23,000 x .000035 x 1.295].

Wind Erosion**Wind erosion from the exposed working area**

Assuming that the exposed working area is approximately 2.6 ha, the annual dust emission will be approximately 9,110 kg/y [2.6 ha x 0.4 kg/ha/h x 24 h/day x 365 day/y].

Wind erosion from stockpiles

Emissions from stockpiles can be controlled by 50% with the use of water sprays. Assuming that the stockpile area is approximately 0.6 ha and 50% control applies, the annual dust emission will be approximately 1,051 kg/y [0.6 ha x 0.4 kg/ha/h x 24 h/day x 365 day/y x 50/100].

STAGE 5 OPERATIONS DUST EMISSIONS KAOLIN MINE - NEWNES JUNCTION

Introduction

Estimated emissions for the proposed Stage 5 mining operations are presented below for all significant dust generating activities associated with this stage.

Dozer ripping material in pit

Assuming that each dozer is working for approximately 2,750 hours/y, the total dust emissions would be approximately 11,385 kg/y [2 dozers x 2,750 h/y x 2.07 kg/h].

Loading ripped material to trucks

The total emissions from loading ripped material to trucks will therefore be approximately 635 kg/y [1,400,000 x 0.00035 x 1.295].

Hauling material to crushing station

Approximately 1,400,000 t/y of material will be hauled using 75 t trucks. Assuming a return travel distance of 2 km, dust generation rate of 4 kg/VKT and 50% control of dust by watering of the haul road, the total dust generated is expected to be 74,667 kg/y [(1,400,000 t / 75 t) x 2 km x 4 kg/km x 50/100].

Dumping material to hopper

The total emissions from unloading the material from trucks will be approximately 635 kg/y [1,400,000 x 0.00035 x 1.295].

Primary crushing of material

The total dust generated from crushing is therefore approximately, 6,300 kg/y [1,400,000 t/y x 0.009 kg/t x 50/100].

Hauling topsoil material to stockpiles

Approximately 104,000 t/y of topsoil will be hauled using 75 t trucks. Assuming a return travel distance of 0.6 km, dust generation rate of 4 kg/VKT and 50% control of dust by watering of the haul road, the total dust generated is expected to be 1,664 kg/y [(104,000 t / 75 t) x 0.6 km x 4 kg/km x 50/100].

Dumping material to stockpiles

Approximately 104,000 t of topsoil will be unloaded from trucks to the stockpiles. Each tonne dumped will generate dust at the rate determined by Equation 2.

The total emission for is therefore given by;

$$E_{TSP} = 104,000 \times 0.00035 \times \left(\frac{U}{2.2} \right)^{1.3}$$

Using the annual average "wind speed factor" of 1.295 (as determined previously), the total emissions from unloading the material from trucks will be approximately 47 kg/y [104,000 x 0.00035 x 1.295].

Wind erosion from the exposed working area

Assuming that the exposed working area is approximately 11 ha (including completed areas that have not been fully rehabilitated), the annual dust emission will be approximately 38,544 kg/y [11 ha x 0.4 kg/ha/h x 24 h/day x 365 day/y].

Wind erosion from stockpiles

Emissions from stockpiles can be controlled by 50% with the use of water sprays. Assuming that the stockpile area is approximately 3 ha and 50% control applies, the annual dust emission will be approximately 5,256 kg/y [3 ha x 0.4 kg/ha/h x 24 h/day x 365 day/y x 50/100].

Wind Erosion

Stage 2 operations	Dozers ripping	Loading to trucks	Hauling material to crusher station	Dumping material to hopper	Crushing of material	Hauling topsoil to stockpiles	Dumping topsoil to stockpiles	Wind erosion from exposed working area	Wind erosion from stockpiles	Total emission rate g/s
Emission rate kg/y	11,385	635	37,333	635	6,300	613	10	9,110	1,051	
Number of sources	2	1	5	1	1	3	1	4	1	
Source ID										
1	1	0	0	0	0	0	0	0	0	0.1805
2	1	0	0	0	0	0	0	0	0	0.1805
3	0	1	0	0	0	0	0	0	0	0.0201
4	0	0	1	0	0	0	0	0	0	0.2368
5	0	0	1	0	0	0	0	0	0	0.2368
6	0	0	1	0	0	0	0	0	0	0.2368
7	0	0	1	0	0	0	0	0	0	0.2368
8	0	0	1	0	0	0	0	0	0	0.2368
9	0	0	0	0	1	0	0	0	0	0.1998
10	0	0	0	0	0	1	0	0	0	0.0065
11	0	0	0	0	0	1	0	0	0	0.0065
12	0	0	0	0	0	1	0	0	0	0.0065
13	0	0	0	0	0	0	1	0	0	0.0003
14	0	0	0	0	0	0	0	1	0	0.0722
15	0	0	0	0	0	0	0	1	0	0.0722
16	0	0	0	0	0	0	0	1	0	0.0722
17	0	0	0	0	0	0	0	1	0	0.0722
18	0	0	0	0	0	0	0	0	1	0.0333
19	0	0	0	1	0	0	0	0	0	0.0201

Stage 5 operations	Dozers ripping	Loading to trucks	Hauling material to crusher station	Dumping material to hopper	Crushing of material	Hauling topsoil to stockpiles	Dumping topsoil to stockpiles	Wind erosion from exposed working area	Wind erosion from stockpiles	Total emission rate g/s
Emission rate kg/y	11,385	635	74,667	635	6,300	1,664	47	38,544	5,256	
Number of sources	2	1	6	1	1	3	1	4	2	
Source ID										
1	1	0	0	0	0	0	0	0	0	0.1805
2	1	0	0	0	0	0	0	0	0	0.1805
3	0	1	0	0	0	0	0	0	0	0.0201
4	0	0	1	0	0	0	0	0	0	0.3946
5	0	0	1	0	0	0	0	0	0	0.3946
6	0	0	1	0	0	0	0	0	0	0.3946
7	0	0	1	0	0	0	0	0	0	0.3946
8	0	0	1	0	0	0	0	0	0	0.3946
9	0	0	1	0	0	0	0	0	0	0.3946
10	0	0	0	0	1	0	0	0	0	0.1998
11	0	0	0	0	0	1	0	0	0	0.0176
12	0	0	0	0	0	1	0	0	0	0.0176
13	0	0	0	0	0	1	0	0	0	0.0176
14	0	0	0	0	0	0	1	0	0	0.0015
15	0	0	0	0	0	0	0	1	0	0.3056
16	0	0	0	0	0	0	0	1	0	0.3056
17	0	0	0	0	0	0	0	1	0	0.3056
18	0	0	0	0	0	0	0	1	0	0.3056
19	0	0	0	0	0	0	0	0	1	0.0833
20	0	0	0	0	0	0	0	0	1	0.0833
21	0	0	0	1	0	0	0	0	0	0.0201

APPENDIX C

ISCST3 INPUT FILE

ISCST3 INPUT FILE:

** ISCST3 model input runstream : Dust

CO STARTING

TITLEONE ISCST3 Dust Model Run
MODELOPT RURAL CONC DDEP DRYDPLT
AVERTIME 24 PERIOD
POLLUTID TSP
ERRORFIL Error.MSG
TERRHGTS ELEV
RUNORNOT RUN

CO FINISHED

SO STARTING

LOCATION	POINT1	VOLUME	244694	6292839	1006.5
LOCATION	POINT2	VOLUME	244768	6292835	1006.6
LOCATION	POINT3	VOLUME	244726	6292874	1007
LOCATION	POINT4	VOLUME	244758	6292894	1006.8
LOCATION	POINT5	VOLUME	244794	6292986	1007.1
LOCATION	POINT6	VOLUME	244809	6293097	1006.4
LOCATION	POINT7	VOLUME	244819	6293200	1007
LOCATION	POINT8	VOLUME	244823	6293334	1007.1
LOCATION	POINT9	VOLUME	244862	6293371	1009.1
LOCATION	POINT10	VOLUME	244889	6293365	1004.7
LOCATION	POINT11	VOLUME	244792	6292836	1008.6
LOCATION	POINT12	VOLUME	244793	6292756	1010.6
LOCATION	POINT13	VOLUME	244808	6292666	1022.9
LOCATION	POINT14	VOLUME	244852	6292719	1029
LOCATION	POINT15	VOLUME	244559	6293011	1006
LOCATION	POINT16	VOLUME	244730	6293014	1007
LOCATION	POINT17	VOLUME	244655	6292880	1005.6
LOCATION	POINT18	VOLUME	244765	6292873	1007
LOCATION	POINT19	VOLUME	244856	6292760	1025.4
LOCATION	POINT20	VOLUME	244852	6292654	1035.6
LOCATION	POINT21	VOLUME	244889	6293365	1004.7
LOCATION	POINT22	VOLUME	244694	6292839	1006.5
LOCATION	POINT23	VOLUME	244768	6292835	1006.6
LOCATION	POINT24	VOLUME	244726	6292874	1007
LOCATION	POINT25	VOLUME	244758	6292894	1006.8
LOCATION	POINT26	VOLUME	244794	6292986	1007.1
LOCATION	POINT27	VOLUME	244809	6293097	1006.4
LOCATION	POINT28	VOLUME	244819	6293200	1007
LOCATION	POINT29	VOLUME	244823	6293334	1007.1
LOCATION	POINT30	VOLUME	244862	6293371	1009.1
LOCATION	POINT31	VOLUME	244889	6293365	1004.7
LOCATION	POINT32	VOLUME	244792	6292836	1008.6
LOCATION	POINT33	VOLUME	244793	6292756	1010.6
LOCATION	POINT34	VOLUME	244808	6292666	1022.9
LOCATION	POINT35	VOLUME	244852	6292719	1029
LOCATION	POINT36	VOLUME	244559	6293011	1006
LOCATION	POINT37	VOLUME	244730	6293014	1007
LOCATION	POINT38	VOLUME	244655	6292880	1005.6
LOCATION	POINT39	VOLUME	244765	6292873	1007
LOCATION	POINT40	VOLUME	244856	6292760	1025.4
LOCATION	POINT41	VOLUME	244852	6292654	1035.6
LOCATION	POINT42	VOLUME	244889	6293365	1004.7
LOCATION	POINT43	VOLUME	244694	6292839	1006.5
LOCATION	POINT44	VOLUME	244768	6292835	1006.6
LOCATION	POINT45	VOLUME	244726	6292874	1007
LOCATION	POINT46	VOLUME	244758	6292894	1006.8
LOCATION	POINT47	VOLUME	244794	6292986	1007.1
LOCATION	POINT48	VOLUME	244809	6293097	1006.4
LOCATION	POINT49	VOLUME	244819	6293200	1007
LOCATION	POINT50	VOLUME	244823	6293334	1007.1
LOCATION	POINT51	VOLUME	244862	6293371	1009.1
LOCATION	POINT52	VOLUME	244889	6293365	1004.7
LOCATION	POINT53	VOLUME	244792	6292836	1008.6
LOCATION	POINT54	VOLUME	244793	6292756	1010.6
LOCATION	POINT55	VOLUME	244808	6292666	1022.9
LOCATION	POINT56	VOLUME	244852	6292719	1029
LOCATION	POINT57	VOLUME	244559	6293011	1006
LOCATION	POINT58	VOLUME	244730	6293014	1007
LOCATION	POINT59	VOLUME	244655	6292880	1005.6
LOCATION	POINT60	VOLUME	244765	6292873	1007
LOCATION	POINT61	VOLUME	244856	6292760	1025.4
LOCATION	POINT62	VOLUME	244852	6292654	1035.6
LOCATION	POINT63	VOLUME	244889	6293365	1004.7

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** Point Source      QS   RH   IL   IV
** Parameters      ----  ---  ---  ---
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SRCPARAM POINT61   1.0 2.0 20. 2.
SRCPARAM POINT62   1.0 2.0 20. 2.
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SRCGROUP REST POINT43-POINT63
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RE STARTING

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UAIRDATA 66666 1997

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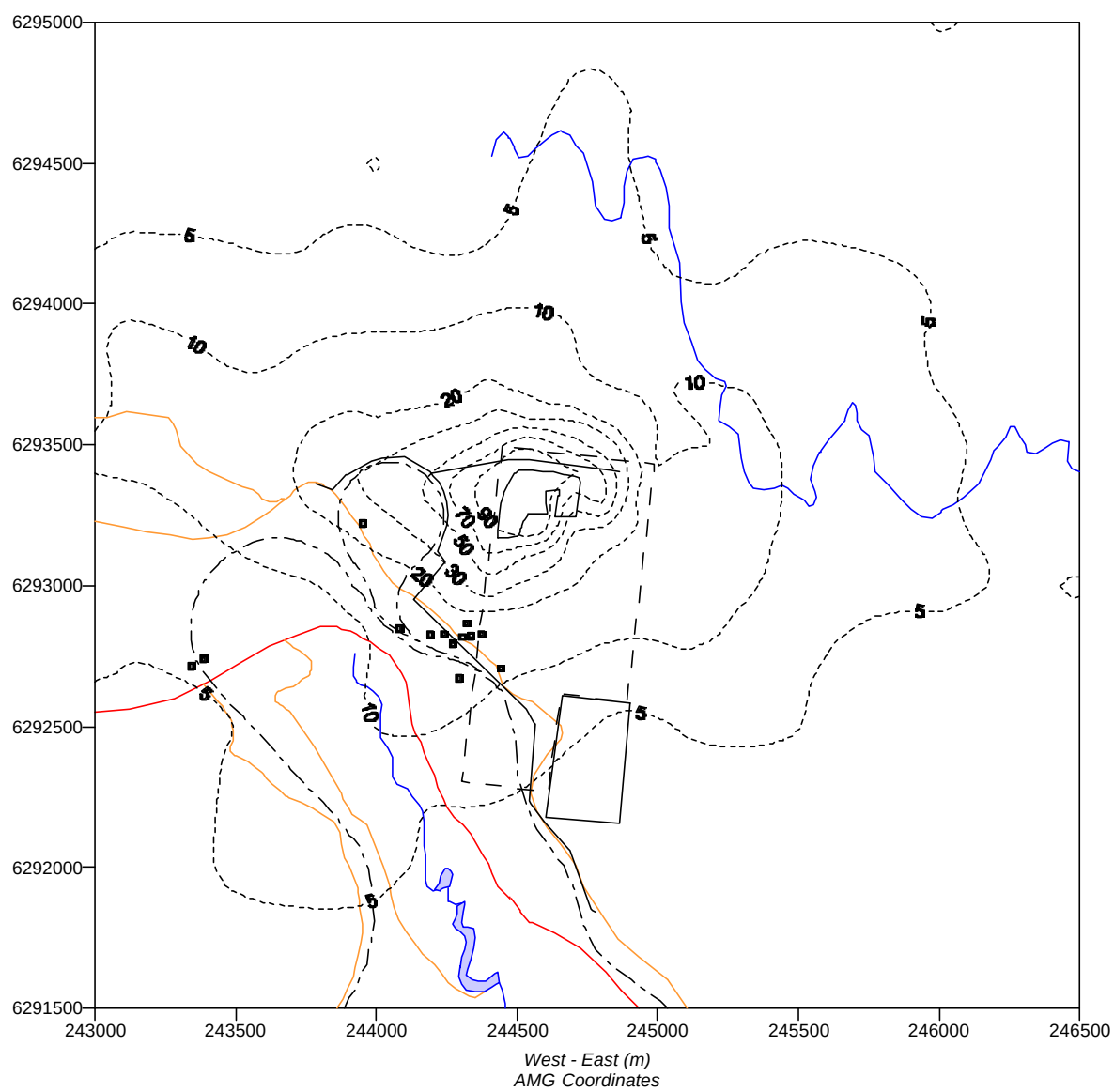
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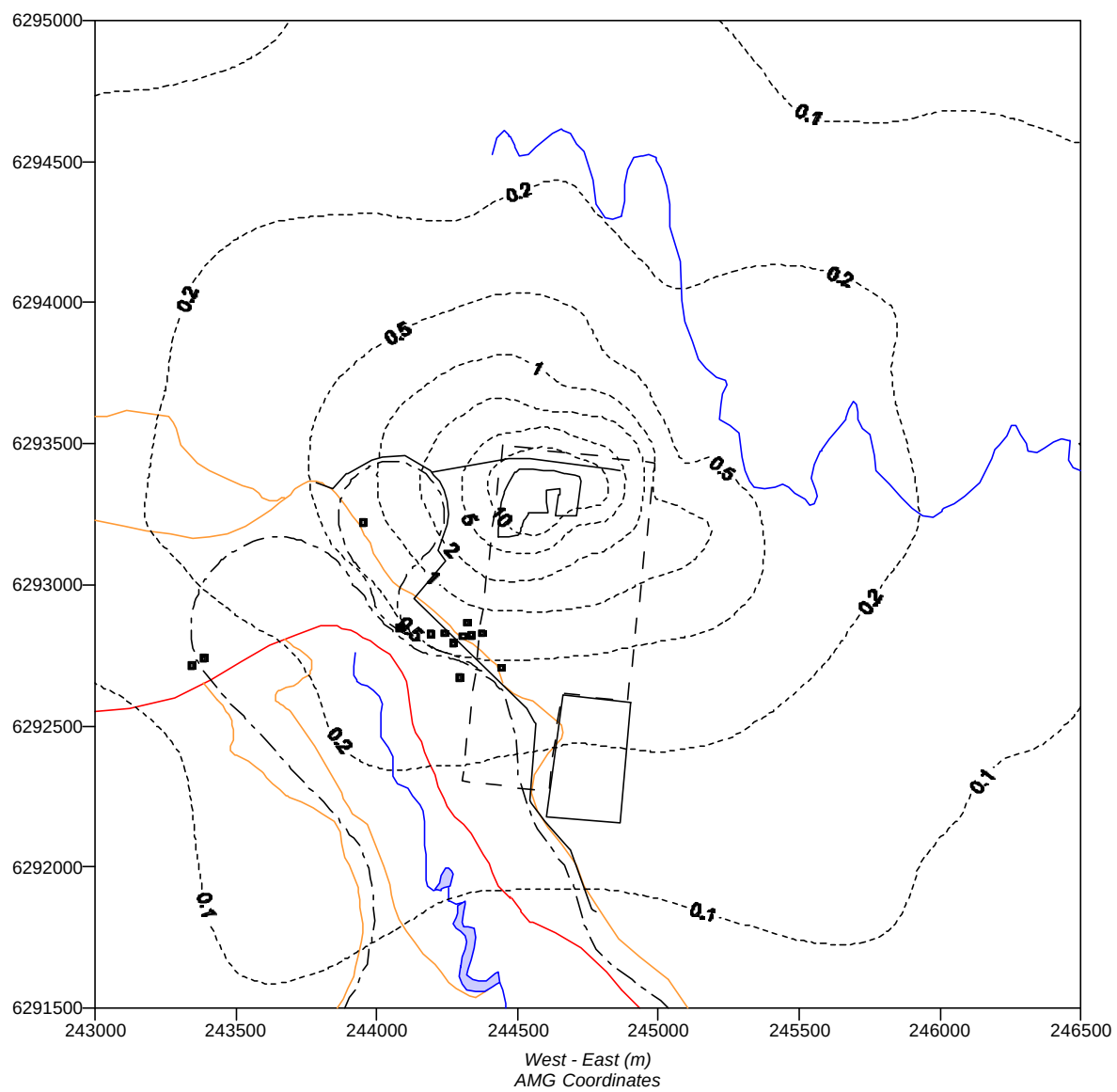
APPENDIX D
DISPERSION MODEL RESULTS USING TAPM METEOROLOGICAL DATA



■ Nearest residences

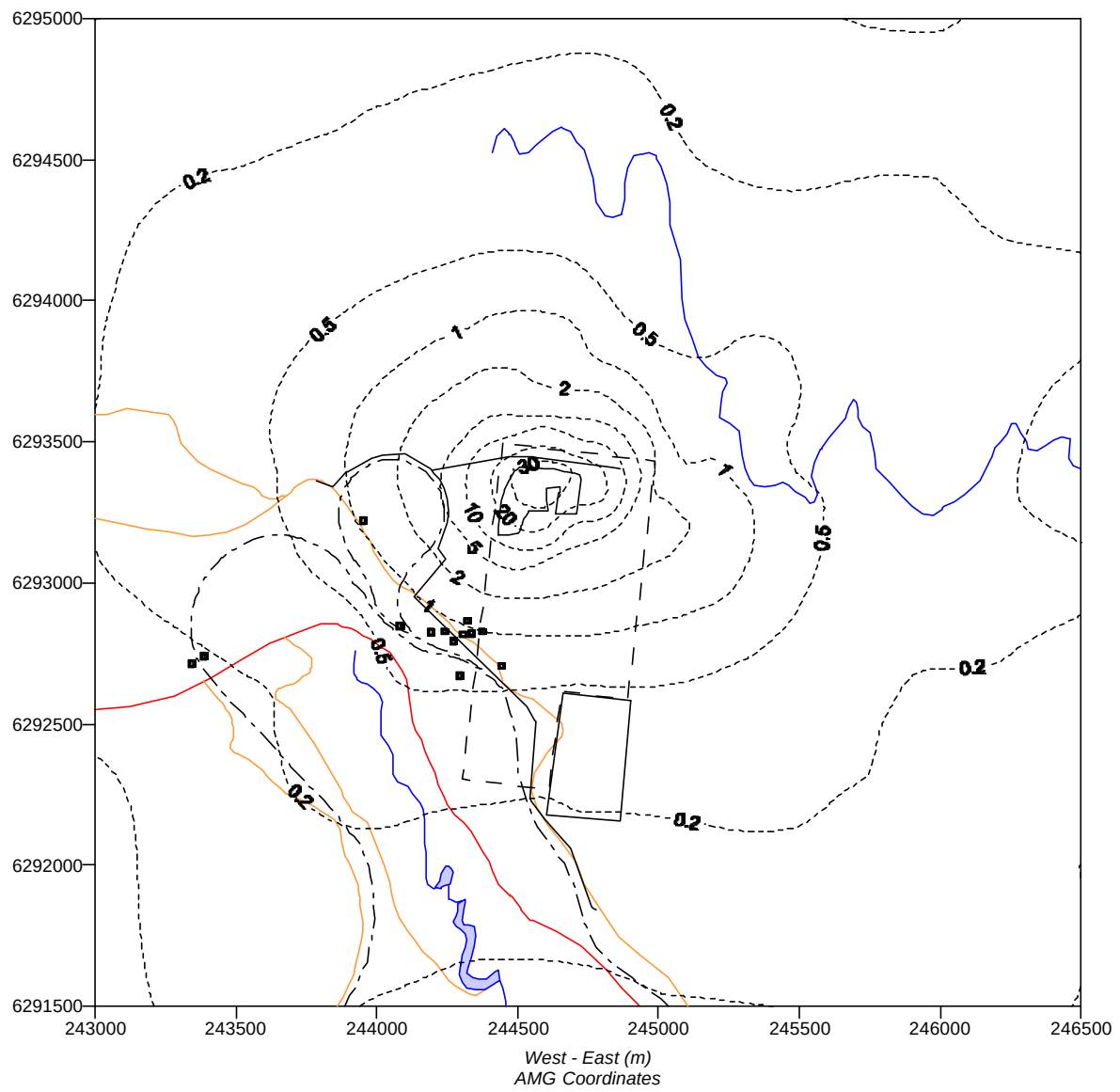
Predicted maximum 24-hour average PM_{10} concentration at ground-level for Stage 2 operations ($\mu g/m^3$)

FIGURE D1



Predicted annual average PM_{10} concentration at ground-level for Stage 2 operations ($\mu\text{g}/\text{m}^3$)

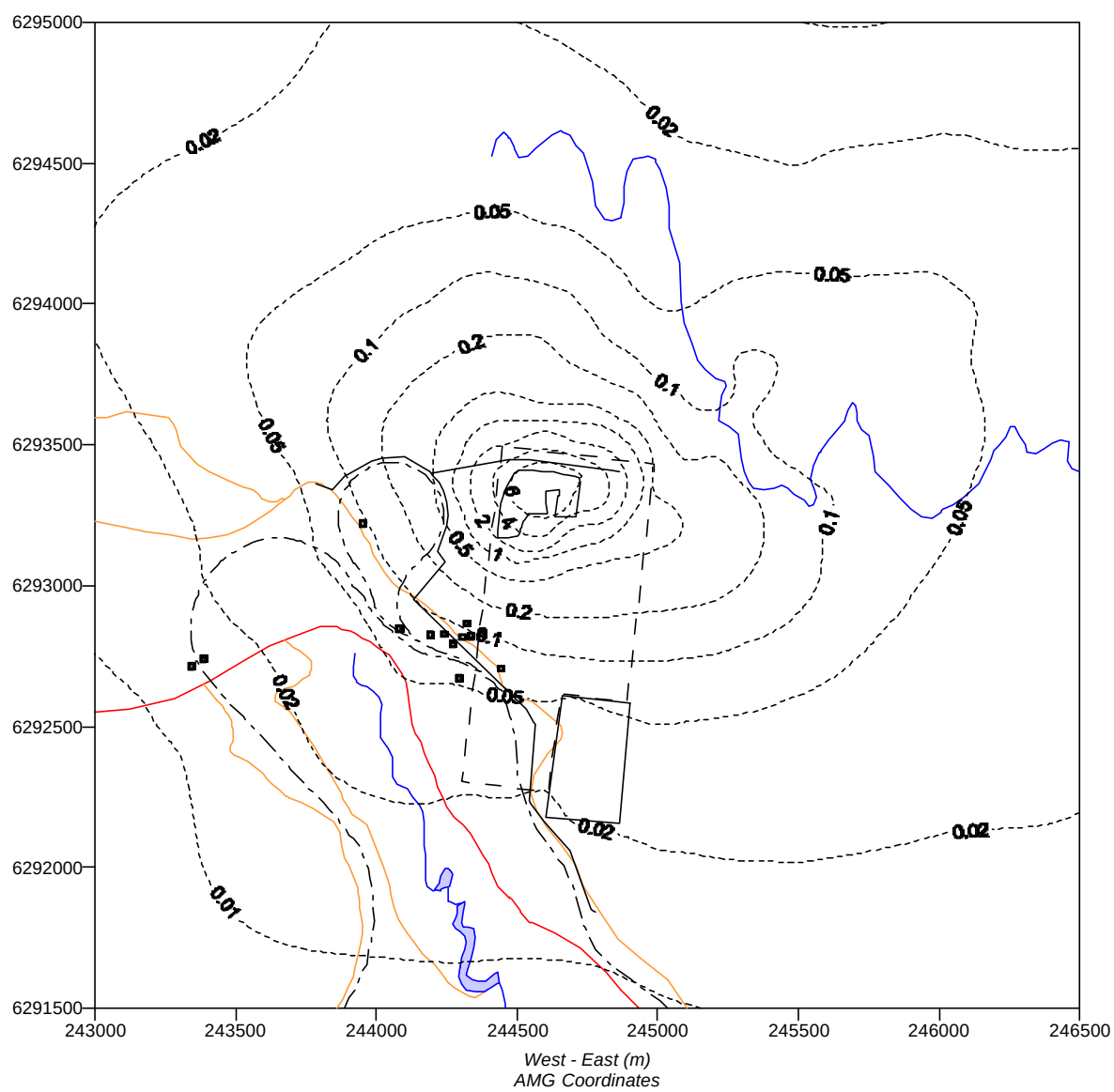
FIGURE D2



■ Nearest residences

Predicted annual average TSP concentration at ground-level for Stage 2 operations ($\mu\text{g}/\text{m}^3$)

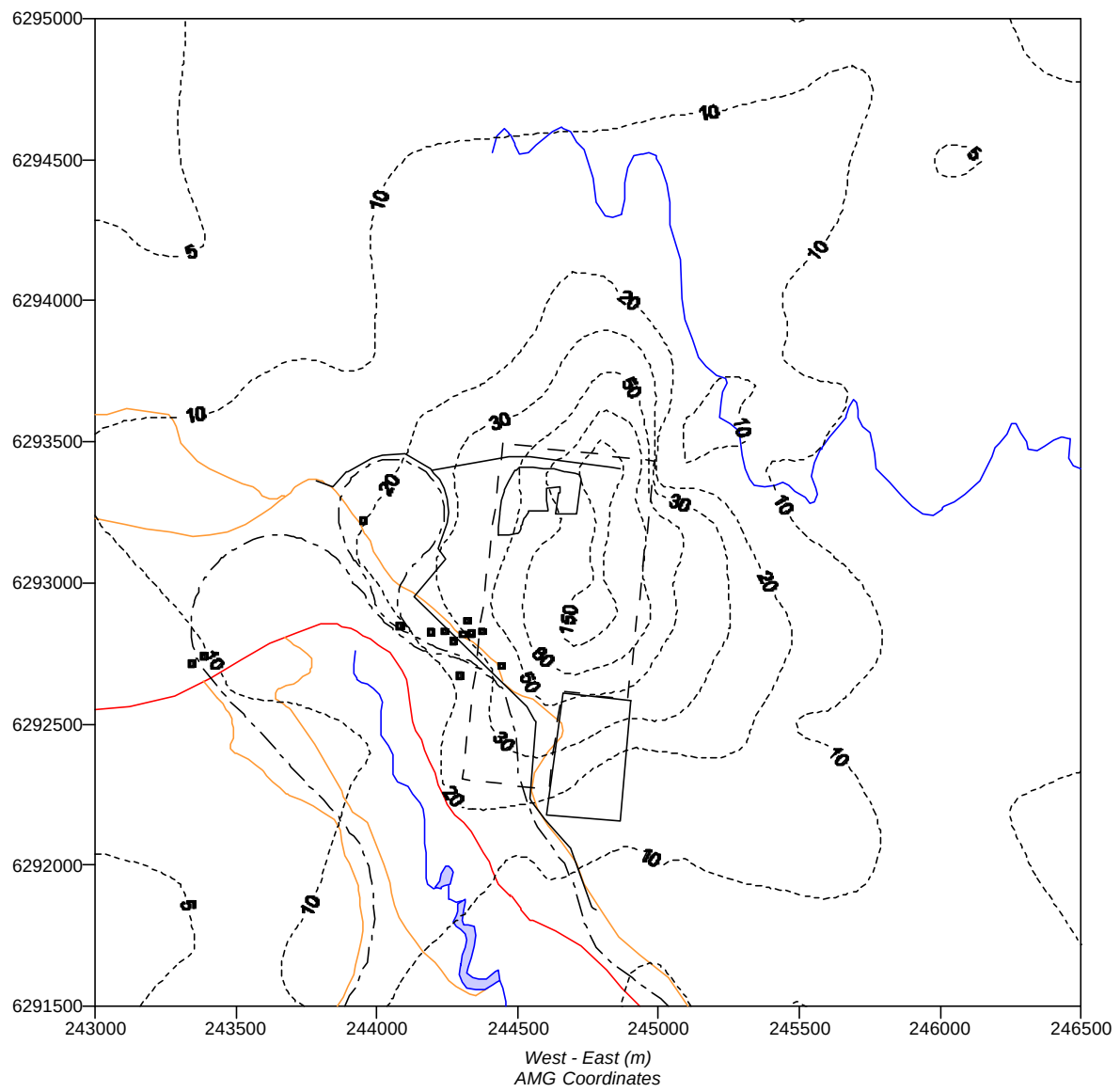
FIGURE D3



■ Nearest residences

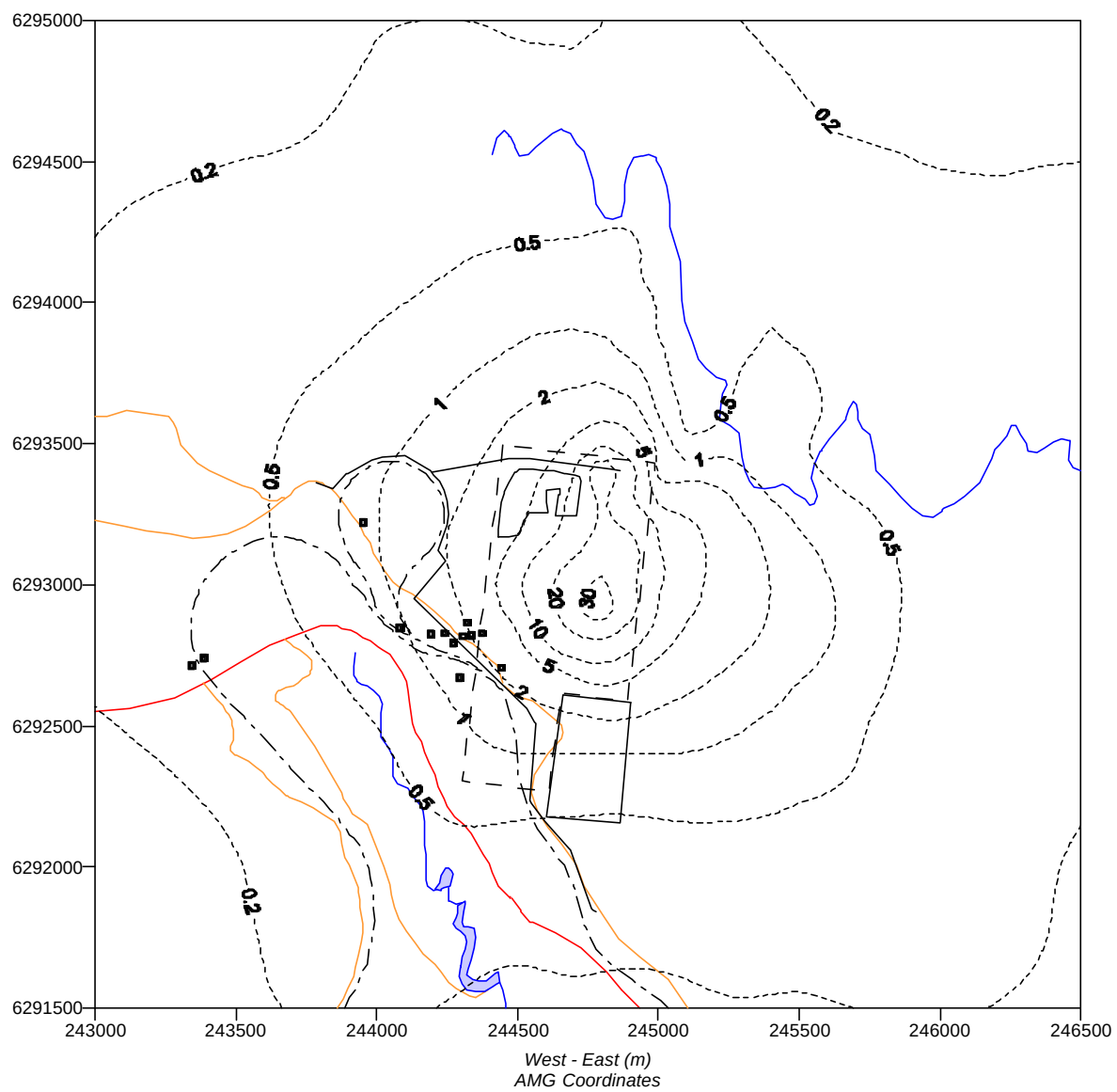
**Predicted annual average dust deposition at
ground-level for Stage 2 operations ($\text{g/m}^2/\text{month}$)**

FIGURE D4



Predicted maximum 24-hour average PM_{10} concentration at ground-level for Stage 5 operations ($\mu g/m^3$)

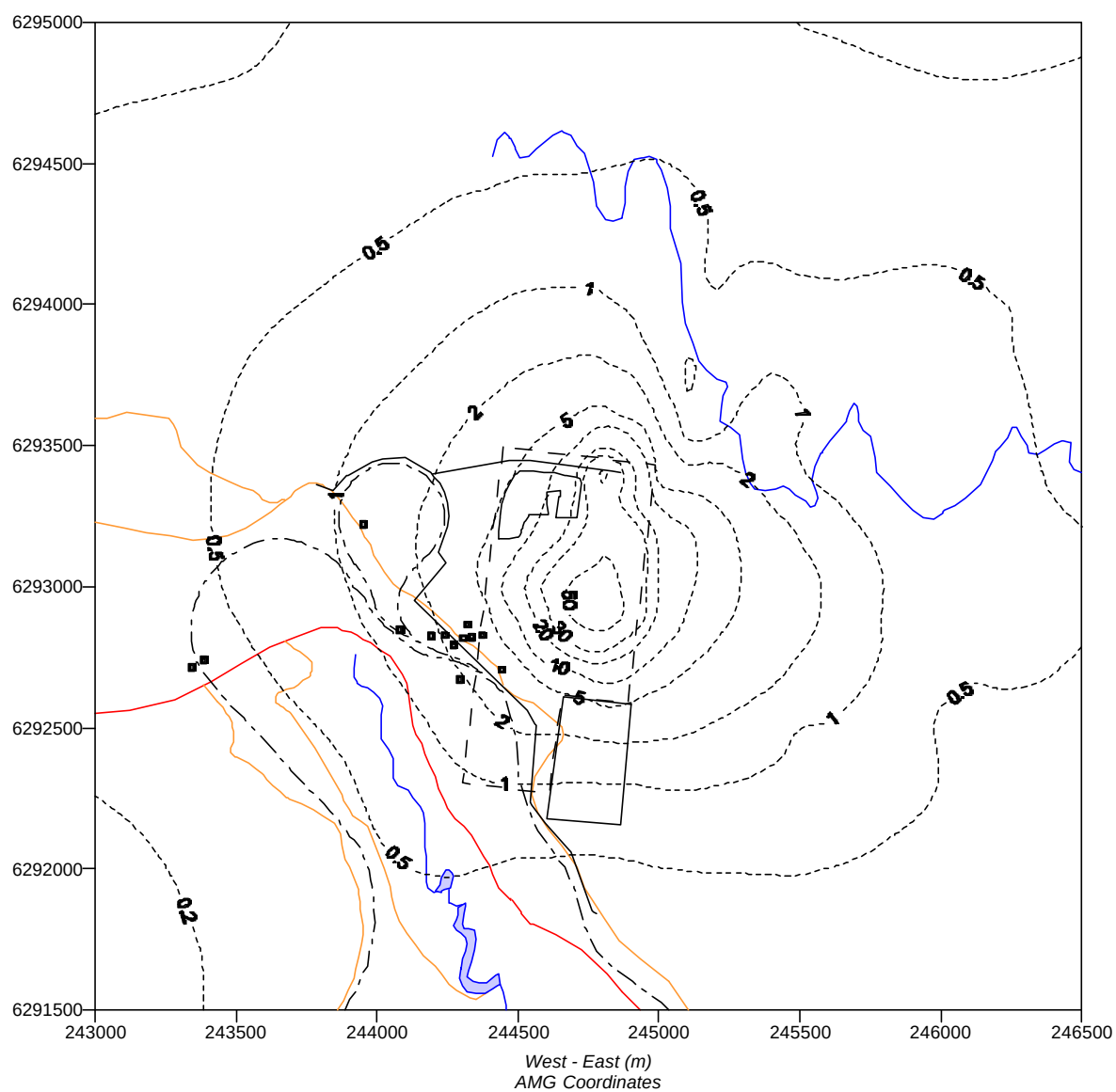
FIGURE D5



■ Nearest residences

**Predicted annual average PM_{10} concentration at
ground-level for Stage 5 operations ($\mu\text{g}/\text{m}^3$)**

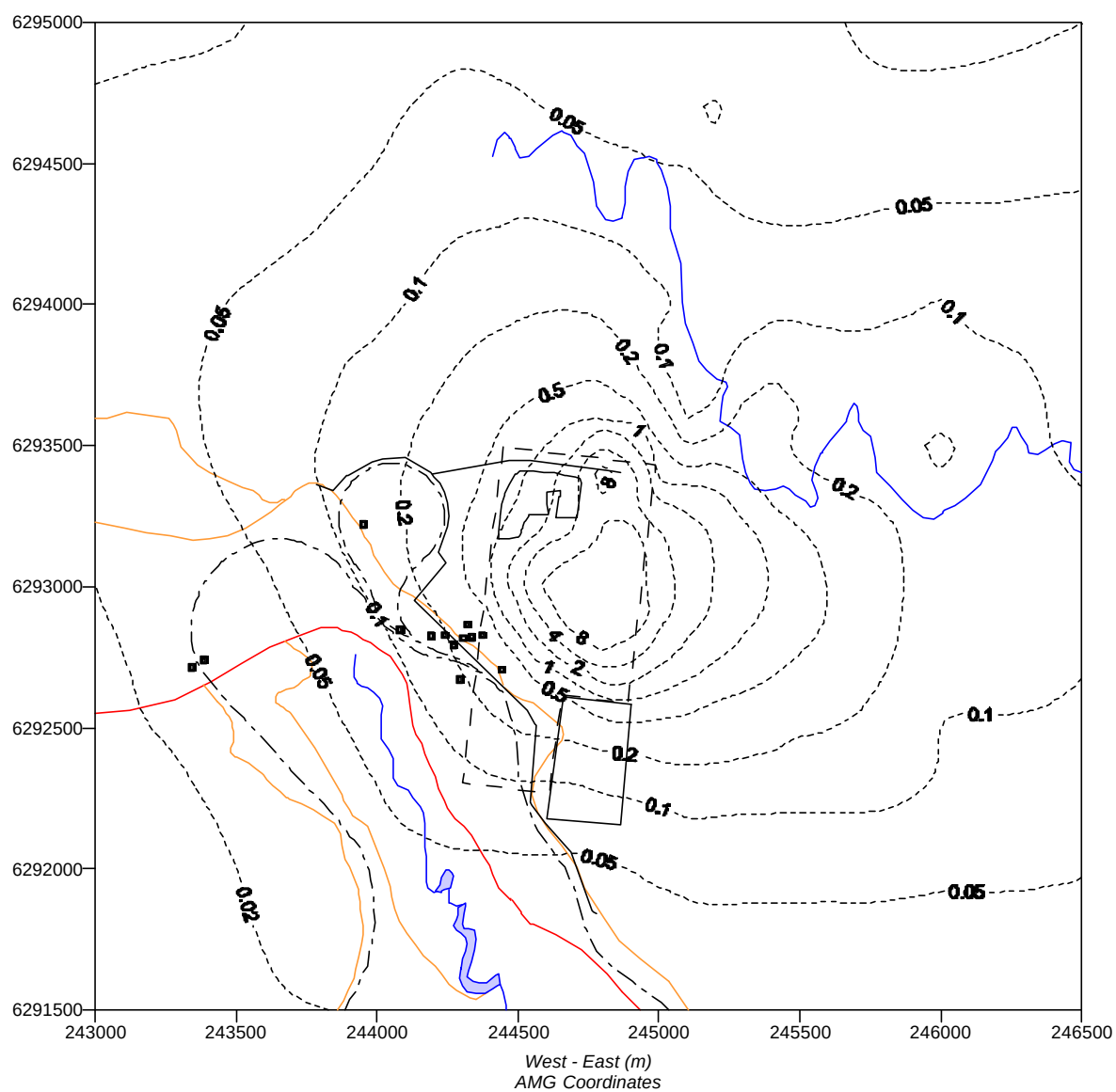
FIGURE D6



■ Nearest residences

**Predicted annual average TSP concentration at
ground-level for Stage 5 operations ($\mu\text{g}/\text{m}^3$)**

FIGURE D7

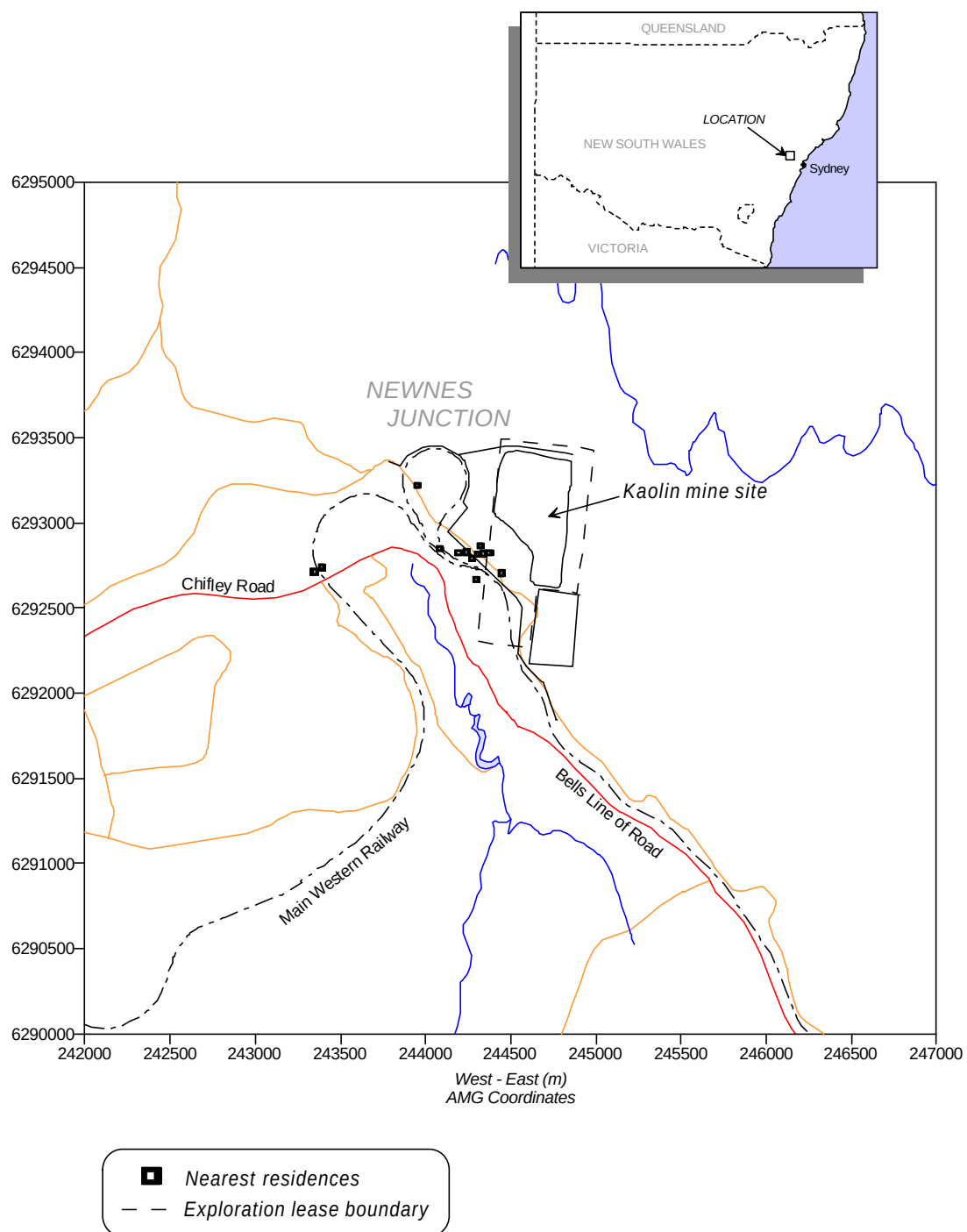


■ Nearest residences

**Predicted annual average dust deposition at
ground-level for Stage 5 operations (g/m²/month)**

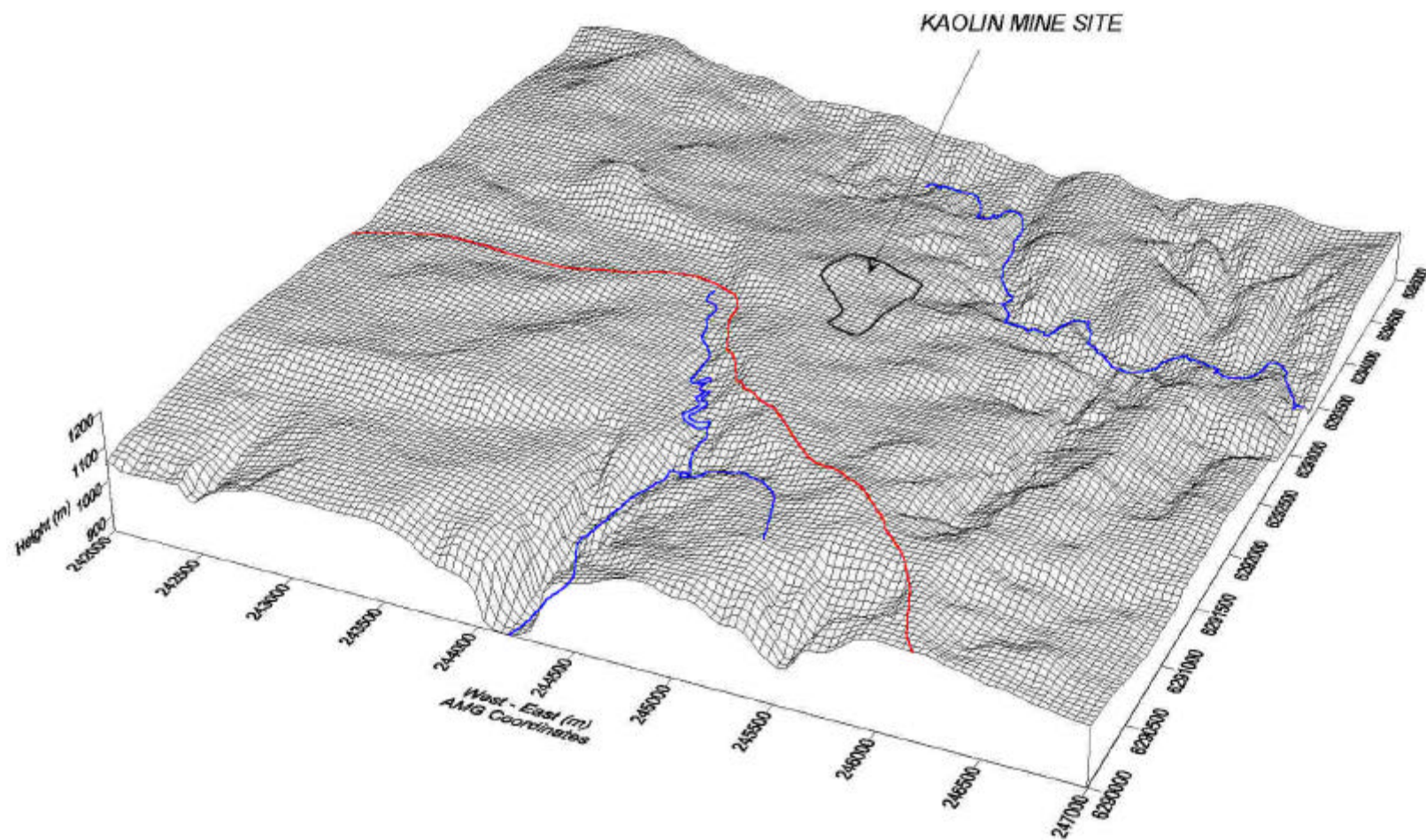
FIGURE D8

FIGURES



Location of Proposed Kaolin Mine

FIGURE 1



Pseudo 3-dimensional representation of local area

FIGURE 2

Annual and Seasonal Windroses for Newnes Junction (TAPM) 2001

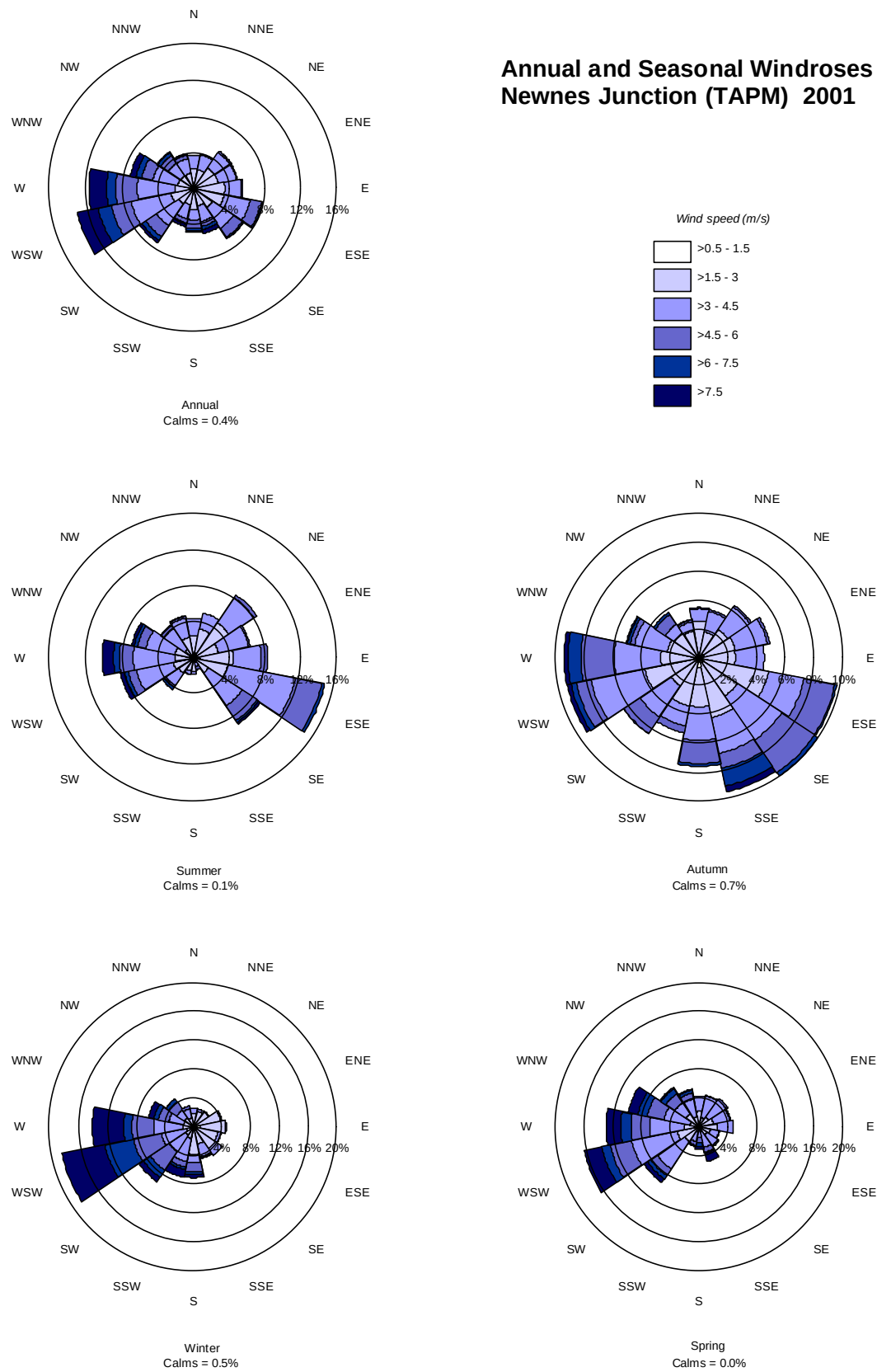
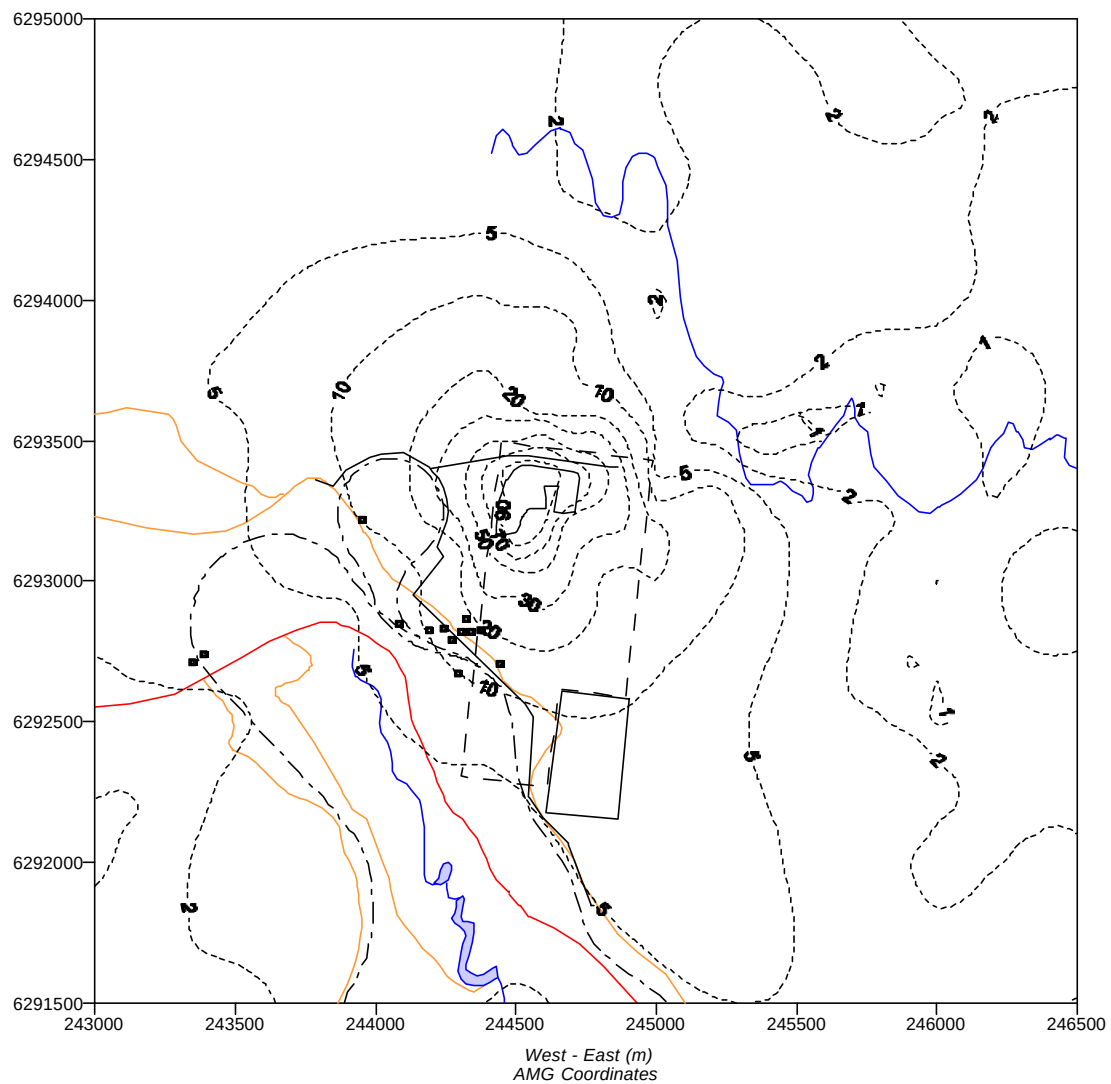


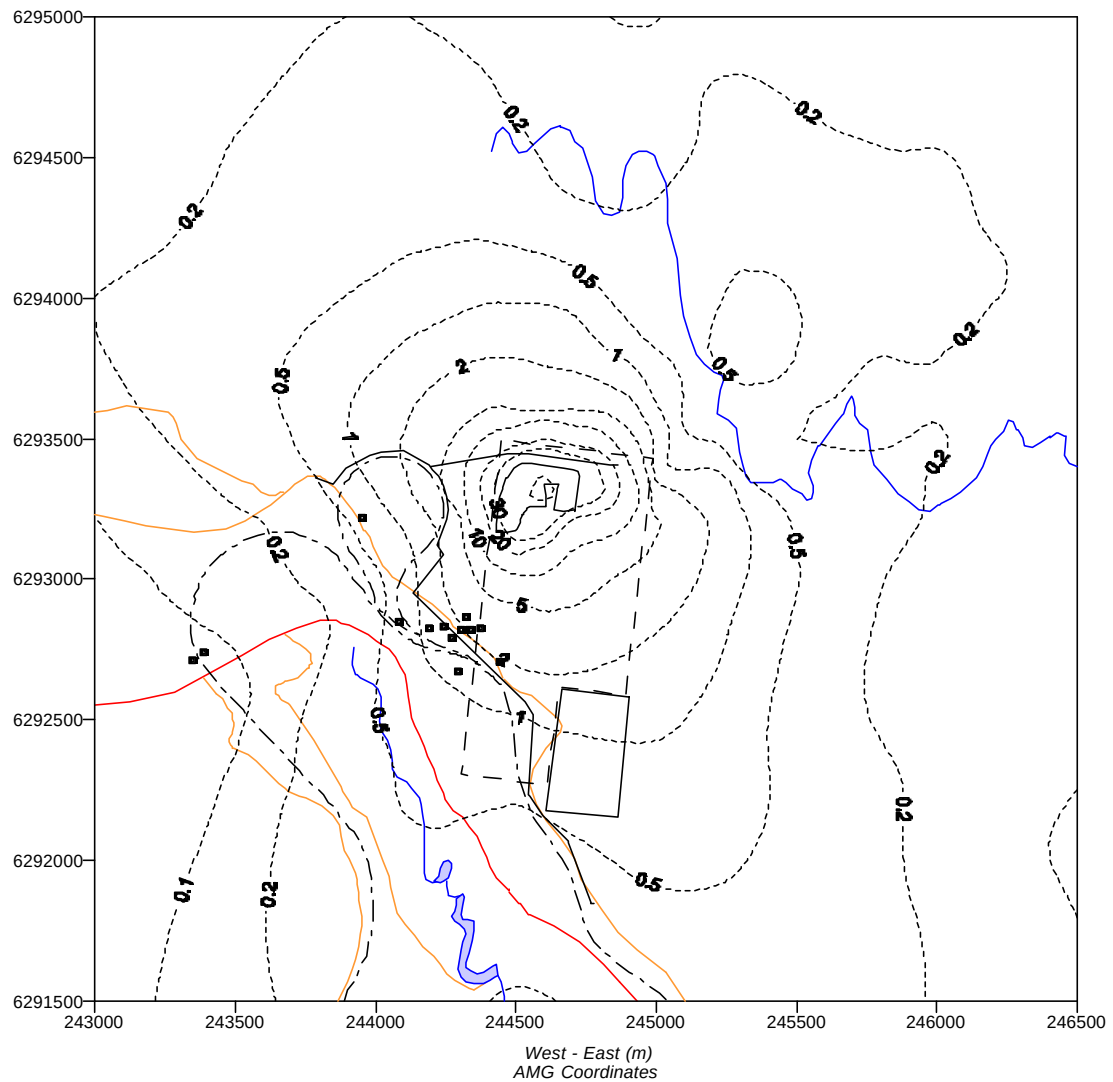
FIGURE 6



■ Nearest residences

Predicted maximum 24-hour average PM_{10} concentration at ground-level for Stage 2 operations ($\mu g/m^3$)

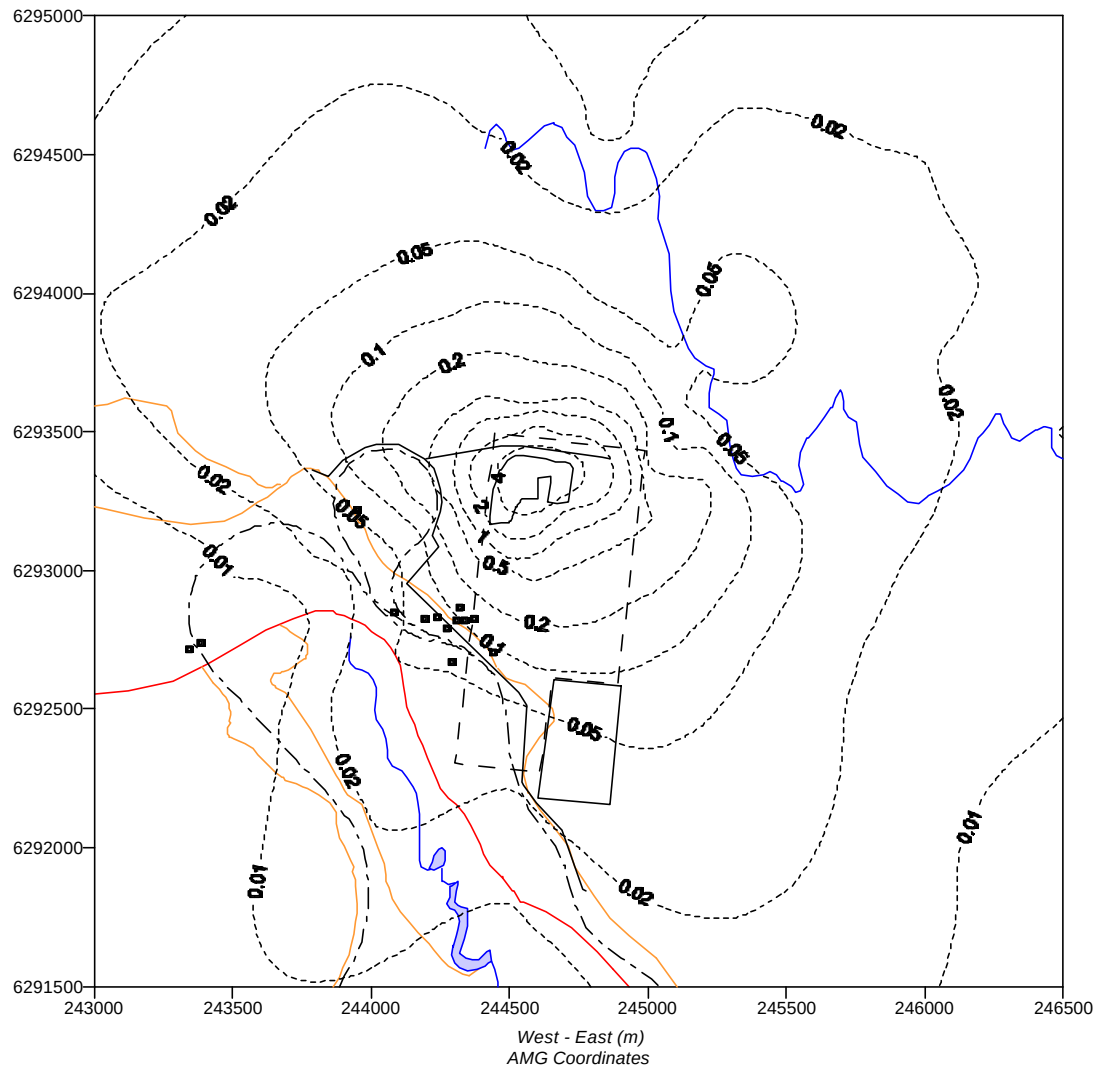
FIGURE 7



■ Nearest residences

**Predicted annual average TSP concentration at
ground-level for Stage 2 operations ($\mu\text{g}/\text{m}^3$)**

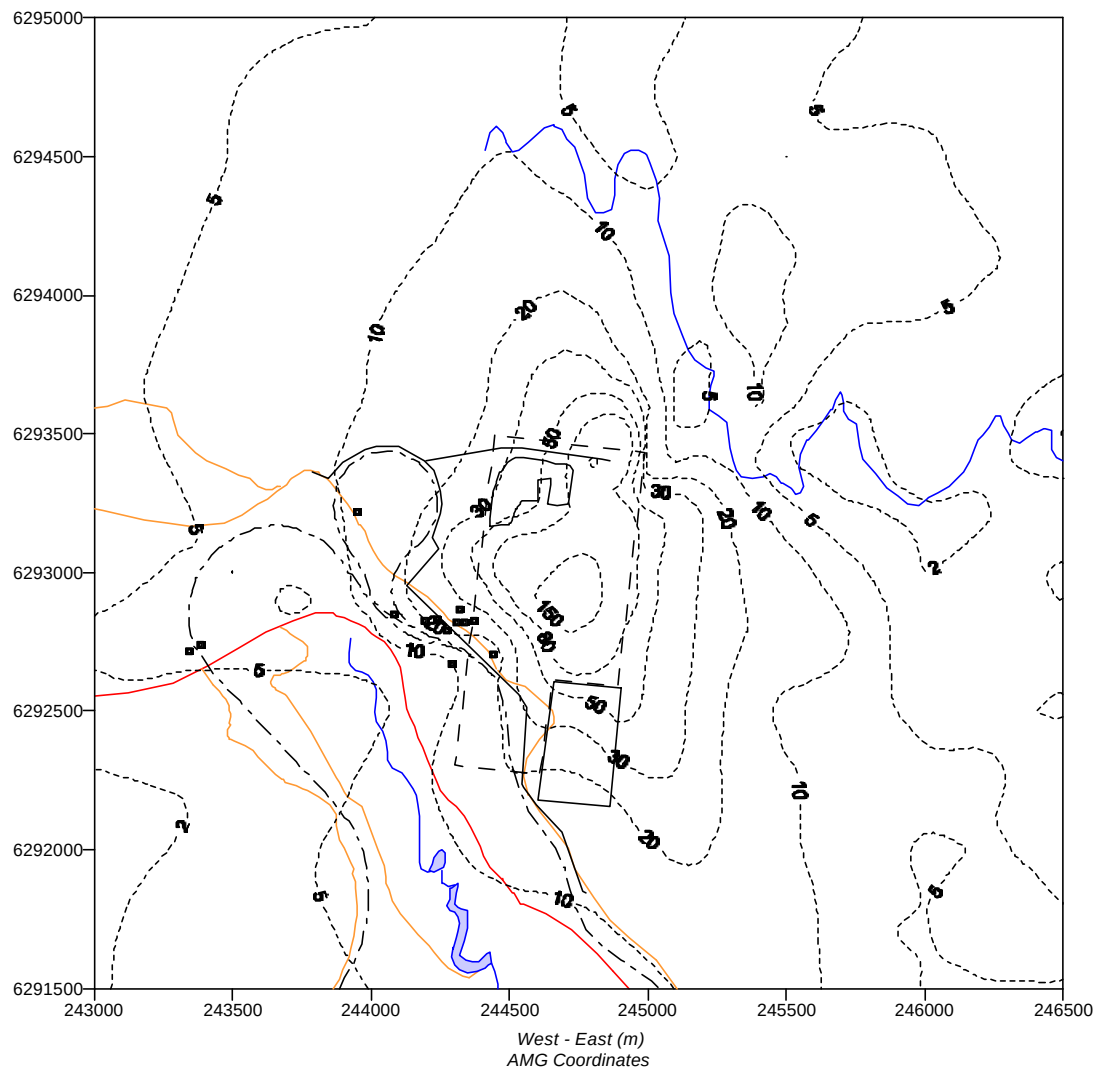
FIGURE 9



■ Nearest residences

**Predicted annual average dust deposition at
ground-level for Stage 2 operations ($\text{g}/\text{m}^2/\text{month}$)**

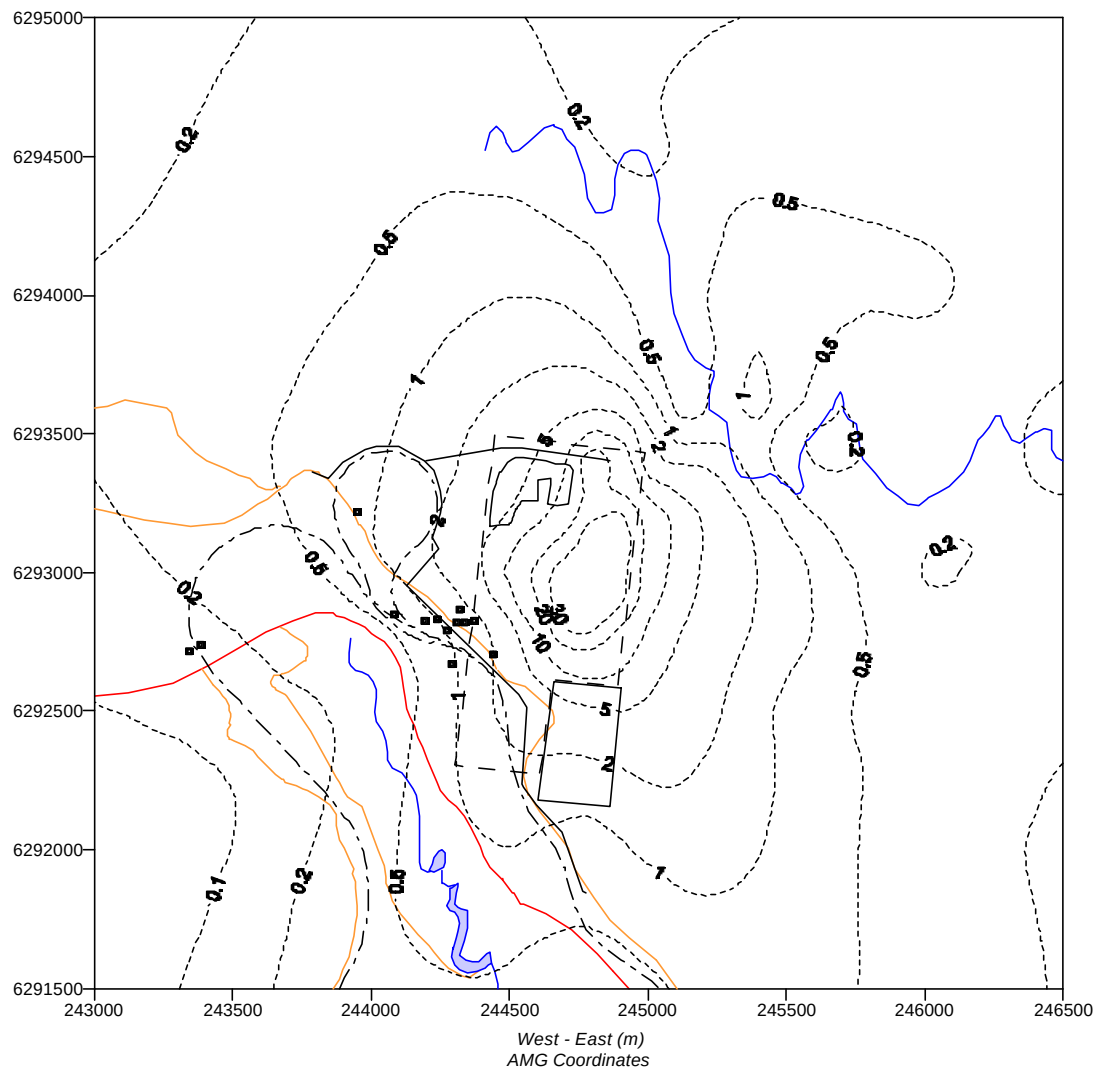
FIGURE 10



■ Nearest residences

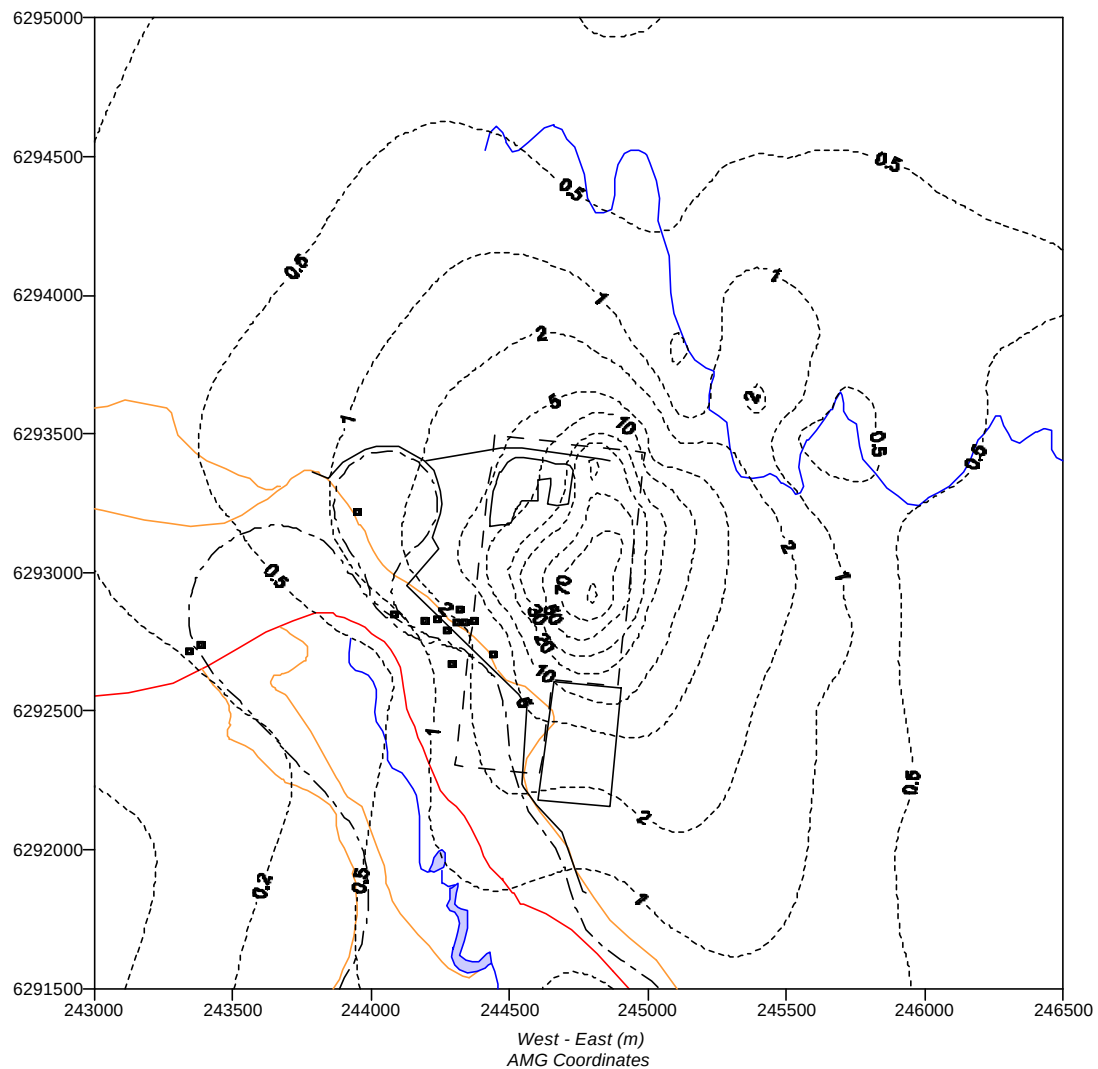
Predicted maximum 24-hour average PM₁₀ concentration at ground-level for Stage 5 operations (µg/m³)

FIGURE 11



**Predicted annual average PM_{10} concentration at
ground-level for Stage 5 operations ($\mu g/m^3$)**

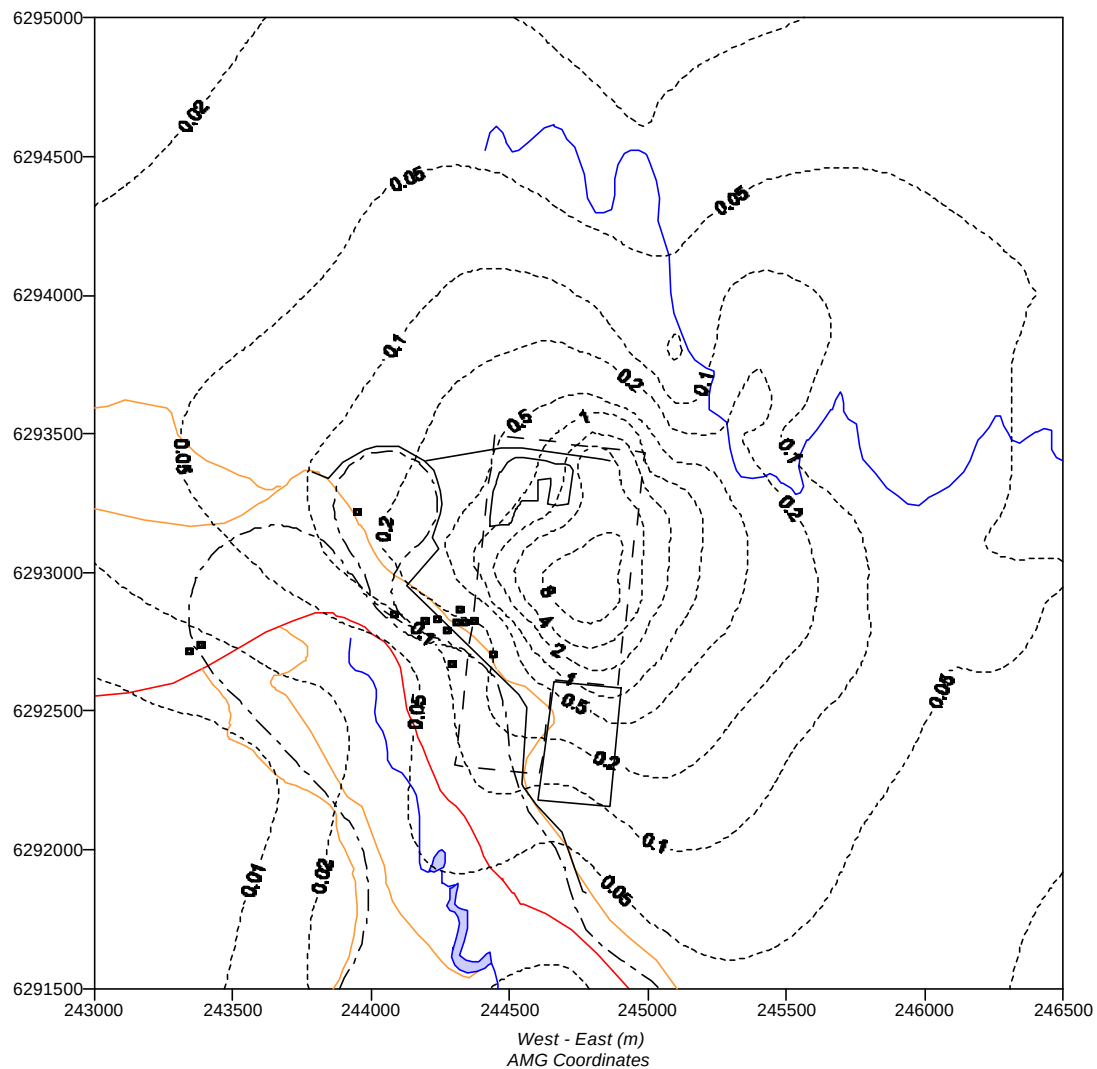
FIGURE 12



■ Nearest residences

**Predicted annual average TSP concentration at
ground-level for Stage 5 operations ($\mu\text{g}/\text{m}^3$)**

FIGURE 13



■ Nearest residences

Predicted annual average dust deposition at ground-level for Stage 5 operations (g/m²/month)

FIGURE 14

Appendix G – Noise Study

NOISE IMPACT ASSESSMENT
KAOLIN MINE
NEWNES JUNCTION

33.5058.R1:CF57
Rev 03

Prepared for: International Environmental Consultants
376 Bay Street
BRIGHTON LE SANDS NSW 2216

Prepared by: Atkins Acoustics and Associates Pty Ltd.
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GLADESVILLE NSW 2111

March 2003

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APPENDIX 7: Stage 5 – Noise Contour Plot - Extraction (Calm)

APPENDIX 8: Stage 6 – Noise Contour Plot - Extraction (Calm)

1.0 INTRODUCTION

Atkins Acoustics was engaged by International Environmental Consultants Pty Ltd on behalf of Newnes Kaolin Pty Ltd to conduct a noise impact assessment for a proposed kaolin mine at Newnes Junction.

This report presents the results, findings and recommendations of the noise assessment. The main aims of the study were to:

- ❑ inspect the site and identify nearby residential dwellings and other sensitive areas potentially exposed to noise emissions from the proposal;
- ❑ measure, review and comment on the existing ambient background noise levels prevailing in the vicinity of the site;
- ❑ recommend noise assessment goals in accordance with the Environment Protection Authority, Industrial Noise Policy (EPA, INP);
- ❑ recommend noise assessment goals in accordance with the Environment Protection Authority, Environmental Noise Control Manual (EPA, ENCM);
- ❑ identify and quantify the main noise sources associated with the proposal;
- ❑ predict and evaluate the likely range of noise emissions;
- ❑ assess potential noise impacts;
- ❑ prepare noise contour plots for the mine operations under varying operational and meteorological conditions; and,
- ❑ where assessment goals are exceeded, recommend ameliorative noise control measures.

The information presented in this report has been prepared for the particular investigation described herein, and should not be used in any other context or for any other purposes.

2.0 SITE DESCRIPTION AND PROPOSAL

2.1 The Site

The proposed site is located north of Newnes Junction, between Bell and Lithgow along the Bells Line of Road (Chifley Road) (*Figure 1*). The site is bounded by the Clarence Colliery to the north-west and north, Blue Mountains National Park to the east, Rocla Quarry to the south, and the Main Western Rail Line. A number of isolated residences and vacant residential building lots are located to the south and south-west.

Potential noise sensitive areas in the vicinity of the proposal and considered in this assessment are isolated residential dwellings to the south-west and the Blue Mountains National Park to the east.

2.2 Description of Proposal

It is proposed to mine an area of approximately 25 hectares. It is estimated that the project will produce approximately 119000 tpa of kaolinite to supply ceramic, paper coating and related industrial markets. A by-product of the separation of kaolin from its ore will be high quality sand suitable for glass manufacture and high grade construction purposes. Up to 1.281 million tonnes per annum of high grade sand will be produced. Average annual extraction rate at the mine will be 1.1 million tonnes.

The expected lifespan of the mine is twenty-one (21) years, with a total estimated reserve of 23.7Mt.

2.3 Site Development

It is proposed that the site will contain a pit from which the kaolin ore will be mined via ripping and pushing with a dozer into heaps, loaded into trucks with a front end loader, prior to being trucked to a on-site crushing facility, and conveyed to a covered stockpile. Ore will be conveyed to a surge bin adjacent to the railway line and loaded into trains for transportation to an off-site processing facility.

The main stationary mine infrastructure including grizzly, crusher, covered stockpile

and maintenance facilities will be located along the northern portion of the site.

2.3.1 Construction

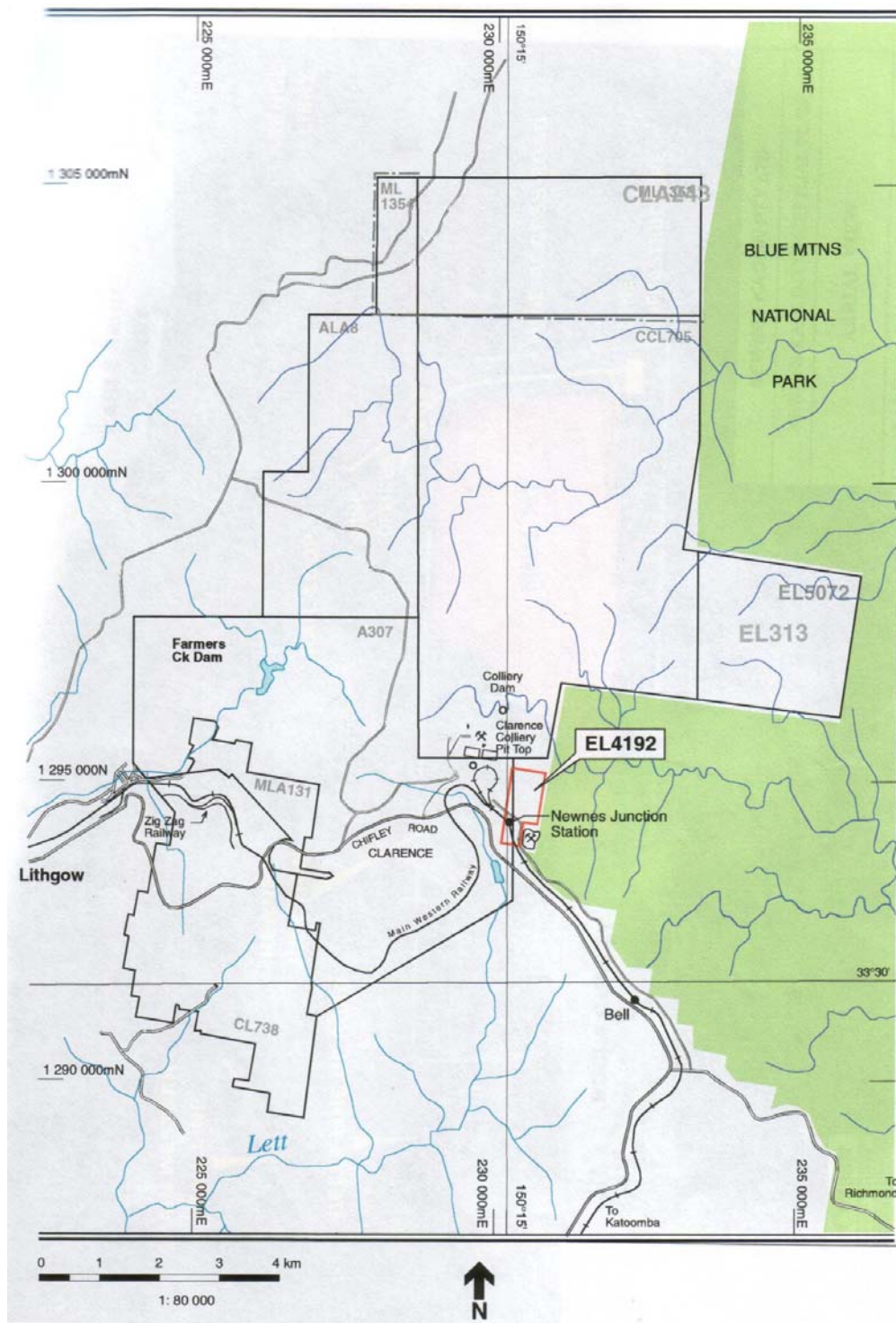
Prior to the commencement of mining operations, the site will require preparation and installation of mine equipment and infrastructure. These construction operations include site access road, internal roads, erection of materials handling, servicing, maintenance and administration facilities, excavation and installation for grizzly and crusher, and erection of conveyor systems.

The construction works will be performed in two (2) stages with total estimated duration of not more than six (6) months (26 weeks). A summary of the envisaged construction stages, description and typical plant and equipment is presented in *Table 1*.

Table 1: Construction Schedule

Construction Stage	Description of Activities	Typical Plant & Equipment
Stage 1 (4-13 weeks)	- Access road - Internal roads - Excavation for crushing facility - Preparation for siting of buildings - Compaction of building sites - Preparation of footings for conveyor	- Dozers - Excavator - Front End Loader - Haul Trucks - Tree Mulcher - Truck Mounted Auger - Vibratory Roller - Water Cart
Stage 2 (4-13 weeks)	- Building erection & fitout - Installation of stationary plant & equipment - Erection of conveyor systems - Commissioning of plant & equipment	- Crane - Concrete Trucks - Welders - Compressors - Generators - General Hand Tools

Figure 1: Site Location



2.4 Mine Development

Newnes Kaolin Pty Ltd has established conceptual designs for the pit, dump areas, covered stockpile, conveyor routes and internal roads. A key feature of the mine is the very shallow stripping required in order to separate the premium ore from the standard ore. As such, the mine will be developed with shallow benches typically 3m high. The basic stages are as follows:

2.4.1 Noise Mitigation Works

During the initial stages of mining, topsoil and overburden will be removed and placed to form acoustic bunds. Excess material will be stockpiled for later rehabilitation works. Noise mitigation works will occur prior to the commencement of each mine stage.

2.4.2 Kaolin Ore Extraction

The winning of kaolin ore will be achieved by ripping and/or digging the ore prior to dozing into heaps. It is proposed to operate in a north to south direction from the top to the bottom.

2.4.3 Kaolin Ore Transportation

The extracted ore will be loaded into haul trucks and transferred to the crusher, from which the fragmented ore will travel by conveyor to a covered stockpile.

2.4.4 Kaolin Ore Transfer Off-site

The stockpiled ore will be transferred from the covered stockpile and loaded onto the conveyor by a feeder and front-end loader. The material will be conveyed to the surge bin located at the train loading facility. The ore will then be transported by rail to an off-site processing facility yet to be determined.

2.5 Mobile Plant and Equipment Schedules

Plant and equipment that will be used to win, load, and transport the ore will typically comprise:

2.5.1 Pit

- 1-2 x dozers (Komatsu D375A) or equivalent
- 1-3 x 50 tonne dump trucks (CAT 969C) or equivalent
- FEL (Volvo L150C) or equivalent

2.5.2 Stationary Mine / Infrastructure

- conveyors (x2)
- crusher
- train loader (surge bin)
- generator

2.6 Hours of Operation

The operation of the mine will be principally governed by market demand for raw material and the site's ability to meet that demand.

The proposed hours of operation would be 7.00am to 6.00pm Monday to Saturday. Loading of trains will be dependant on State Rail schedules and timetables. Where practical, daytime loading will be undertaken.

3.0 EXISTING AMBIENT NOISE LEVELS

3.1 Ambient Noise Measurements

For the purposes of assessing noise from the proposal, the existing ambient background noise levels were measured and recorded from Thursday 16 March 2000 to Tuesday 18 April 2000.

The reference locations (Figure 1) selected to acquire ambient noise levels that are representative of those presently experienced by the residences identified in Section 2.1 were:

Measurement Location 1: 5 Sandham Road

Representing the residences at the north-western portion of the Newnes 'village' on the south-western side of Sandham Road. The residences are exposed to noise from rail traffic and distant road traffic noise from Bells Line of Road (Chifley Road).

Measurement Location 2: Sandham Road (opp. Newnes Junction Railway Station)

Representing the residences at the south-eastern portion of Newnes 'village' on the north-eastern side of Sandham Road. The residences are shielded from noise from road traffic on Bells Line of Road.

The instrumentation selected for the measurements consisted of two (2) RTA Technology Environmental Noise Loggers. The reference level of each instrument was checked prior to and after the measurements with a NATA calibrated (Certificate No. 3630) Bruel & Kjaer Sound Level Calibrator Type 4230, Serial No. 623590, with no significant drift recorded. The sound logging meters were set to A-weighting, fast response and fifteen (15) minute sampling period.

The ambient noise levels were measured and assessed as percentile A-weighted sound levels. The parameters regarded as being the most important amongst these, are the " L_{A90} ", the level exceeded for 90% of the sample period and referenced as the "background or average minimum noise level", and the " L_{Aeq} ", which is the A-weighted energy equivalent continuous (constant) sound level.

3.2 Meteorology

Meteorological conditions including wind speed, wind direction, temperature, humidity and rainfall were recorded during the noise measurement period using a Davis Instruments – Weather Monitor II and Weatherlink data logger. The weather station was installed at the rear of the property identified as 5 Sandham Road and adjacent to noise measurement location 1.

3.3 Results

From the procedures recommended in the EPA, “Industrial Noise Policy”, the Rating Background Level (RBL) and ambient L_{Aeq} noise levels have been established to assess noise emissions from the proposal. The RBL is the median of the tenth percentile background levels for each assessment period over the seven (7) day measurement period. The L_{Aeq} level represents the energy averaged noise level for each assessment period. *Table 2* presents a summary of the existing ambient noise levels for the daytime, evening and night-time hours, and the calculated RBL and L_{Aeq} levels.

Table 2: Measured RBL and L_{Aeq} Noise Levels
dB(A) re: 20×10^{-6} Pa

Date	Assessment Background Level L_{A90}			Equivalent Continuous Level L_{Aeq}		
	Day	Evening	Night	Day	Evening	Night
Location 1: 5 Sandham Road						
Thu 16.3.00		32	29		57	51
Fri 17.3.00	32	32	29	56	58	50
Sat 18.3.00	37	31	30	51	49	52
Sun 19.3.00	31	32	31	54	50	51
Mon 20.3.00	38	37	34	57	58	54
Tue 21.3.00	42	39	36	56	59	54
Wed 22.3.00	42	37	33	57	58	55
Thu 23.3.00	34	33	31	56	56	54
Fri 24.3.00	33	32	29	55	51	50
Sat 25.3.00	32	29	28	50	46	45
Sun 26.3.00	30	29	28	48	48	49
Mon 27.3.00	31	31	30	53	52	54
Tue 28.3.00	34	33	38	53	53	54
Wed 29.3.00	31	31	30	52	56	52
Thu 30.3.00	32	29	30	54	56	53
Fri 31.3.00	39	34	34	55	55	54
Sat 1.4.00	34	29	29	49	40	47
Sun 2.4.00	33	30	30	48	45	51

Table 2: Measured RBL and L_{Aeq} Noise Levels (cont.)
dB(A) re: 20×10^{-6} Pa

Date	Assessment Background Level L_{A90}			Equivalent Continuous Level L_{Aeq}		
	Day	Evening	Night	Day	Evening	Night
Location 1: 5 Sandham Road (cont.)						
Mon 3.4.00	36	33	31	52	57	53
Tue 4.4.00	32	29	30	53	56	51
Wed 5.4.00	43	39	39	54	58	54
Thu 6.4.00	36	32	30	56	58	52
Fri 7.4.00	33	31	28	52	54	51
Sat 8.4.00	32	31	29	51	51	50
Sun 9.4.00	30	29	28	49	46	51
Mon 10.4.00	34	33	28	50	53	49
Tue 11.4.00	31	30	28	50	55	51
Wed 12.4.00	31	31	29	53	55	50
Thu 13.4.00	31	30	31	53	56	52
Fri 14.4.00	36	34	30	52	55	50
Sat 15.4.00	36	28	28	51	54	46
Sun 16.4.00	38	29	35	49	48	52
Mon 17.4.00	35	29		50	54	
RBL	33	31	30			
Ambient L_{Aeq}				53	55	52
Location 2: Sandham Road						
Thu 16.3.00		28	28		47	36
Fri 17.3.00	32	29	29	49	47	36
Sat 18.3.00	33	28	28	46	49	40
Sun 19.3.00	31	28	29	54	43	41
Mon 20.3.00	42	34	31	53	50	45
Tue 21.3.00	40	38	33	50	50	45
Wed 22.3.00	41	37	31	50	46	42
Thu 23.3.00	34	32	30	51	46	41
Fri 24.3.00	31	31	29	47	44	41
Sat 25.3.00	30	28	28	47	37	37
Sun 26.3.00	29	28	28	48	41	40
Mon 27.3.00	30	29	32	50	56	46
Tue 28.3.00	40	41	33	51	57	45
Wed 29.3.00	34	29	28	53	48	42
Thu 30.3.00	31	29	32	48	46	45
Fri 31.3.00	38	34	30	49	45	45
Sat 1.4.00	31	28	28	47	32	43
Sun 2.4.00	29	29	30	47	35	45
Mon 3.4.00	34	36	31	52	55	44
Tue 4.4.00	30	28	29	48	45	46
Wed 5.4.00	38	36	38	48	50	50
Thu 6.4.00	34	31	30	52	47	43
Fri 7.4.00	30	30	28	47	42	40
Sat 8.4.00	30	30	28	49	36	38
Sun 9.4.00	29	27	27	44	32	41
Mon 10.4.00	40	40	27	49	45	44
Tue 11.4.00	30	29	27	48	45	42

Table 2: Measured RBL and L_{Aeq} Noise Levels (cont.)

dB(A) re: 20 x 10⁻⁶ Pa

Date	Assessment Background Level L _{A90}			Equivalent Continuous Level L _{Aeq}		
	Day	Evening	Night	Day	Evening	Night
Location 2: Sandham Road (cont.)						
Wed 12.4.00	29	30	28	45	44	37
Thu 13.4.00	31	29	32	49	45	43
Fri 14.4.00	34	33	29	46	44	42
Sat 15.4.00	36	27	27	67	43	40
Sun 16.4.00	32	27	32	47	42	45
Mon 17.4.00	30	28	28	47	45	44
RBL	32	29	29			
Ambient L_{Aeq}				54	48	43

NOTE: Daytime : (7.00am to 6.00pm)
Evening : (6.00pm to 10.00pm)
Night-time : (10.00pm to 7.00am)

Meteorological conditions experienced during the noise measurement period were typified by generally low wind speeds (<2m/s) and temperatures ranging from 7°C at night to 30°C during the day. Rainfall experienced during the measurement period has been reviewed and is not considered to have significantly altered the noise measurement results. Appendix 2 presents a summary of the meteorological conditions recorded during the survey period (Thursday 16 March 2000 to Tuesday 18 April 2000).

Additional meteorological information (Appendix 2) supplied by Holmes Air Sciences provided annual and seasonal data on wind speed and direction for the closest meteorological stations of Mount Piper and Lithgow. A review of the data for the purposes of noise modelling identifying the predominant wind directions and percentage occurrence for Mount Piper and Lithgow is provided in *Table 3*. The data confirms that west winds are predominant and should be considered in the noise modelling. In terms of source to receiver winds, a review of the windrose data (Appendix 2), considering the sum of winds (0.1-3m/s) in the quadrants 45° either side of direct source to receiver wind (north and north-east), has shown that wind in the direction of the referenced receivers does not occur for more than 30% of the time in any season. Accordingly in accordance with the EPA, INP procedures source to receiver winds conditions are not required for the noise modelling.

The supplied data (Appendix 2) also identified that E and F Stability Class conditions at wind speeds of less than 3m/s occur for less than 30% of the time. Accordingly as the EPA, INP recommends that adverse meteorological condition need only be assessed when wind speeds of 3m/s or below occur for 30% or more of the time in any assessment period or season, the effects of temperature inversions have not been considered in the noise modelling.

Table 3: Predominant Wind Direction and Percentage Occurrence
Holmes Air Sciences

Meteorological Station	Time Period	Wind Direction	Percentage Occurrence (%)
Mount Piper	Winter 1997	SW	16
		WSW	15
		Calm	10.3
	Autumn 1997	SW	13
		WSW	10
		Calm	8.8
	Spring 1997	SW	13
		WSW	15
		Calm	6.5
	Summer 1997	ESE	11
		Calm	4.6
Lithgow	Annual 1997	SW	13
		WSW	13
		Calm	7.9
	Winter 1997	W	31
		SW	17
		Calm	17.4
	Autumn 1997	W	20
		SW	11
		SE	18
		Calm	17.8
	Spring 1997	W	30
		SW	13
		NW	19
		Calm	10.5
	Summer 1997	W	15
		SE	18
		E	15
		NW	15
		Calm	15.2

Table 3: Predominant Wind Direction and Percentage Occurrence (cont.)
Holmes Air Sciences

Meteorological Station	Time Period	Wind Direction	Percentage Occurrence (%)
Lithgow	Annual 1997	W	24
		SW	12
		SE	15
		NW	15
		Calm	15.3

3.4 Audit Noise Measurements

Site attended audit measurements of noise generated by existing rail activities were conducted to assist in assessing potential noise impact associated with increased rail movements as a result of the proposal. Measurements were conducted at the rear of the residence identified as 5 Sandham Road on the 7 March 2000 and 18 March 2000. A summary of the L_{Amax} noise level and sound exposure level (SEL) recorded are presented in *Table 4*. The location was approximately sixty (60) metres from the main western rail line, and partially shielded by existing cuttings.

Table 4: Audit Train Measurements at 5 Sandham Road (rear-60m from rail line)
dB(A) re: 20×10^{-6} Pa

Date	Train Type	Speed	Duration	Direction	SEL dB(A)	Sound Pressure Level L_{Amax} dB(A)
7.4.00	Silver commuter	fast	15s	W	79.7	70
	Silver commuter	fast	15s	E	82.1	71
	Goods train	med	38s	W	87.6	72
	Silver commuter	fast	13s	W	79.9	70
18.4.00	Silver commuter	med	15s	E	82.6	72
	Silver commuter	slow	20s	W	78.7	68
	Silver commuter	fast	22s	E	81.4	70

4.0 NOISE ASSESSMENT GOALS

In accordance with the Environment Protection Authority, Industrial Noise Policy (EPA, INP) and Environmental Noise Control Manual (EPA, ENCM) the following goals have been considered for assessing noise associated with the proposed mine operations.

4.1 Construction

The NSW Environment Protection Authority, Environmental Noise Control Manual (ENCM) ^(Chapter 171) construction noise guidelines have been adopted for this assessment.

These guidelines consider the L_{A10} noise level (the noise level exceeded for 10% of the time) from construction activities and provide assessment goals depending on the construction period. These are:

Short Term – 4 weeks or less. The L_{A10} level of construction noise should not exceed the L_{A90} background noise level by more than 20dB(A).

Medium Term – greater than 4 weeks but less than 26 weeks. The L_{A10} level of construction noise should not exceed the L_{A90} background noise by more than 10dB(A).

Long Term – greater than 26 weeks. The L_{A10} level of construction noise should not exceed the L_{A90} background noise by more than 5dB(A).

In setting these goals the EPA recognises that the levels set will not always be achieved. Accordingly where there is a technical exceedance of the assessment goals, it is generally recommended that the construction activities be restricted to daytime hours.

Noise emissions from construction activities were assessed to the residential premises identified as:

Location 1: 5 Sandham Road (R1)

Location 2: Sandham Road (R2)

Considering the duration of the proposed construction activities is less than 26 weeks, the recommended goal for assessing noise from construction activities associated with the proposal is background $L_{A90} + 10\text{dB(A)}$.

4.2 Mining Operations

The EPA, INP assessment procedure for industrial noise sources has two (2) components:

- (1) controlling intrusive noise; and
- (2) maintaining noise level amenity.

The intrusiveness of a noise source is considered to be acceptable if the $L_{Aeq, 15 \text{ minute}}$ noise level does not exceed the RBL by more than 5dB(A). In order to determine the amenity noise goal, the ambient L_{Aeq} noise levels should not normally exceed the acceptable noise levels (*Table 5*). Where existing L_{Aeq} noise levels approach or exceed acceptable noise levels, design goals are set below the existing L_{Aeq} in order to limit any further increase or “creep” in the ambient levels.

Table 5: EPA Noise Policy Amenity Criteria
dB(A) re: $20 \times 10^{-6} \text{ Pa}$

Type of Receiver	Indicative Noise Amenity Area	Time of Day	Recommended L_{Aeq} Noise Level dB(A)	
			Acceptable	Recommended Maximum
Residence	Rural	Day	50	55
		Evening	45	50
		Night	40	45

Table 5: EPA Noise Policy Amenity Criteria (cont.)
dB(A) re: 20×10^{-6} Pa

Type of Receiver	Indicative Noise Amenity Area	Time of Day	Recommended L_{Aeq} Noise Level dB(A)	
			Acceptable	Recommended Maximum
Area specifically reserved for passive recreation	All	When in use	50	55

It is noted (EPA, INP ^{Section 1.4.1}) that the criteria presented above are best regarded as planning tools. They are not mandatory, and an application for a noise producing development is not determined purely on the basis of compliance or otherwise of noise criteria. Numerous other factors need to be taken into account in the determination. These factors include economic consequences, other environmental effects and the social worth of the development.

Located to the west of the proposed mine is the Blue Mountains National Park. The EPA, INP provides recommended noise levels for areas specifically reserved for passive recreation such as National Parks. Section 2 ^(Table 2.1) of the EPA, INP recommends a L_{Aeq} noise level of 50dB(A), with a maximum of 55dB(A) for these areas when in use.

Considering the measured ambient noise levels and the EPA guidelines, *Table 6* presents the assessment RBL's, the L_{Aeq} noise levels together with the intrusive and amenity noise goals.

Table 6: Assessment RBL and Ambient L_{Aeq} Noise Levels
dB(A) re: 20×10^{-6} Pa

Period ⁽¹⁾	Recommended Noise Level L_{Aeq}	Existing RBL L_{A90}	Existing L_{Aeq}	Intrusive Criterion L_{Aeq}	Amenity Criterion L_{Aeq}
Location 1: 5 Sandham Road					
Day	50	33	53	38	43
Evening	45	31	55	36	45
Night	40	30	52	35	42
Location 2: Sandham Road					
Day	50	32	54	37	44
Evening	45	30 ⁽²⁾	48	35	38
Night	40	30 ⁽²⁾	43	35	33
Location 3: Blue Mountains National Park					
Day	50 ⁽³⁾	-	-	-	50 ⁽³⁾

- (1) Daytime: (7.00am to 6.00pm)
Evening: (6.00pm to 10.00pm)
Night-time: (10.00pm to 7.00am)
- (2) In accordance with the procedures of the EPA, INP^{Section 3.1.2} where the rating background level (RBL) is found to be less than 30dB(A), then it is set to 30dB(A)
- (3) Recommended maximum level of 55dB(A)

4.3 Site Preparation – Noise Mitigation Works

Site preparation and the construction of bunding for the purposes of noise control will be required prior to the commencement of extraction operations for each mine stage. In order to construct noise control bunds plant and equipment will be required on the surface for removal and placement of topsoil and overburden material. Considering the short duration (less than 4 weeks) of the noise mitigation works, the goal adopted for assessing noise impact is background (L_{90}) +20dB(A).

4.4 Train Loading Operations

Train loading activities involving the use of a front-end loader, conveyors and surge bin were assessed in terms of the EPA, INP noise goals outlined in Section 4.1.

4.5 Train Movements

In accordance with the EPA, ENCM^{Chapter 163} the recommended goals for assessing train noise at the residential receivers are $L_{Aeq,24hour}$ 60dB(A) and a L_{Amax} 85dB(A).

4.6 Recommended Goals

Having regard to the measured ambient noise levels and the EPA guidelines, the goals recommended for assessing noise emissions from the proposal are tabulated below:

Table 7: Recommended Noise Goals
dB(A) re: 20×10^{-6} Pa

Noise Goals	Sound Pressure Levels dB(A)	
	Day 7.00am–6.00pm	Evening 6.00pm–10.00pm
5 Sandham Road (R1)		
Construction (L_{A10})	43	41
Stage Preparation (L_{A10})	53	51
Mining Operations (L_{Aeq})	38	36
Train Loading (L_{Aeq})	38	36
Train Passby ($L_{Aeq,24hour}$)	60	
Train Passby (L_{Amax})	85	
Sandham Road (R2) – opposite railway station		
Construction (L_{A10})	42	40
Stage Preparation (L_{A10})	52	50
Mining Operations (L_{Aeq})	37	35
Train Loading (L_{Aeq})	37	35
Train Passby ($L_{Aeq,24hour}$)	60	
Train Passby (L_{Amax})	85	
Blue Mountains National Park		
Mining Operations (L_{Aeq})	50-55	

For the purposes of assessing noise levels at residences, the noise is assessed at the most affected point on or within the residential property boundary or, if this is more than 30m from the residence, at the most affected point within 30m of the residence (EPA, INP^{Section 2.2.1}). When assessing noise impacts for passive and active recreation areas, the noise is assessed at the most affected point within 50m of the area boundary (EPA, INP^{Section 2.2.1 NOTES}).

5.0 SITE PLANT AND EQUIPMENT

Noise emissions from the proposal have been modelled and assessed in terms of continuous noise from the fixed and mobile plant, haul truck movements, conveyors and train loading operations. In addition noise emissions from construction activities associated with noise mitigation controls, site preparation, access road, buildings and conveyor erection were assessed to the residential premises identified.

5.1 Construction

The main plant of acoustical significance associated with construction activities consists of a dozer, excavator, front end loaders, grader, vibratory roller, truck mounted boring machine, haul trucks, water cart, crane, concrete trucks, generator, grader, and compressor. For the assessment of noise emissions from the plant and equipment, the following schedule and sound pressure levels have been established from site attended audit measurements, published data and discussions with the proponent.

Table 8: Construction Plant & Equipment Sound Pressure Levels @7m
dB(A) re: 20×10^{-6} Pa

Plant Description	Number of Items	Sound Pressure Level dB(A) @ 7m
STAGE 1		
Dozer	1	89
Excavator	1	86
Front End Loader	1	80
Tree Mulcher	1	90
Vibratory Roller	1	87
Truck Mounted Auger	1	90
Haul Truck	2	83
Water Cart	1	81
STAGE 2		
Crane	1	83
Concrete Truck	2	83
Generator	2	81
Compressor	2	75
General Hand Tools	5	78

5.2 Mine Operations

5.2.1 Noise Mitigation

Prior to commencing each mining stage dozers, front-end loader and trucks will be utilized to establish the required bunding for the purpose of noise mitigation.

The sound power levels summarised in *Table 9* were adopted for the purposes of assessing noise during the stage preparation and construction of noise bunds.

5.2.2 Extraction

The main plant of acoustical significance operated on the mine site would consist of 1-2 dozers, front-end loaders, haul trucks, generator, crusher and conveyors. For the assessment of noise emissions from this plant, the following sound power levels (*Table 9*) have been established from site attended audit measurements.

Table 9: Mine Plant Sound Power Levels
dB(A) re: 10⁻¹² Watts

Plant Description	Sound Power Level dB(A)								
	dB(A)	63	125	250	500	1k	2k	4k	8k
Dozer (Komatsu D375A)	112	111	113	109	108	107	104	100	93
FEL (Volvo L150C)	105	115	109	106	100	96	99	90	81
50tn Haul Truck (CAT 969C)	108	110	105	99	102	103	103	96	92
Generator	106	103	102	96	105	102	99	94	92
Crusher*	106	114	108	104	104	100	99	96	90
Conveyor (1) Drive – 30kW	85	69	74	76	79	82	77	71	58
Conveyor (1) Belt – 70m	96	79	85	87	90	93	88	82	69

* crusher located below ground in a 'room' excavated within the bedrock, with an opening facing nominally north (R. Smith).

5.3 Train Loading Operations

It is expected that train-loading operations would have a duration of forty-five (45) minutes to one (1) hour. For the purposes of assessing noise from train loading operations the sound power levels of typical equipment have been established from site attended audit measurements and published data, and are presented in *Table 10*. Train loading operations involving the use of a front end loader, conveyors, surge bin

and Class 81 locomotives were assessed with all mine plant and equipment operating under normal extraction presenting a worst case scenario.

In terms of train movements on the main rail line, the train noise was assessed in terms of a maximum passby noise level, and a $L_{Aeq,24hour}$ taking into account existing train activities and additional train activities as a result of the proposal. Information available at the time of the assessment projected a maximum of two (2) trains being loading within any twenty four (24) hour period, with a maximum of seven (7) trains per week. However it is considered unlikely that more than one (1) train will be loaded on any one day within the first nine (9) years of extraction.

Table 10: Train Loading Sound Power Levels
dB(A) re: 10^{-12} Watts

Item Description	Sound Power Level dB(A) re: 10^{-12} Watts								
	dBA	63	125	250	500	1k	2k	4k	8k
Surge Bin	112	98	100	104	102	104	108	105	92
Class 81 Locomotive*	114	106	99	99	105	107	110	106	100
Conveyor (2) Drive – 200kW	93	77	82	84	87	90	85	79	66
Conveyor (2) Belt – 400m	104	89	94	96	98	101	97	93	78
FEL (Volvo L150C)	105	115	109	106	100	96	99	90	81

* at Notch 3 power setting

Information provided by FreightCorp has identified that between two (2) and three (3) Class 81 (3000hp – diesel/electric) locomotives would be utilised for rail transportation of the ore. It is understood that a train may be loaded with two (2) locomotives operating at a power setting of Notch 2 or 3. The noise modelling predictions for train loading has assumed this operational situation.

Previous studies (James Heddle Acoustical Consultants) of Class 81 Locomotives have been conducted and recorded train noise levels. These measurements were utilised and adjusted to account for a power setting of Notch 3 for the locomotives and sixty (60) wagons providing an SEL of L_w 111dB(A).

6.0 SITE NOISE EMISSIONS

Noise emissions from the site operations were modelled with the EPA approved Environmental Noise Model (ENM) computer model. The model considers attenuation factors such as distance, shielding from working faces, ground coverage, atmospheric absorption, topographical features of the area and building structures.

The noise model input data for the Newnes Kaolin Mine has been based on noise measurements at similar sites, manufacturers specifications, digital ground contours plotted from aerial survey (MineConsult Pty Ltd), ground contour intervals of two (2) metres, digital mine plans (MineConsult Pty Ltd).

The EPA, INP^(Section 5.3.1) guidelines for noise assessment under varying wind conditions recommend that wind effects should be assessed when wind speeds of 3m/s or below occur for 30 percent of the time or more in any assessment period or season. Considering the meteorological and seasonal wind data from Holmes Air Sciences (Section 3.2^{Table 2}), only calm conditions and westerly winds were assessed. The meteorological scenarios modelled are outlined below:

- Calm: no wind, relative humidity of 70%, and air temperature of 18°C;
- West wind: 3m/sec west wind (270°), relative humidity of 70%, and air temperature of 18°C;

Records reported by Holmes Air Sciences show that the occurrence of temperature inversion is less than 30%, therefore in accordance with the EPA, INP^(Appendix C) assessment procedures, inversion effects have not been considered in the noise modelling.

6.1 Construction

Noise emissions for the construction activities were predicted considering the sound pressure levels presented in *Table 8* and calm meteorological conditions, 70%

humidity and air temperature of 18°C. The results of the modelling are summarised in *Table 11*.

Table 11: Predicted Construction Noise Levels
L_{A10} dB(A) re: 20 x 10⁻⁶ Pa

Reference Location	Predicted Noise Level dB(A)	
	Stage 1	Stage 2
5 Sandham Road (R1)	42	40
Sandham Road (R2)	42	41

The results of the noise predictions associated with the site establishment and construction activities have shown that the recommended noise goals are satisfied at the reference assessment locations during both Stage 1 and Stage 2 construction works.

6.2 Mine Operations

The mine development stages (Appendices 3-8) considered in the noise modelling included:

- Stage 1:** Before any substantial worked faces are established, removal of vegetation, pit depth of RL 1020.
- Stage 2:** Four (4) benches have been formed with elevations of RL 1053, RL 1044, RL 1035 and RL 1020 respectively.
- Stage 3:** Further bench established, five (5) benches with elevations of RL 1053, RL 1044, RL 1035, RL 1026, and RL 1020.
- Stage 4:** Pit widened significantly with three (3) large benches of RL 1008, RL 999 and RL 993; and four small benches of RL 1017, RL 1026, RL 1035, RL 1044 and RL 1053 respectively.
- Stage 5:** Pit is doubled in size with seven (7) benches of RL 993, RL 999, RL 1008, RL 1017, RL 1026, RL 1035 and RL 1044 respectively.
- Stage 6:** Pit increased in depth and extended further south, one (1) main bench forming base of pit RL 993.

The above scenarios generally cover the envisaged situations throughout the life of the mine. They were selected to present the range of activities, situations and noise

levels likely to be emitted from the site.

6.2.1 Phase 1 – Noise Mitigation

During initial site preparation for each mine area (Stages 1 to 6) equipment will be located on the existing ground surface for short-term periods in order to construct bunds and establish working faces for the purpose of noise control. These situations will result in the emission of higher noise levels in the short-term. Bunds in the order of three (3.0) to four (4.0) metres high are proposed and will be erected along the southern and western mine boundaries.

Table 12: Predicted Noise Levels: Mine Operations – Stage Preparation
L_{A10} dB(A) re: 20 x 10⁻⁶ Pa

Meteorological Scenario	Predicted Noise Level dB(A)					
	Stage 1	Stage 2	Stage 3	Stage 4	Stage 5	Stage 6
5 Sandham Road (R1)						
Calm	33	35	39 (41)	36 (39)	37 (39)	35 (37)
West Wind	26	33	37 (39)	32 (34)	32 (34)	30 (32)
Sandham Road (R2)						
Calm	36	39	41 (44)	41 (44)	55 (57)	53 (55)
West Wind	34	39	42 (44)	41 (43)	52 (54)	50 (52)

NOTE: Exceedance of recommended goal presented in BOLD
Level in parenthesis represents two (2) dozers operating

The noise predictions presented in *Table 12* show that during initial stage preparation the recommended goals are satisfied at 5 Sandham Road (R1). The predictions show noise exceedances of 3-5dB(A) (Stage 5-calm), 2dB(A) (Stage 5-west wind) and 1-3dB(A) (Stage 6-calm) at Sandham Road (R2).

6.2.2 Phase 2 – Mine Extraction

Normal mine extraction was modelled on the assumption that up to two (2) metres of soil and overburden had been removed from the existing ground level within the mine area and the noise control bunds had been constructed at the perimeter of the stage to the south and west. Additional noise levels have been predicted for extraction at the base of the finished bench level of each stage.

The noise assessment was based on the assumption that all the fixed and mobile plant was operating simultaneously. Whilst this working situation will not occur all of the time, for the purpose of the noise assessment the worst case scenario has been presented. A review of the production schedule for the mine identified that more than one (1) dozer would be required from Stage 3 to Stage 6 inclusive. Specifically from Year 5 (approximately Stage 3) 1.1 dozers would be required, increasing to 1.7 dozers for Years 11-20 (Stages 5 and 6), equating to 10% use of an additional dozer during Stage 3 increasing to 70% use during Stages 5 and 6. The assessment has considered the continuous operation of two (2) dozers for Stage 3 through to Stage 6.

Table 13: Predicted Noise Levels: Mine Operations –Mine Extraction
L_{Aeq} dB(A) re: 20 x 10⁻⁶ Pa

Meteorological Scenario	Predicted Noise Level dB(A)					
	Stage 1	Stage 2	Stage 3	Stage 4	Stage 5	Stage 6
5 Sandham Road (R1)						
Calm	32	34	34 (36)	35 (37)	36 (38)	35 (37)
West Wind	29	32	33 (34)	33 (35)	31 (33)	31 (32)
Sandham Road (R2)						
Calm	35	36	36 (38)	36 (37)	45 (48)	48 (52)
West Wind	33	36	36 (38)	36 (37)	43 (46)	45 (48)

NOTE: Exceedance of recommended goal presented in BOLD
Level in parenthesis represents two (2) dozers operating

The noise predictions presented in *Table 13* show that for normal extraction activities during both calm and west wind meteorological conditions the recommended noise goals are satisfied for all Stages at 5 Sandham Road (R1). The results also show that the recommended noise goals are generally satisfied for Stages 1-4 (approximately 9 years of mining activity) at Sandham Road (R2). The predicted 1dB(A) exceedance during Stage 4 with two (2) dozers operating is considered marginal. The results show that during Stage 5 noise exceedances of 8-11dB(A) (calm) and 6-9dB(A) (west wind), and during Stage 6 of 11-15dB(A) (calm) and 8-11dB(A) (west wind) are predicted.

Table 14: Predicted Noise Levels: Mine Operations – Base of Bench
L_{Aeq} dB(A) re: 20 x 10⁻⁶ Pa

Meteorological	Predicted Noise Level dB(A)

Scenario	Stage 1	Stage 2	Stage 3	Stage 4	Stage 5	Stage 6
5 Sandham Road (R1)						
Calm	27	33	32 (34)	32 (34)	35 (37)	28 (29)
West Wind	24	31	30 (32)	30 (31)	32 (34)	25 (26)
Sandham Road (R2)						
Calm	28	34	34 (35)	32 (33)	40 (42)	31 (32)
West Wind	27	34	34 (35)	32 (33)	38 (40)	29 (30)

NOTE: Exceedance of recommended goal presented in BOLD
Level in parenthesis represents two (2) dozers operating

The noise predictions in *Table 14* show that during the final phases of extraction, the recommended goals are satisfied at 5 Sandham Road (R1) for all stages. During Stage 5 noise exceedances of 3-5dB(A) (calm) and 1-3dB(A) (west wind) are predicted at Sandham Road (R2).

The results of the noise modelling for the six (6) stages during calm meteorological conditions and normal extraction activities with two (2) dozers operating are presented as noise contours in Appendices 3-8. It is noted that the noise contours are for conceptual purposes only.

6.3 Train Loading Operations

Train loading operations have been considered with all mine plant operating under normal extraction activities. While this situation may not occur all of the time it represents a worst case prediction. The noise predictions (*Table 15*) show that the cumulative noise from the site operation during train loading increase by up to 3dB(A), however generally 1-2dB(A). A summary of the predicted noise levels during each stage and under varying meteorological conditions are presented in *Table 15*.

Table 15: Predicted Noise Levels: Train Loading and Normal Operations
L_{Aeq} dB(A) re: 20 x 10⁻⁶ Pa

Meteorological Scenario	Predicted Noise Level dB(A)					
	Stage 1	Stage 2	Stage 3	Stage 4	Stage 5	Stage 6
5 Sandham Road (R1)						
Calm	33	35	35 (37)	36 (37)	37 (39)	36 (38)
West Wind	32	34	34 (35)	34 (36)	33 (34)	33 (34)
Sandham Road (R2)						
Calm	35	37	37 (38)	37 (38)	45 (48)	48 (52)
West Wind	35	37	37 (39)	37 (38)	43 (46)	45 (48)

NOTE: Exceedance of recommended goal presented in BOLD
Level in parenthesis represents two (2) dozers operating

The predicted noise levels (*Table 15*) show that the recommended goal is generally satisfied during all stages at 5 Sandham Road (R1). The exceedance of 1dB(A) during Stage 5 (calm) with two (2) dozers operating is considered marginal. At Sandham Road (R2) the results show a marginal noise exceedance of 1-2dB(A) (Stage 3 – calm and west wind) and 1dB(A) (Stage 4 – calm and west wind) respectively. During Stage 5 exceedances of 8-11dB(A) (calm) and 6-9dB(A) (west wind) were predicted; whilst Stage 6 predicted an exceedance of 11-14dB(A) (calm) and 8-11dB(A) (west wind).

6.4 Train Movements

The maximum noise levels for a train passby (Class 81 Locomotive) set to Notch 3 power setting at the entrance to the rail loop for the receiver identified as 5 Sandham Road (R1), and the main western rail line for the receiver identified as Sandham Road (R2) were predicted. A summary of the predicted maximum passby noise levels are presented in *Table 16*.

Table 16: Predicted Train Passby Noise Levels (Class 81 Locomotive)
L_{Amax} dB(A) re: 20 x 10⁻⁶ Pa

Reference Location	Predicted Noise Level dB(A)	
	Facade	Within 30m of Dwelling
5 Sandham Road (R1)	77	81
Sandham Road (R2)	78	80

Taking account of the projected maximum of two (2) trains in a twenty four (24) hour

period (Section 5.2), and the measured SEL noise levels of train passbys (*Table 4*), *Table 17* provides a summary of the existing and projected rail movements, and calculated existing and projected $L_{Aeq, 24hour}$ noise levels.

Table 17: Predicted Train Noise Levels ($L_{Aeq, 24hour}$)
dB(A) re: 20×10^{-6} Pa

Reference Location	Existing Daily Rail Movements	Projected Daily Rail Movements	Existing $L_{Aeq, 24hour}$	Projected $L_{Aeq, 24hour}$	Increase dB(A)
5 Sandham Road (R1)	25 ^(C) 20 ^(F)	25 ^(C) 22 ^(F)	54.9	55.4	+0.5
Sandham Road (R2)	25 ^(C) 20 ^(F)	25 ^(C) 22 ^(F)	55.6	56.0	+0.4

NOTE: (F) Freight Train – indicative provided by RailAccess Corporation
(C) Commuter Train – provided by CityRail

The calculated noise levels for the additional rail movements projected for the proposal satisfy the recommended goal of $L_{Aeq, 24hour}$ 60dB(A).

6.5 Assessment

The results of the predictions associated with noise emissions from construction activities has shown that the recommended noise goals are satisfied at the reference assessment locations during both Stage 1 and Stage 2 construction works.

The assessment has shown that during the short-term activities associated with initial stage preparation and the construction of bunds for the purpose of noise control, noise exceedances are predicted during Stage 5 and Stage 6 works at the reference location identified as Sandham Road (R2).

Similarly the assessment has shown that noise exceedance are predicted for mine extraction and train loading activities during Stage 5 and Stage 6 at Sandham Road (R2) with marginal exceedances of 1-2dB(A) predicted for worst case scenario during Stage 3 and Stage 4 respectively. It is understood that Stages 1 to 4 represent more than nine (9) years into the development of the mine.

Noise levels associated with rail movements on the main rail line are predicted to

satisfy the recommended L_{Amax} noise level of 85dB(A) and the recommended L_{Aeq} _{24hour} noise level of 60dB(A) when assessed to 5 Sandham Road (R1) and Sandham Road (R2).

With respect to the Blue Mountains National Park to the east, the assessment has shown (Appendices 3-8) for normal mining operations, the recommended noise goal of 55dB(A) is achieved within fifty (50) metres of the park boundary.

7.0 FINDINGS AND RECOMMENDATIONS

The results of noise predictions associated with the construction and development of the proposed mine has shown that the recommended noise goals are satisfied at the reference assessment locations.

Noise modelling has shown that during stage preparations involving the construction of bunds for noise control, the recommended goals are satisfied at 5 Sandham Road (R1). Noise exceedances of 3-5dB(A) (Stage 5-calm), 2dB(A) (Stage 5-west wind) and 1-3dB(A) (Stage 6-calm) are predicted at Sandham Road (R2).

Noise modelling for normal mining activities during calm and west wind meteorological conditions has shown that the recommended noise goals are satisfied for all stages at 5 Sandham Road (R1). The modelling has also shown that the recommended noise goals are generally satisfied for Stages 1-4 (approximately 9 years of mining activity) at Sandham Road (R2) during both calm and west wind meteorological conditions. Predicted 1dB(A) exceedance during Stage 4 with two (2) dozers operating is considered marginal. During Stage 5 exceedances of 8-11dB(A) (calm) and 6-9dB(A) (west wind), and during Stage 6 of 11-15dB(A) (calm) and 8-11dB(A) (west wind) are predicted.

Noise predictions during the final extraction for all stages, has shown that the recommended goals are satisfied at 5 Sandham Road (R1). During Stage 5 noise exceedances of 3-5dB(A) (calm) and 1-3dB(A) (west wind) are predicted at Sandham Road (R2).

The assessment has shown that Stages 1 to 4, that is the first nine (9) years of an estimated twenty-one (21) year lifespan of the mine generally comply with the recommended noise goals. The technical exceedances of 1-2dB(A) are considered marginal. The proponent (Newnes Kaolin Pty Ltd) has consulted with the local community comprising six (6) residential premises on Sandham Road, and discussed

potential mitigation strategies including purchase. These strategies will be executed if:

- the owner believes he or she is adversely affected by noise from the proposal; and
- noise level measurements confirm the recommended goals are exceeded.

The assessment has indicated that although noise exceedances are anticipated in the later stages of the mine development, the affected residences will be given the opportunity to negotiate the sale of their property if the two (2) conditions presented above are confirmed. Additionally the proponent has indicated the potential of a 'peppercorn' lease back arrangement, whereby the occupant may remain within the dwelling for a nominal rent for the duration of the mining activities. With the implementation of the proposed negotiated agreements for affected properties, the operation of the mine will be technically compliant with the recommended assessment goals throughout the twenty-one (21) year life of the mine.

With respect to the Blue Mountains National Park, the assessment has shown under normal mining operations, the recommended noise goal of 55dB(A) is satisfied within fifty (50) metres of the park boundary.

With respect to the cumulative noise during train loading operations the assessment has shown that the recommended noise goal is satisfied during all stages at 5 Sandham Road (R1). At Sandham Road (R2) the results have shown a marginal noise exceedance of 0.2dB(A) (Stage 3) and 0.4dB(A) (Stage 4) respectively. During Stage 5 an exceedance of 8.3dB(A) was predicted, whilst Stage 6 predicted an exceedance of 11.6dB(A) (calm) and 7.9dB(A) (west wind). The noise increase resulting from train loading activities (generally 1-2dB(A)) would normally be considered marginal.

The assessment has shown that predicted noise levels associated with rail movements on the main rail line satisfy the recommended L_{Amax} noise level of 85dB(A) and the recommended $L_{Aeq\ 24hour}$ noise level of 60dB(A).

7.1 Operational Noise Control Recommendations

- ❑ to minimise the degree of noise generated during the construction activities, it is recommended that as part of the contractors undertaking that an “Construction Noise Management Plant” (CNMP), be prepared to address the issue of construction noise;
- ❑ all construction activities shall only take place between the hours of 7.00am – 6.00pm Monday to Friday, and 7.00am-1.00pm Saturday;
- ❑ the tree mulcher shall be located as far as practicable within the valley located adjacent the northern boundary of the lease area;
- ❑ all construction site plant and equipment shall satisfy the acoustic performance referenced in *Table 8*;
- ❑ all loading and building conveyor systems shall be belt type conveyors;
- ❑ all permanent site plant and equipment shall satisfy the acoustic performance referenced in *Tables 9 and 10*;
- ❑ where practical all permanent site mobile plant shall be fitted with secondary/residential grade noise controls and acoustic treated engine enclosures;
- ❑ where practical audible alarms shall be replaced with flashing lights or a similar warning system;

- ❑ during Stages 1 to 6 of mining operations a bund shall be formed from stockpiled overburden and/or topsoil to a height not less than three (3.0) metres above the existing ground level. The bund shall be constructed on the western and southern perimeter during Stages 1 to 6 as close as practicable to the finished pit limits;

- ❑ as part of the Mine EMP a “Noise Management Plan” (NMP) shall be implemented with noise monitoring being conducted during initial stages of mine development to confirm noise levels and where required assess the practicability of additional noise controls. Subsequent annual noise audits should be undertaken if considered necessary to ensure that all noise control measures are installed and maintained, and that the environmental noise levels (criteria) are satisfied. The program shall incorporate a complaint management protocol that facilitates investigation and actioning of noise related complaints.

8.0 CONCLUSION

It is proposed to establish a kaolin ore mine with an area of approximately twenty-three (23) hectares a greenfield site at Newnes Junction. The mine proposal is located north of Newnes Junction, between Bell and Lithgow along Bells Line Road (*Figure 1*). The mine infrastructure will be located along the northern portion of the site.

The results of ambient noise monitoring and environmental noise audits conducted in the area have confirmed that the existing ambient noise is typically rural and influenced by road traffic on the Bells Line of Road (Chifley Road), rail traffic, local domestic, existing colliery and Rocla quarry operations and natural elements such as wind, birds, animals, etc.

Noise modelling of activities associated with construction has shown with appropriate selection of plant and equipment the recommended assessment goals can be achieved.

During the initial stages of the mine development acoustic mounds will be constructed along the western and southern boundaries for each stage of the mine. The noise predictions (*Table 12*) show that during initial stage preparation the recommended goals are satisfied at 5 Sandham Road (R1) for all stages (1-6). However during Stage 5 and 6 exceedances are predicted at Sandham Road (R2).

The findings of the noise modelling for the proposal have shown that with appropriate selection of equipment, effective noise controls and management procedures, noise from the mine under normal extraction operations and train loading operations can be controlled to generally satisfy the daytime assessment goals under calm and west wind meteorological conditions for Stages 1 to 4. That is for the first nine (9) years of an estimated twenty-one (21) year lifespan of the mine when assessed to 5 Sandham Road (R1) and Sandham Road (R2). Noise exceedances are predicted for Stages 5 and 6 during years 10 – 21 of the estimated mine operations. It is anticipated that an

approval for the mine will include conditions relating to any predicted noise exceedances. The proponent is confident that any exceedances identified during the latter stages of the mine development will be able to be negotiated.

With respect to the Blue Mountains National Park, the assessment has shown under normal extraction operations, the recommended noise goal of 55dB(A) is achieved within fifty (50) metres of the park boundary.

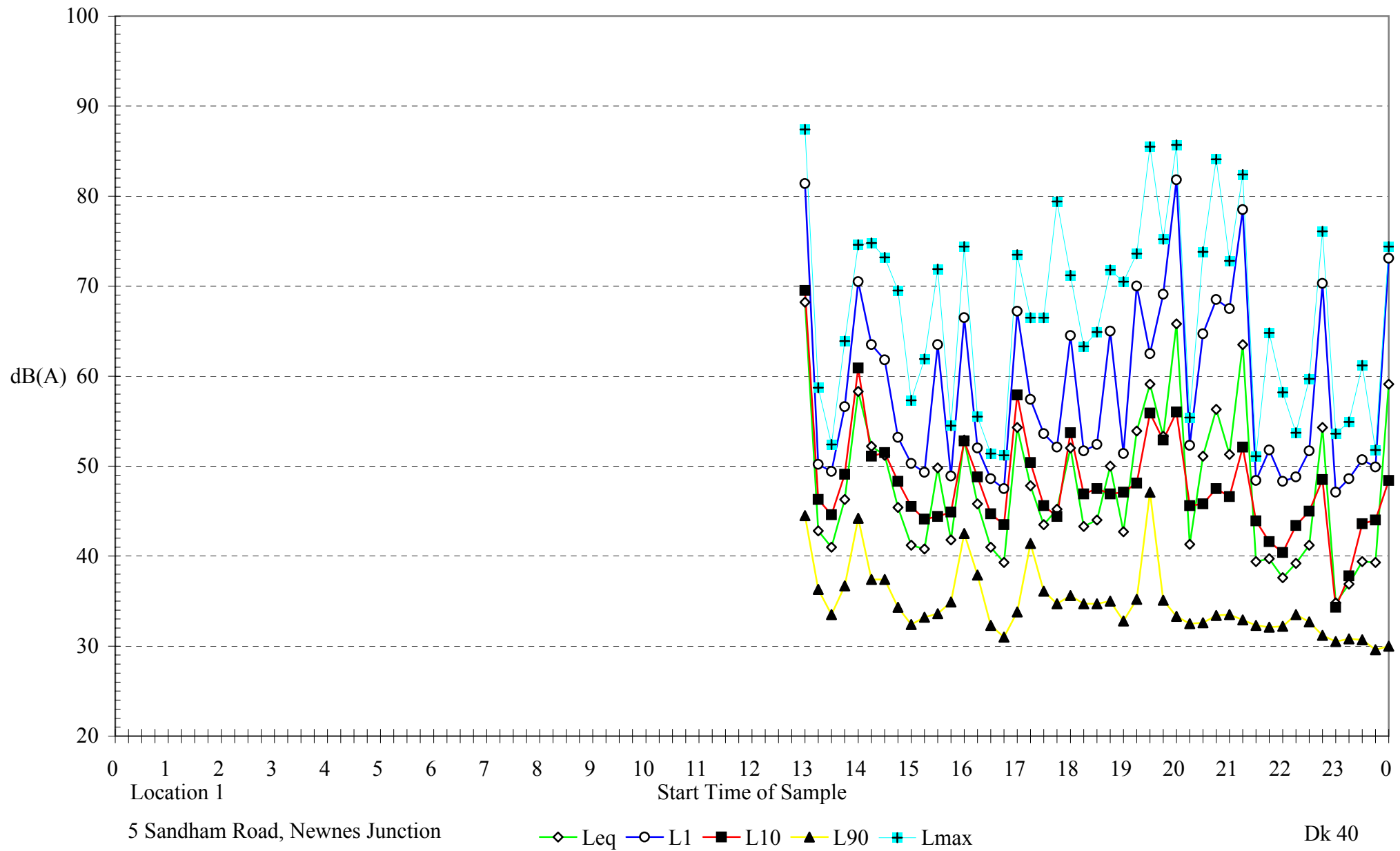
The assessment also found the predicted noise levels associated with rail movements on the main rail line satisfy the recommended L_{Amax} noise level of 85dB(A) and the recommended $L_{Aeq\ 24hour}$ noise level of 60dB(A)

Based on the findings of the assessment and as part of the Noise Management Plan for the proposal it is recommended that noise monitoring be conducted during initial stages of mine development to confirm the above findings and establish the practicability of additional noise controls where required.

APPENDIX 1: AMBIENT NOISE LEVELS

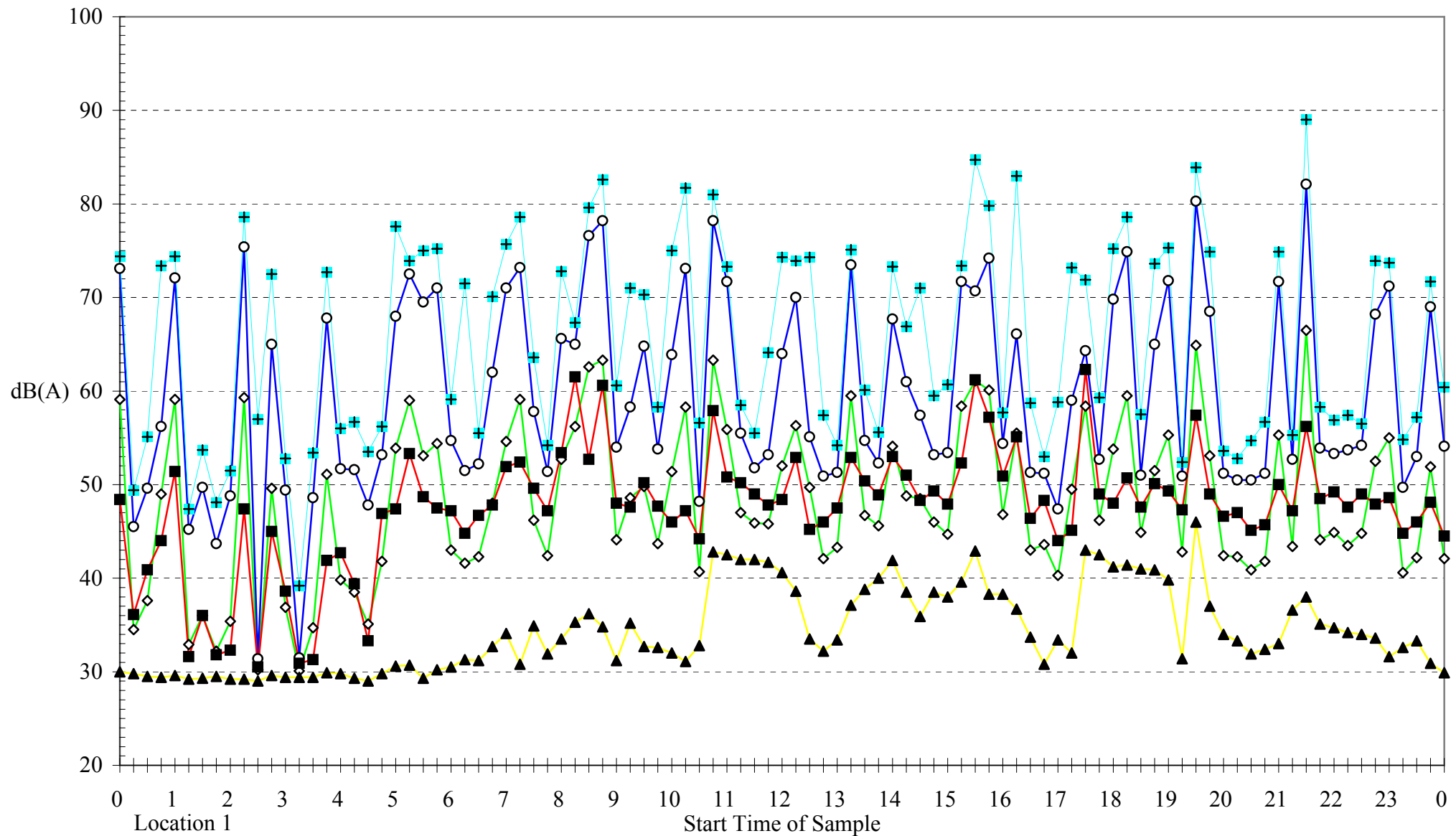
Ambient Sound Pressure Levels

Thursday 16 March 2000



Ambient Sound Pressure Levels

Friday 17 March 2000



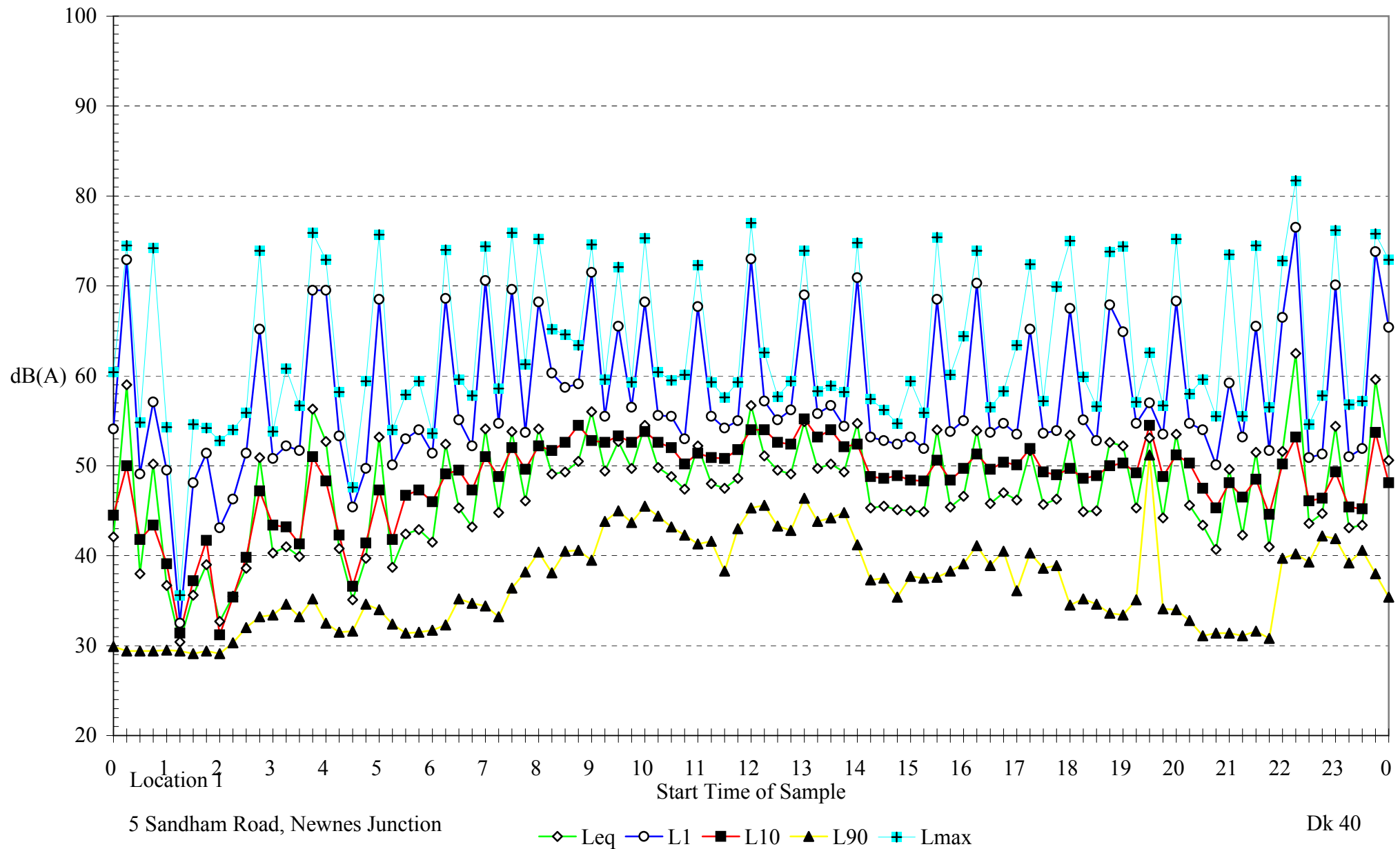
5 Sandham Road, Newnes Junction

—◇— Leq —○— L1 —■— L10 —▲— L90 —+— Lmax

Dk 40

Ambient Sound Pressure Levels

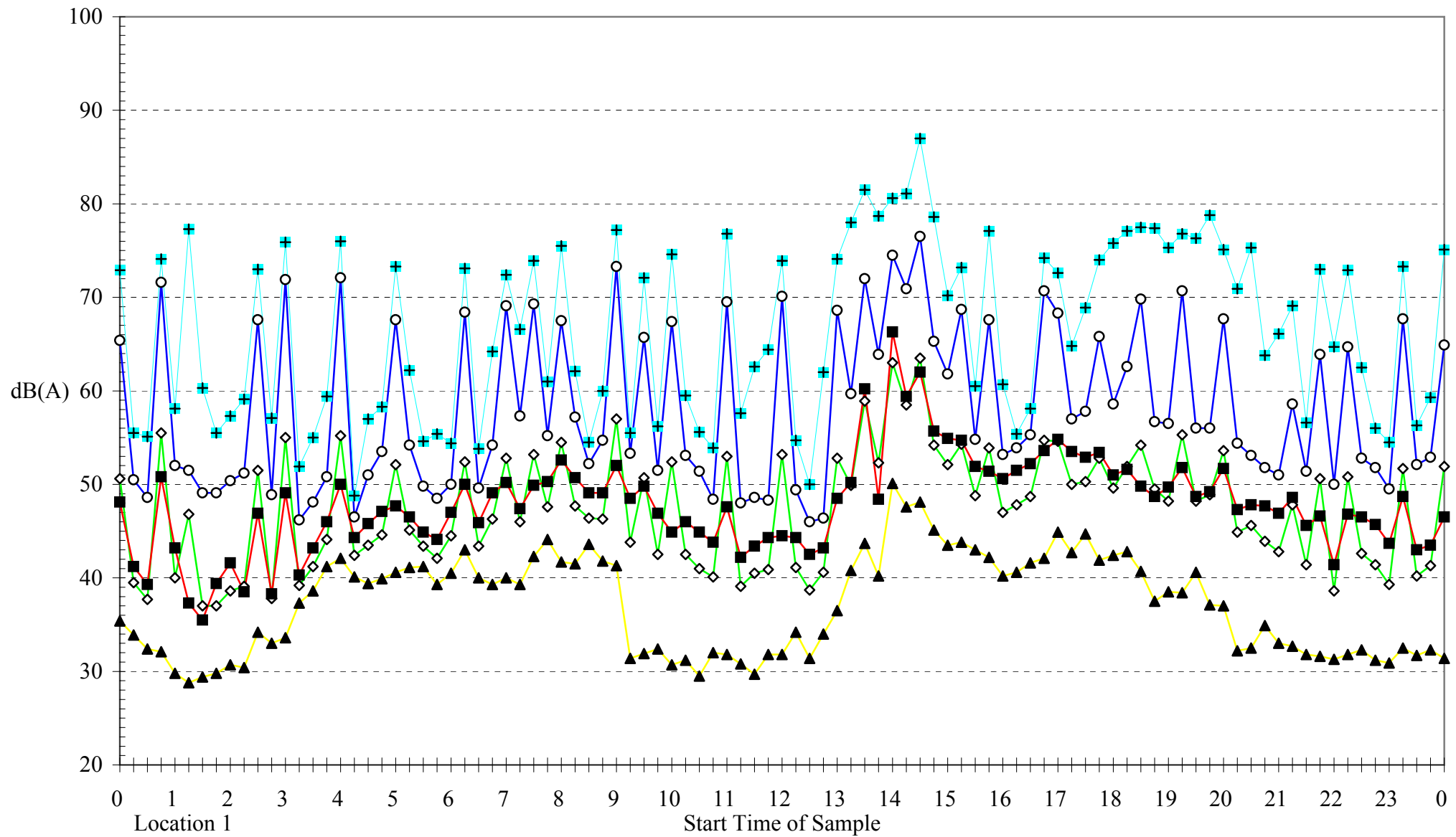
Saturday 18 March 2000



Dk 40

Ambient Sound Pressure Levels

Sunday 19 March 2000



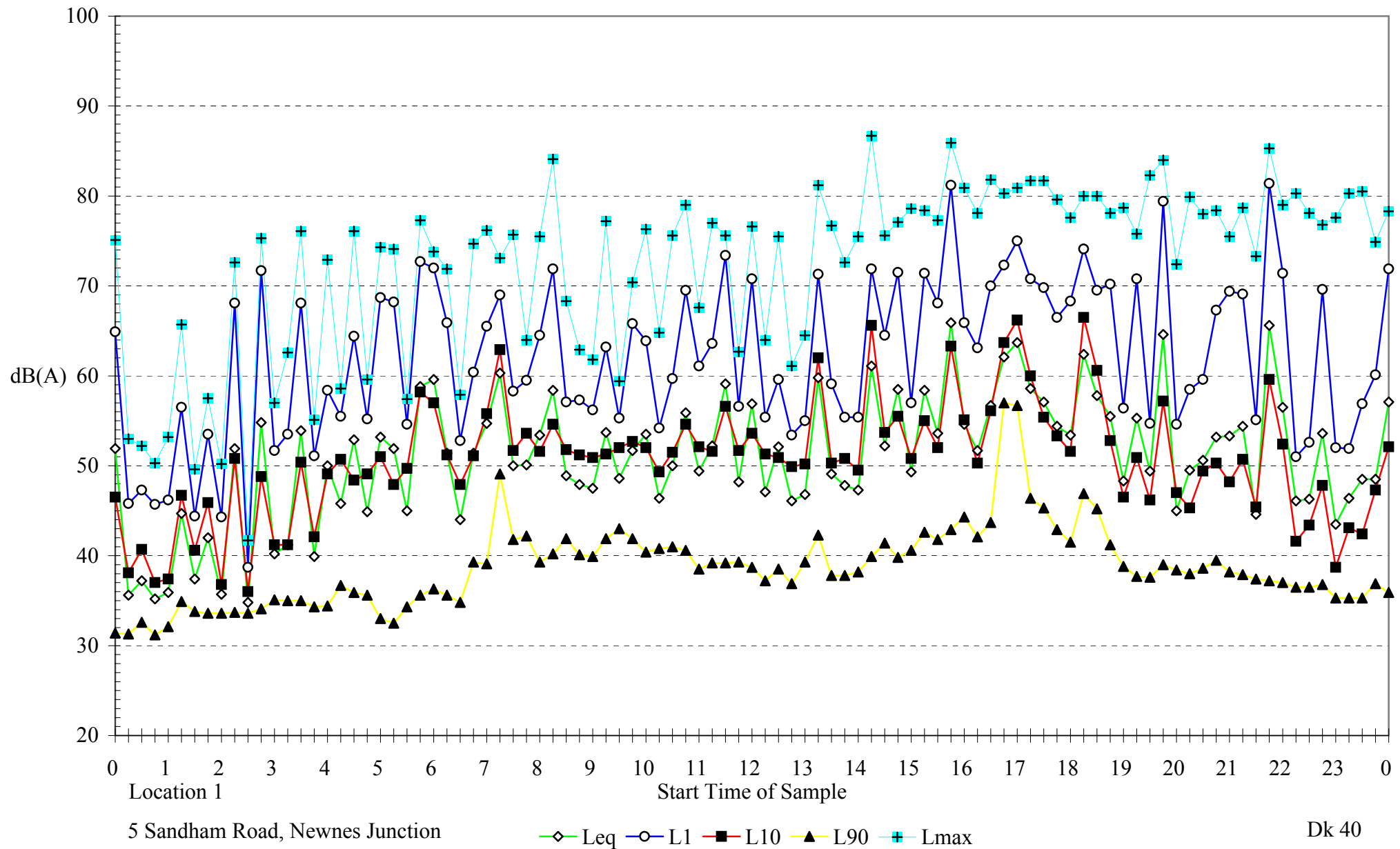
5 Sandham Road, Newnes Junction

—◇— Leq —○— L1 —■— L10 —▲— L90 —+— Lmax

Dk 40

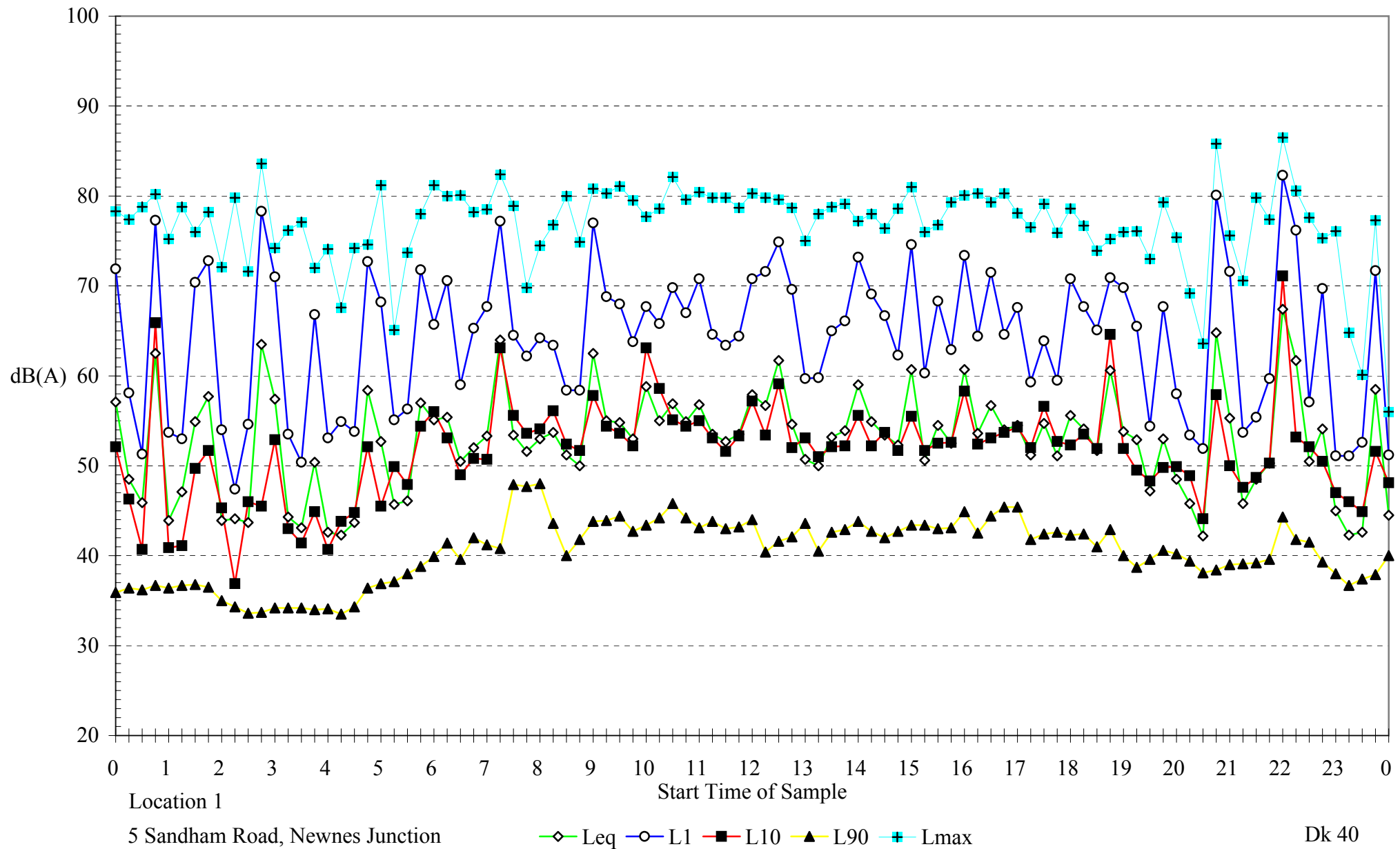
Ambient Sound Pressure Levels

Monday 20 March 2000



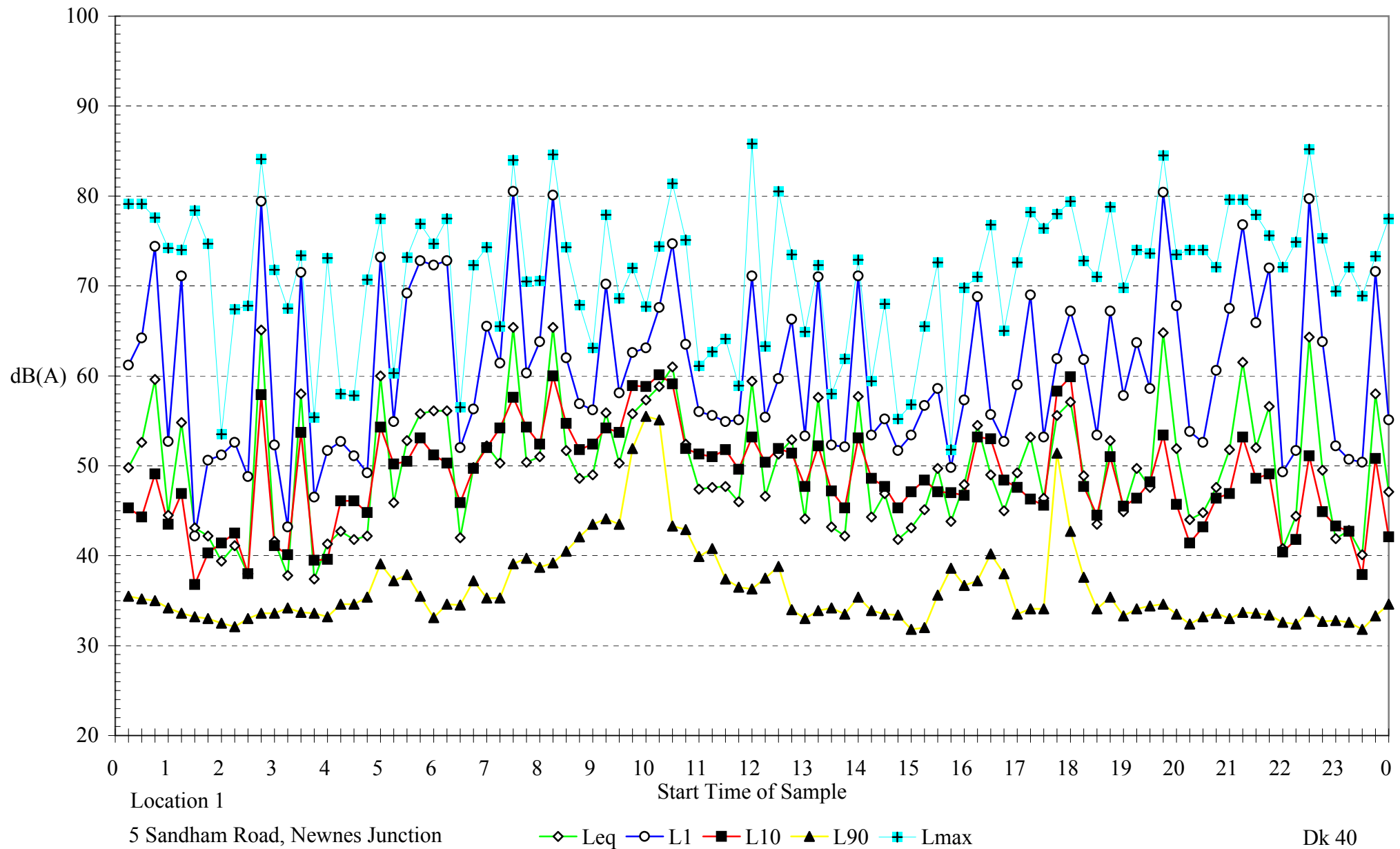
Ambient Sound Pressure Levels

Tuesday 21 March 2000



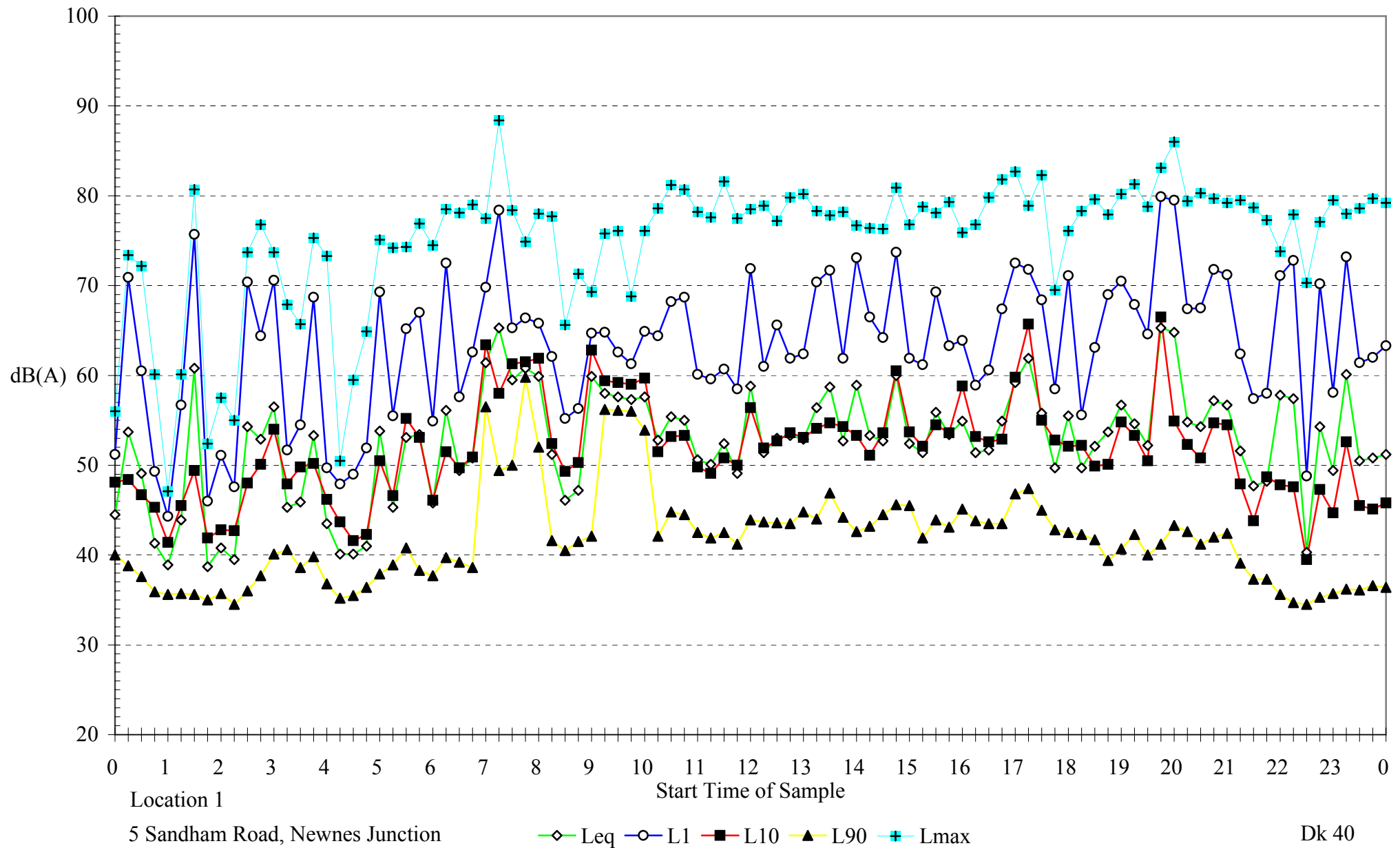
Ambient Sound Pressure Levels

Thursday 23 March 2000



Ambient Sound Pressure Levels

Wednesday 22 March 2000



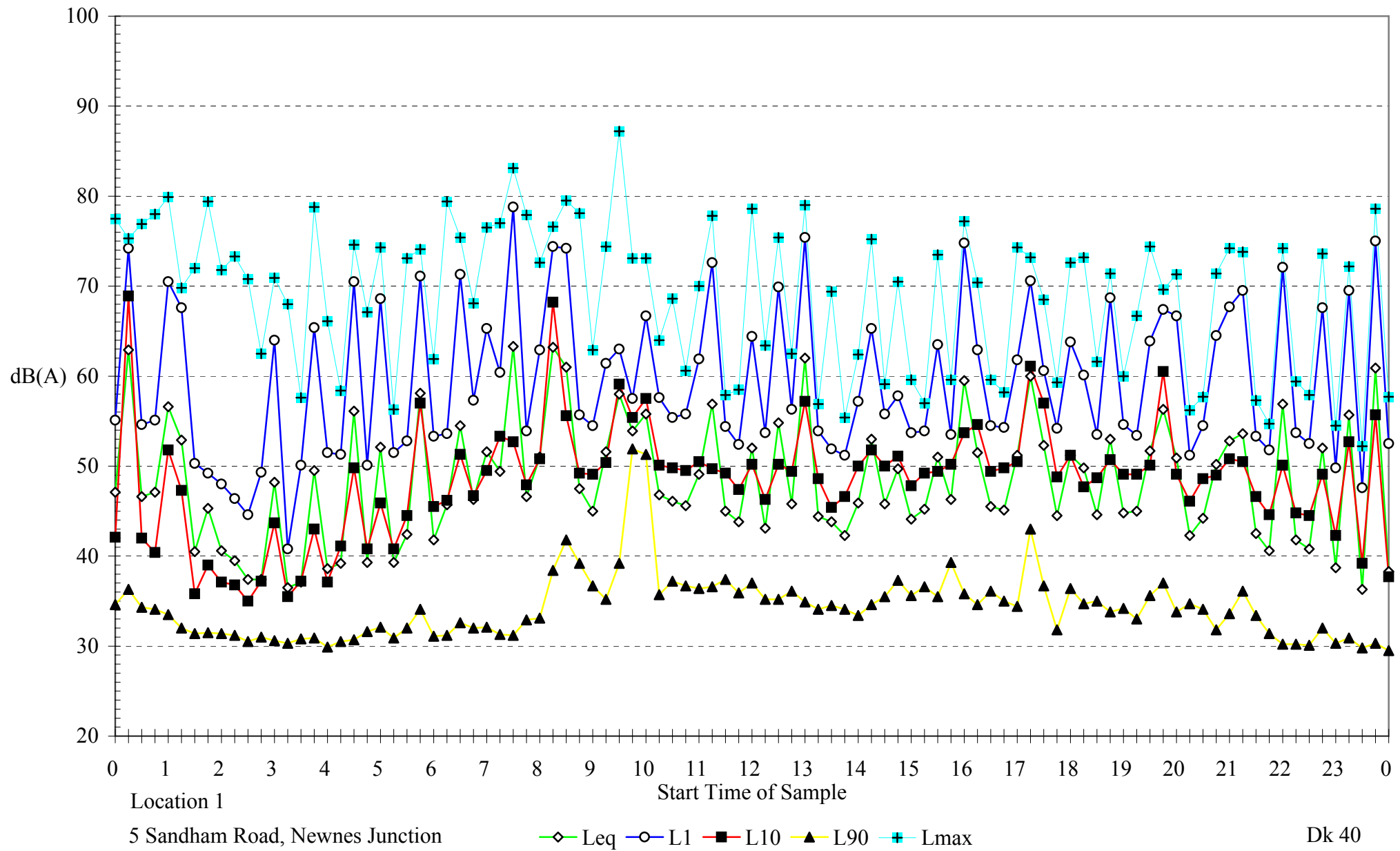
Location 1

5 Sandham Road, Newnes Junction

Dk 40

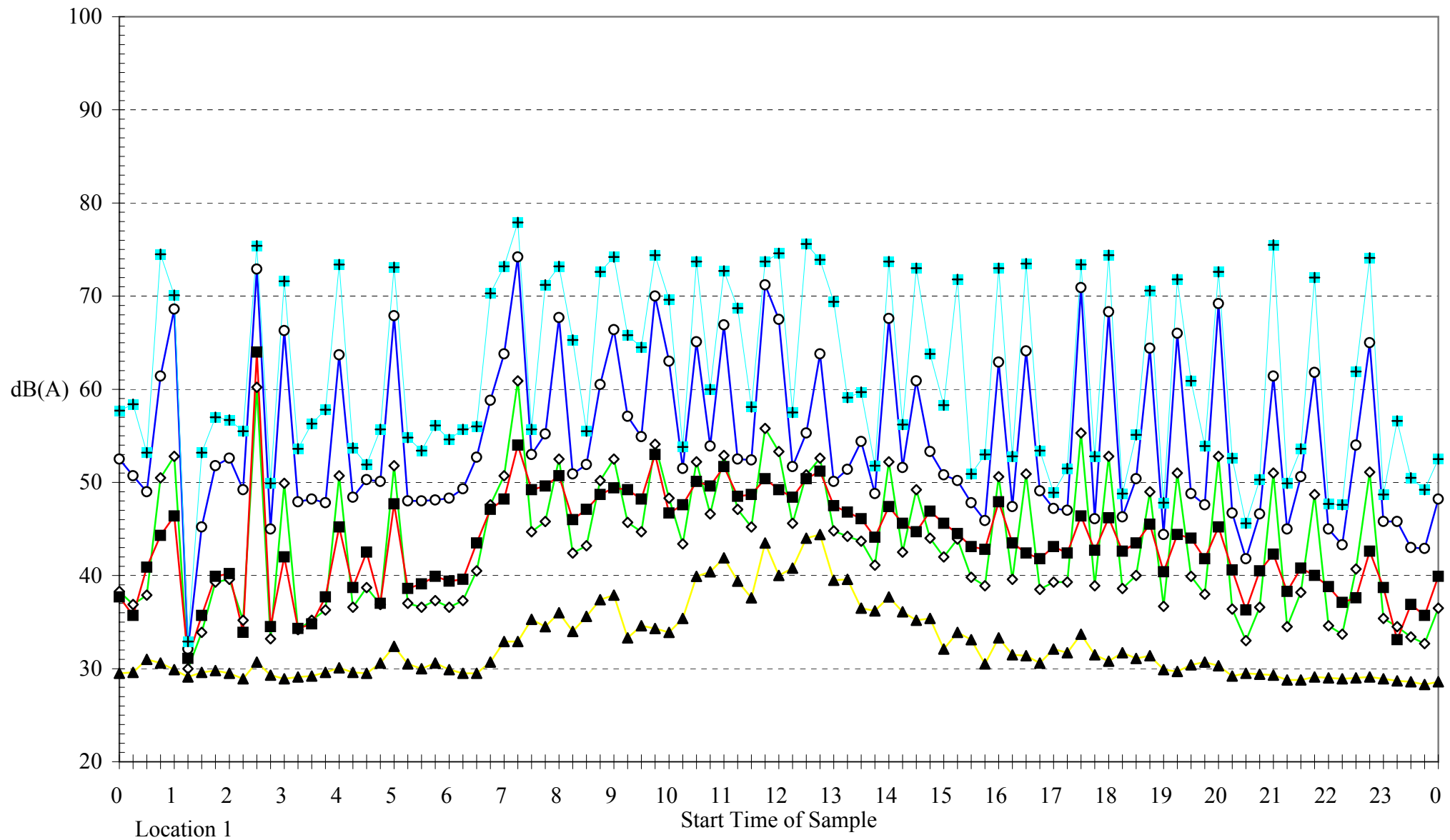
Ambient Sound Pressure Levels

Friday 24 March 2000



Ambient Sound Pressure Levels

Saturday 25 March 2000



Location 1

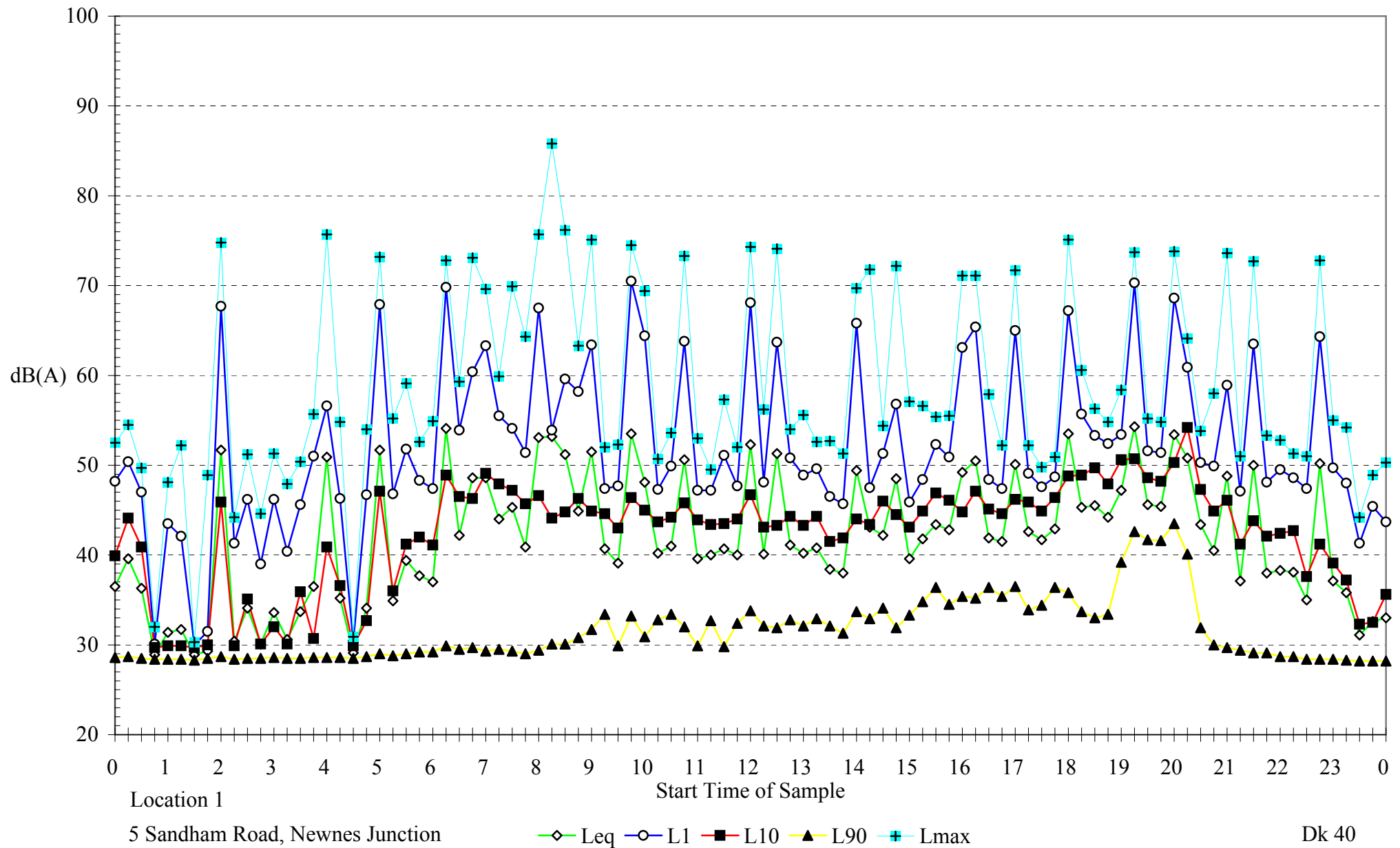
5 Sandham Road, Newnes Junction

—◇— Leq —○— L1 —■— L10 —▲— L90 —+— Lmax

Dk 40

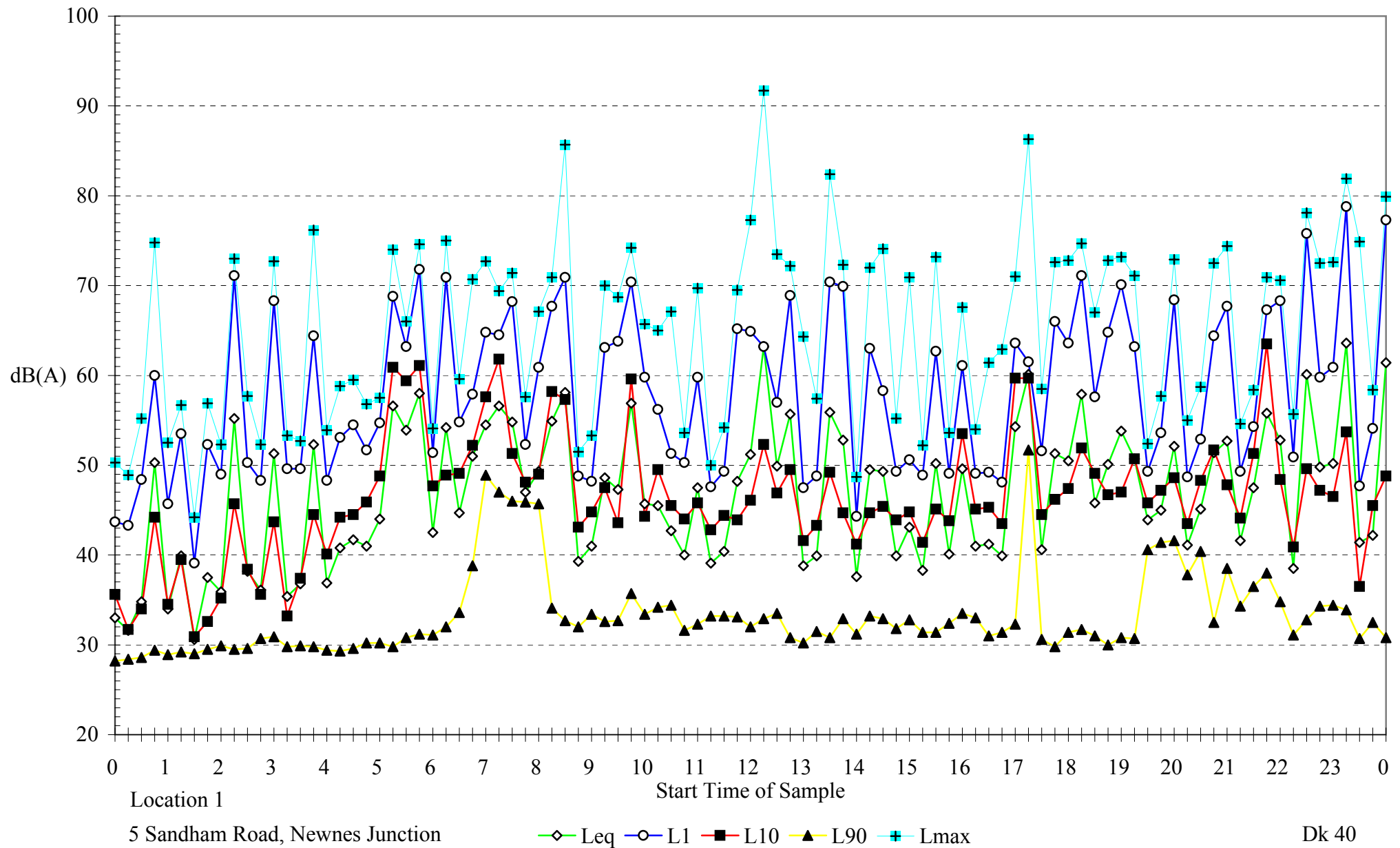
Ambient Sound Pressure Levels

Sunday 26 March 2000



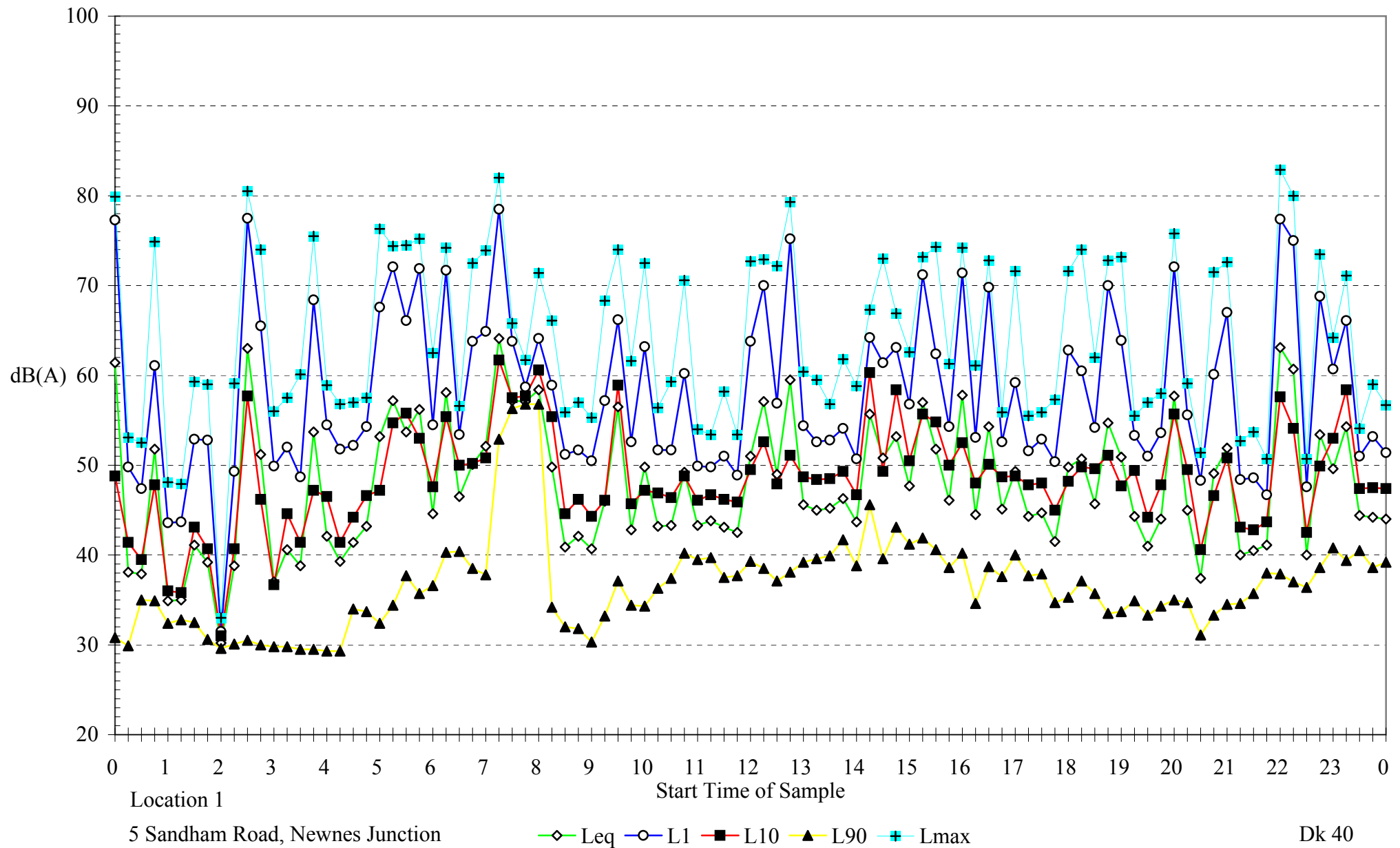
Ambient Sound Pressure Levels

Monday 27 March 2000



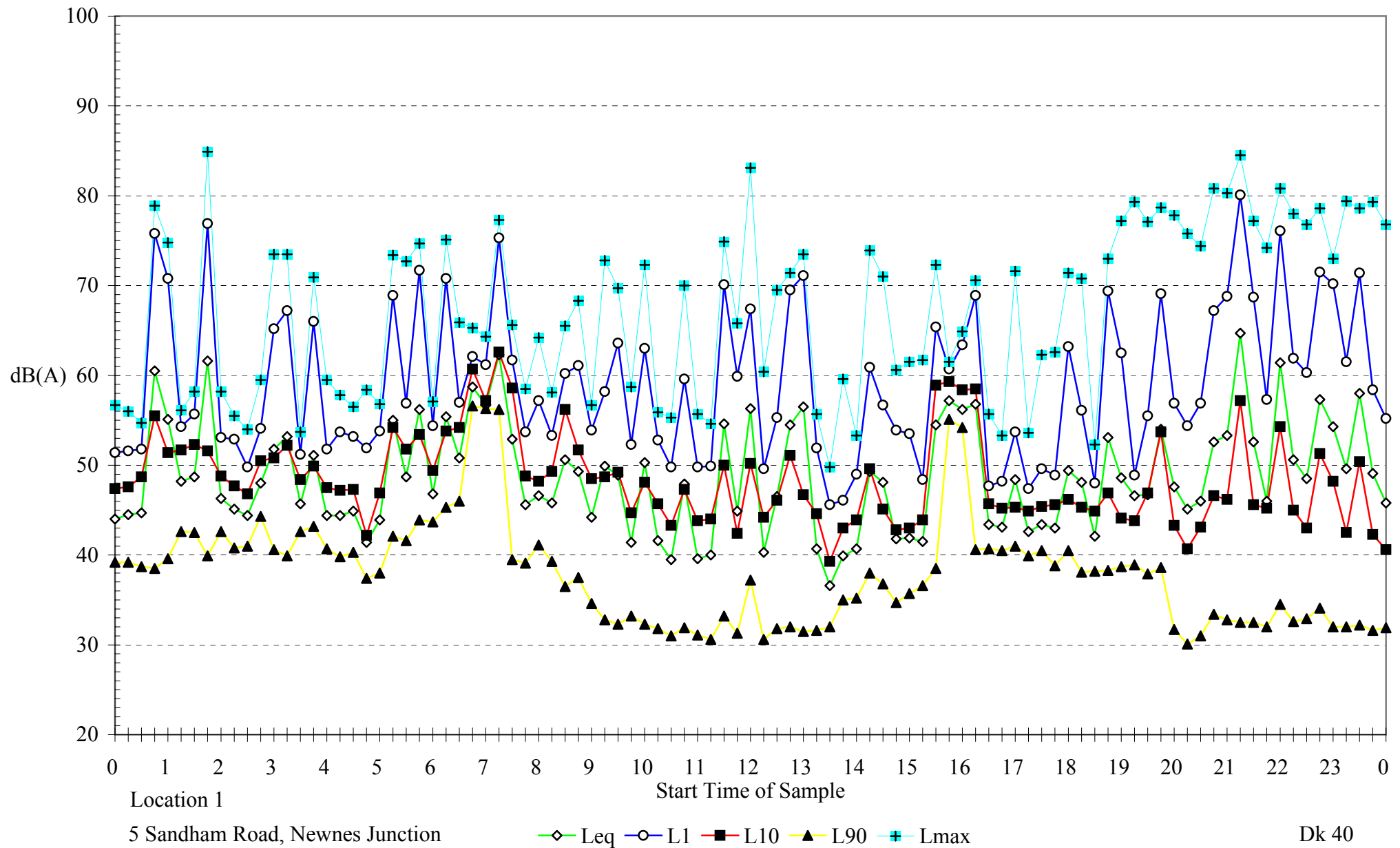
Ambient Sound Pressure Levels

Tuesday 28 March 2000



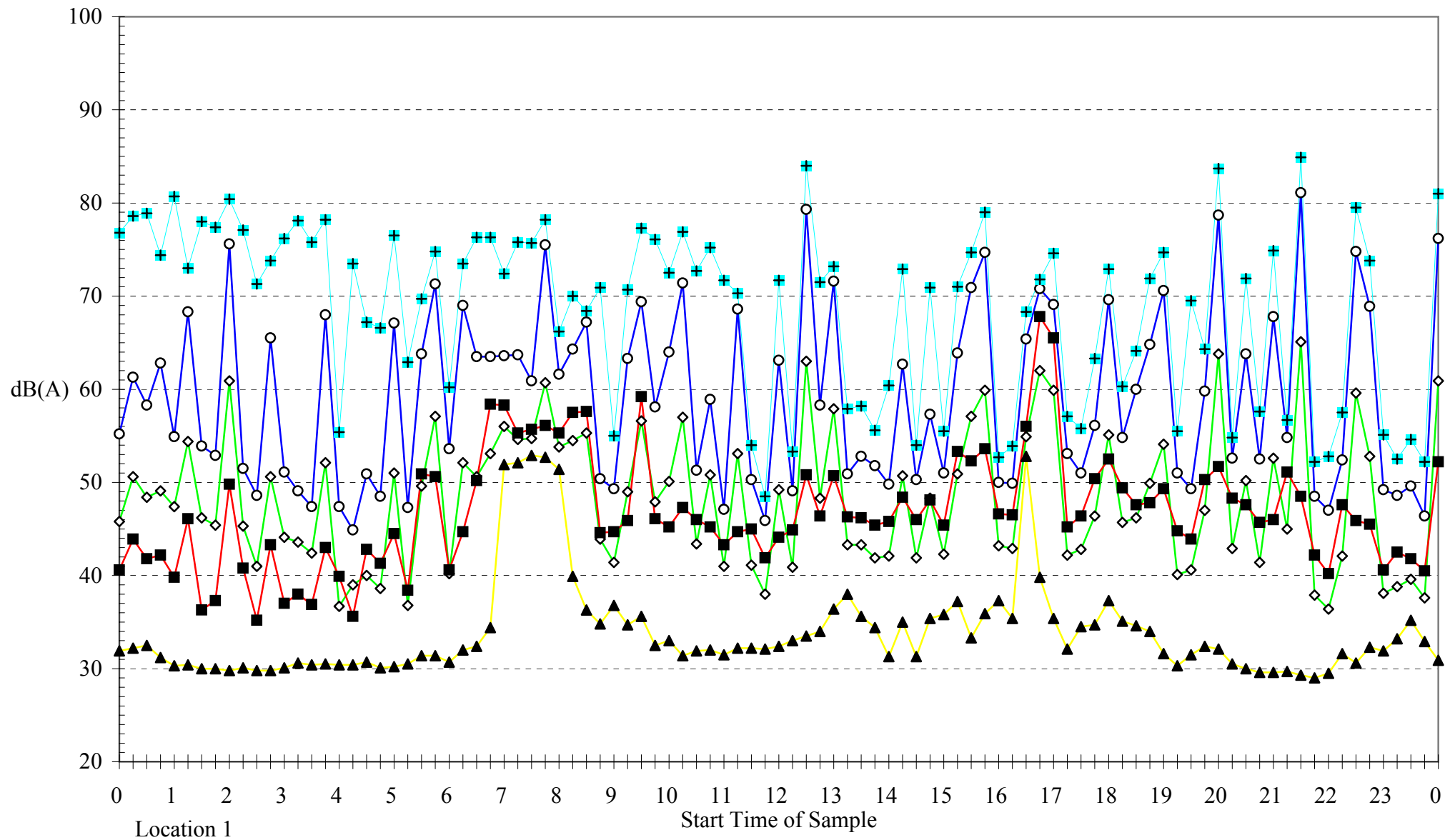
Ambient Sound Pressure Levels

Wednesday 29 March 2000



Ambient Sound Pressure Levels

Thursday 30 March 2000



Location 1

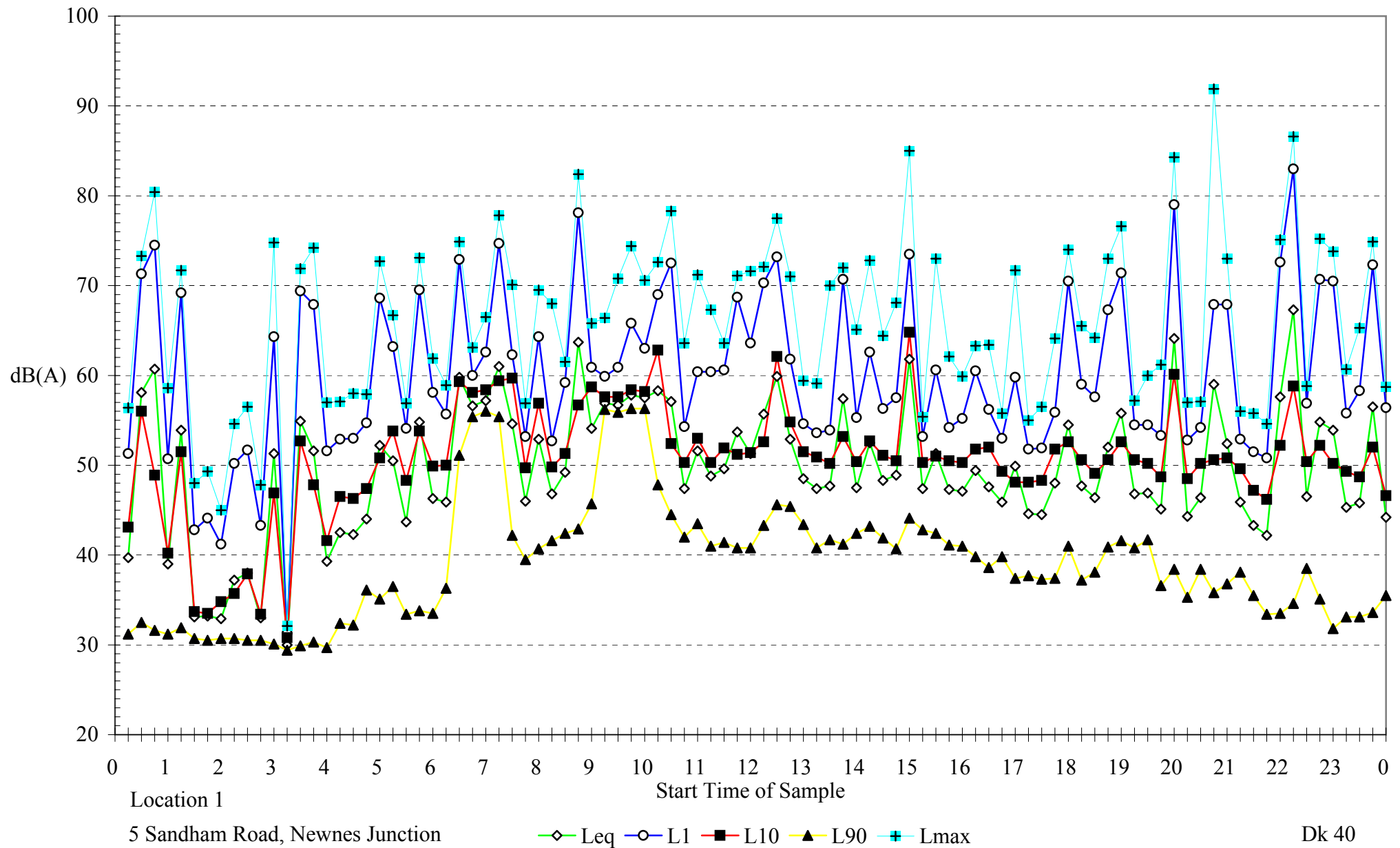
5 Sandham Road, Newnes Junction

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Dk 40

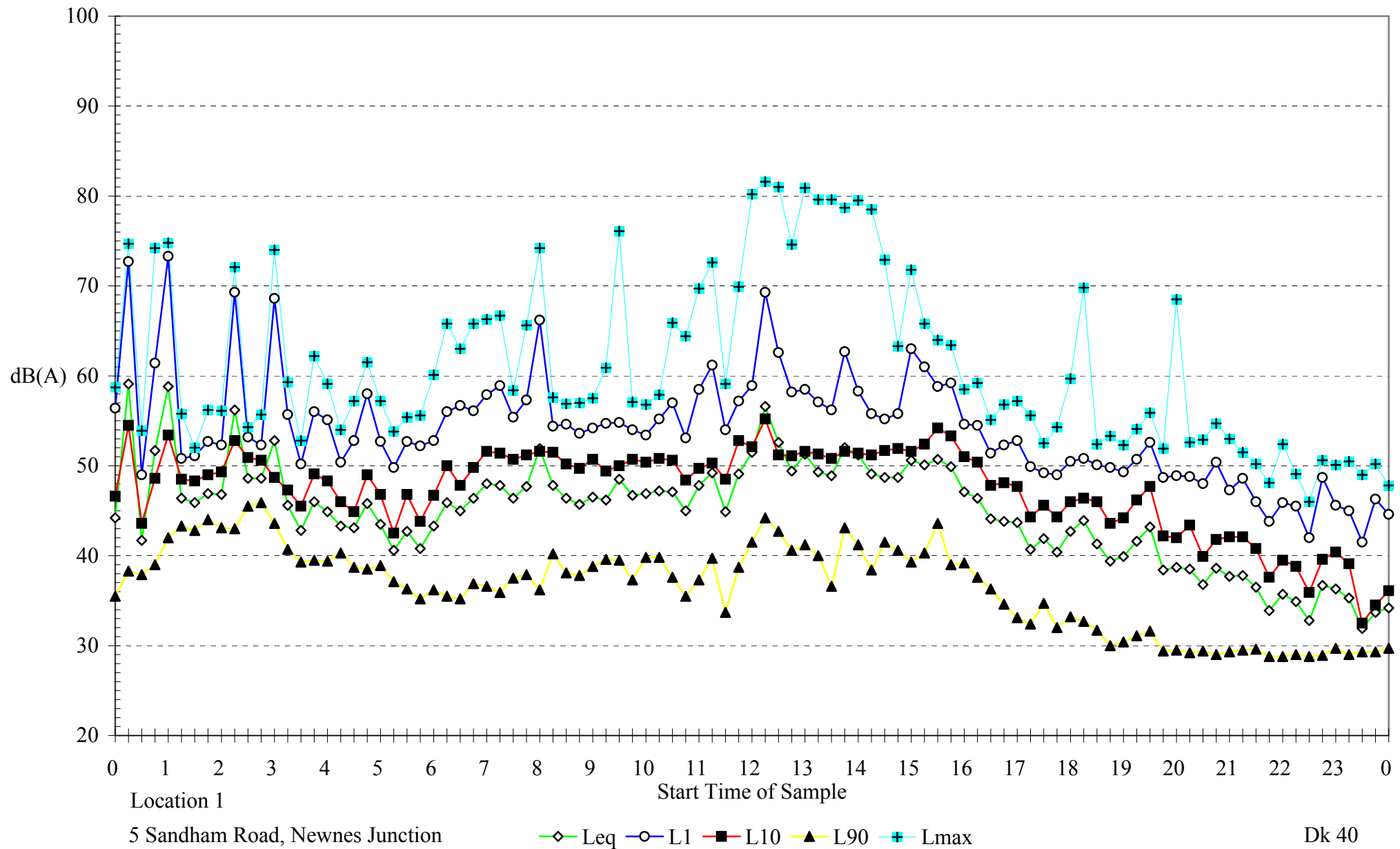
Ambient Sound Pressure Levels

Friday 31 March 2000



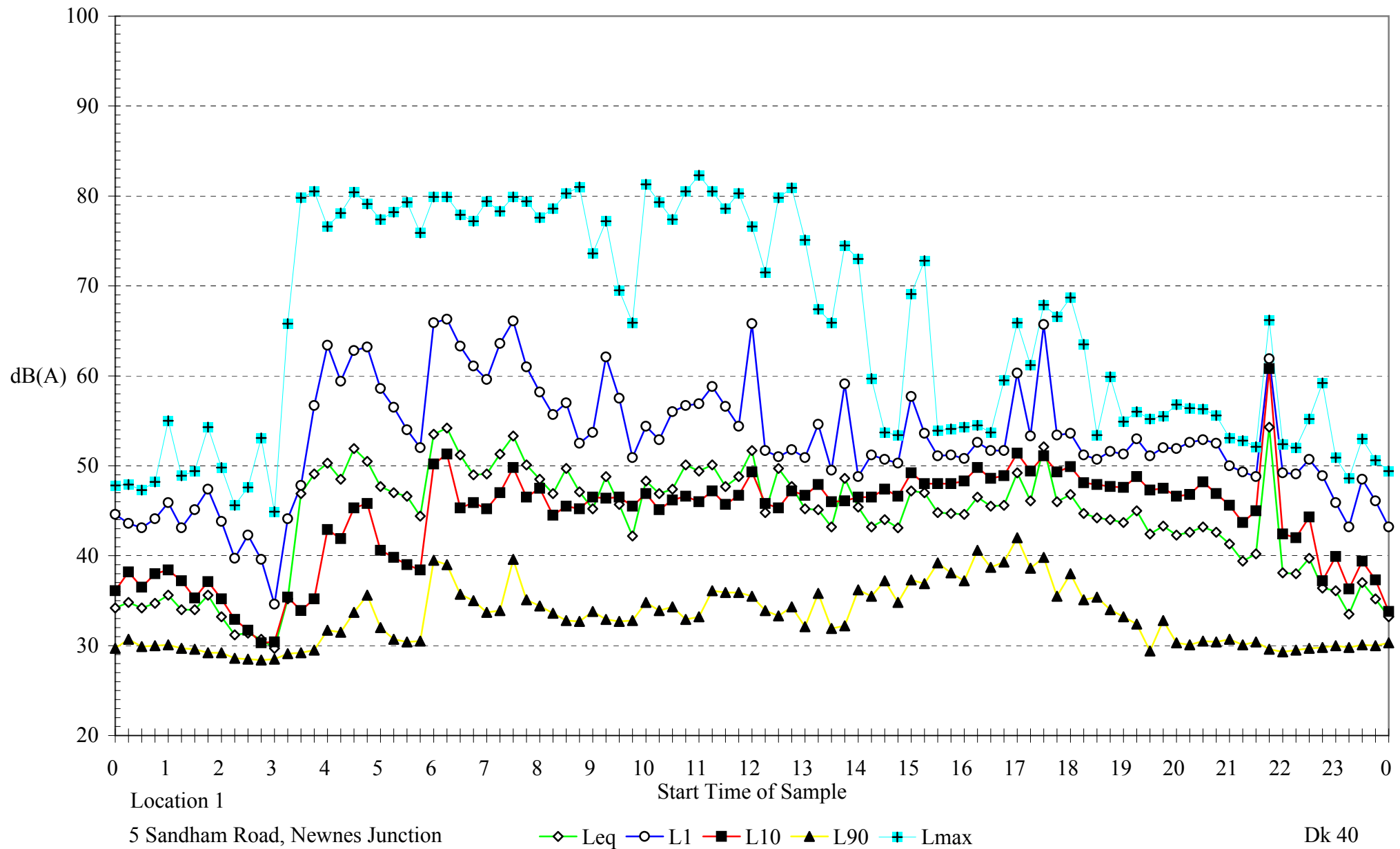
Ambient Sound Pressure Levels

Saturday 1 April 2000



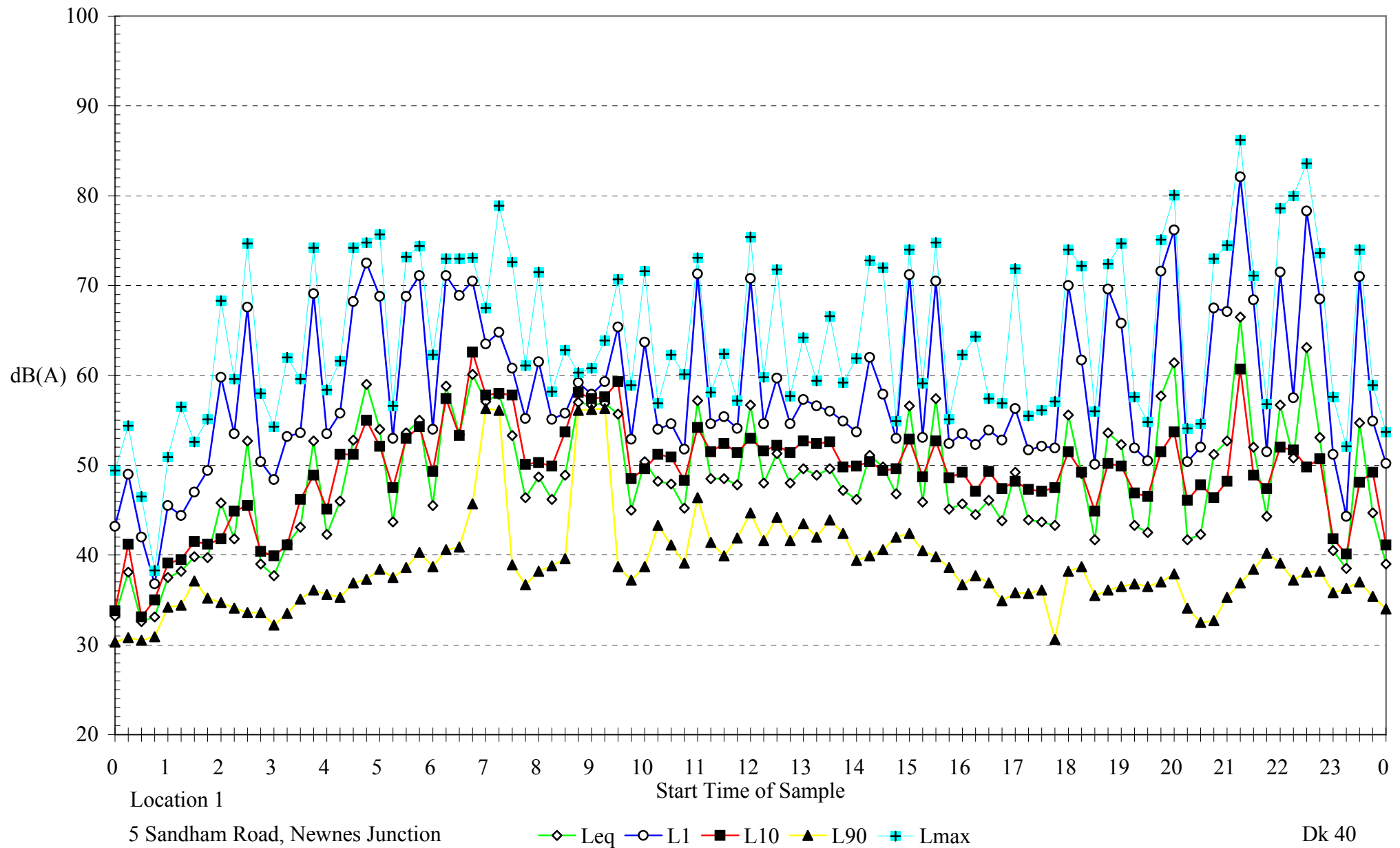
Ambient Sound Pressure Levels

Sunday 2 April 2000



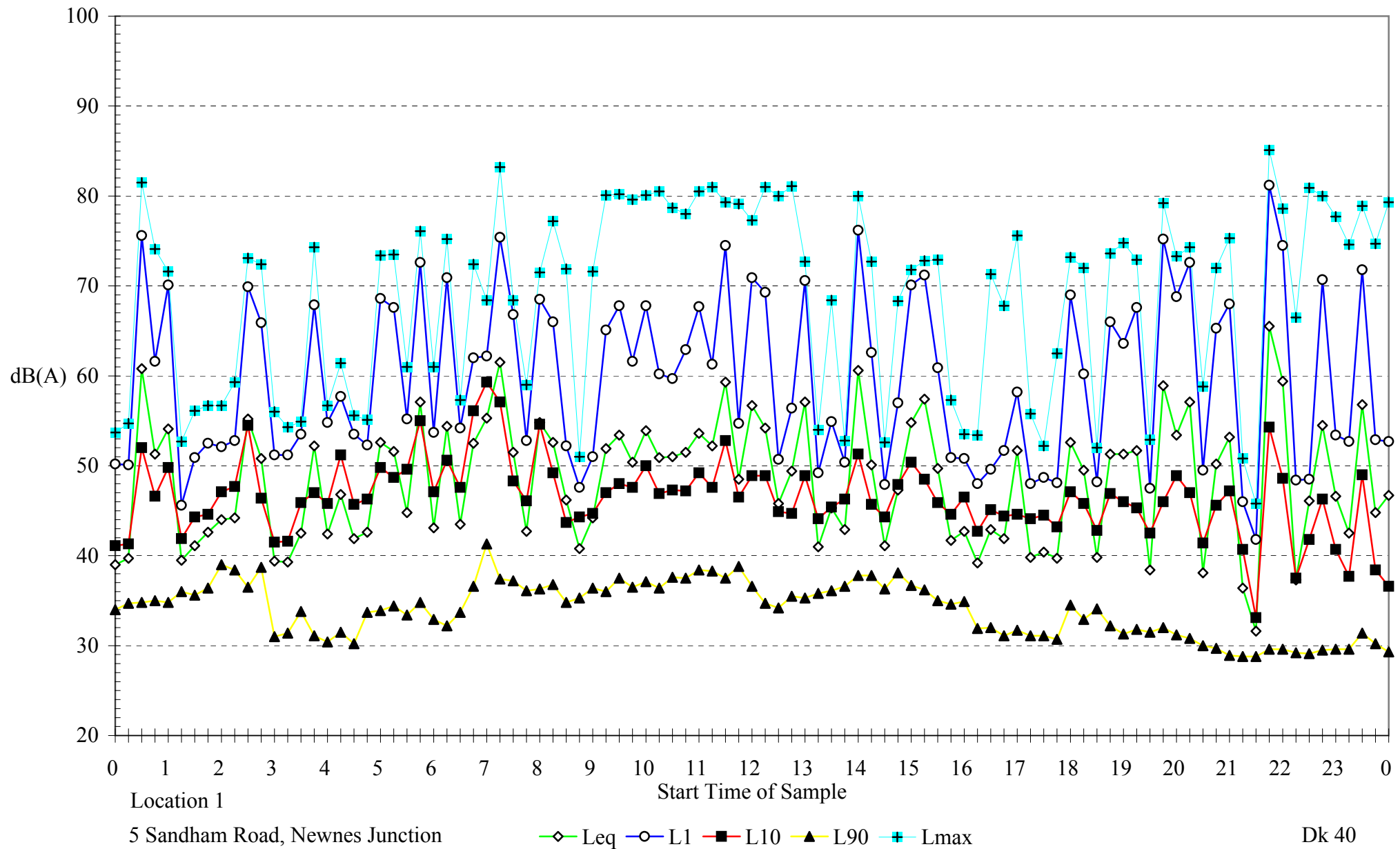
Ambient Sound Pressure Levels

Monday 3 April 2000



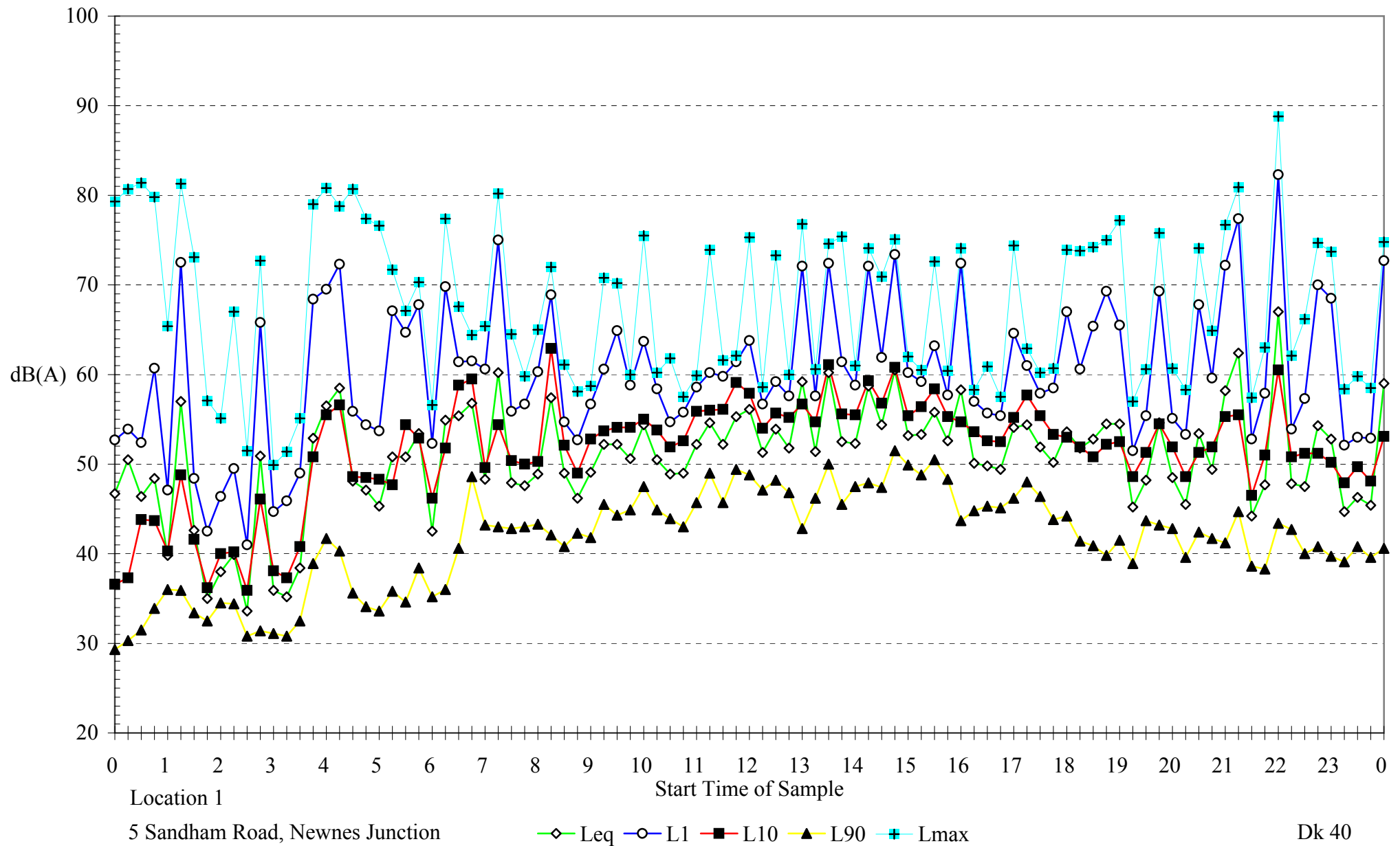
Ambient Sound Pressure Levels

Tuesday 4 April 2000



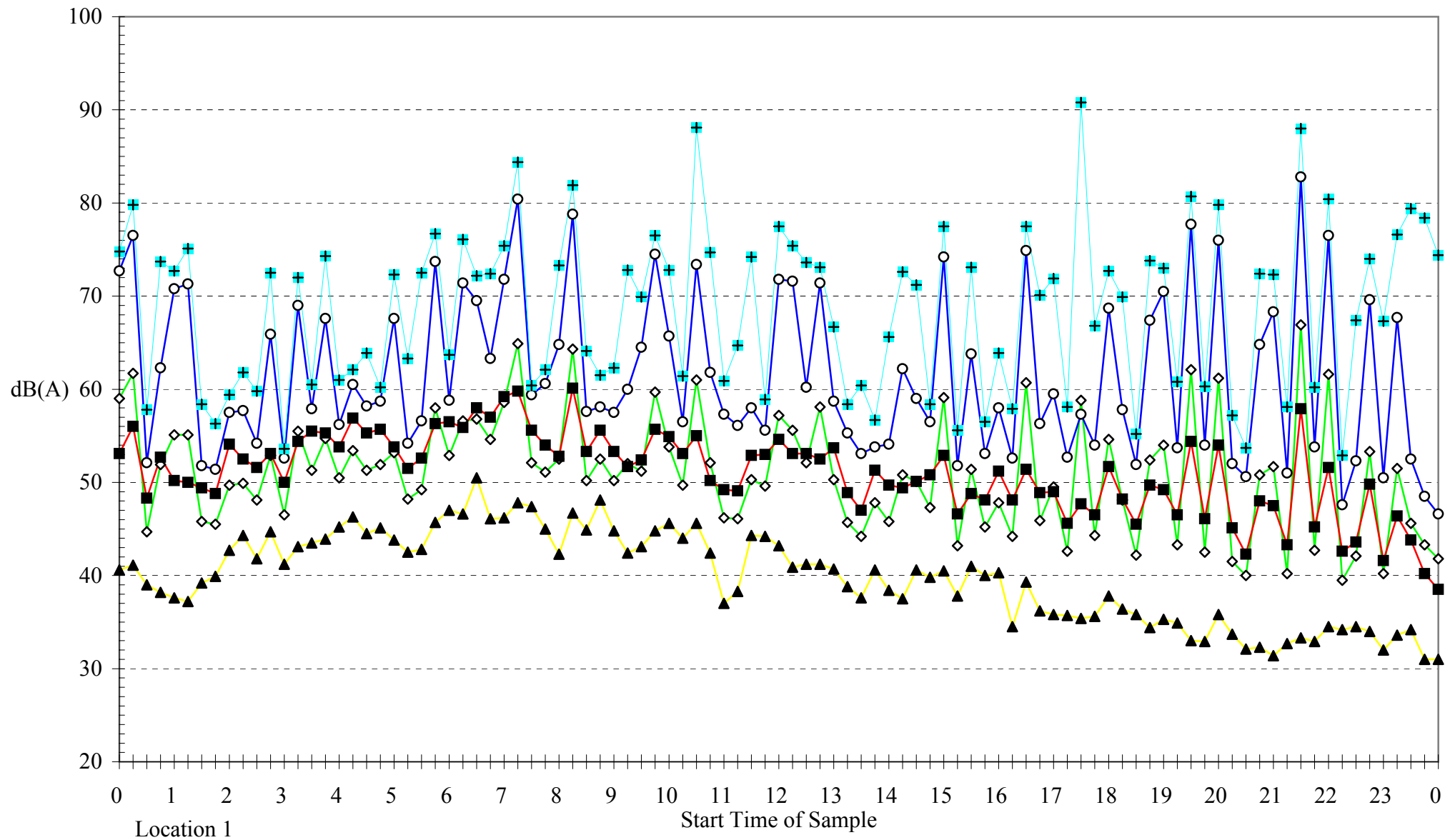
Ambient Sound Pressure Levels

Wednesday 5 April 2000



Ambient Sound Pressure Levels

Thursday 6 April 2000



Location 1

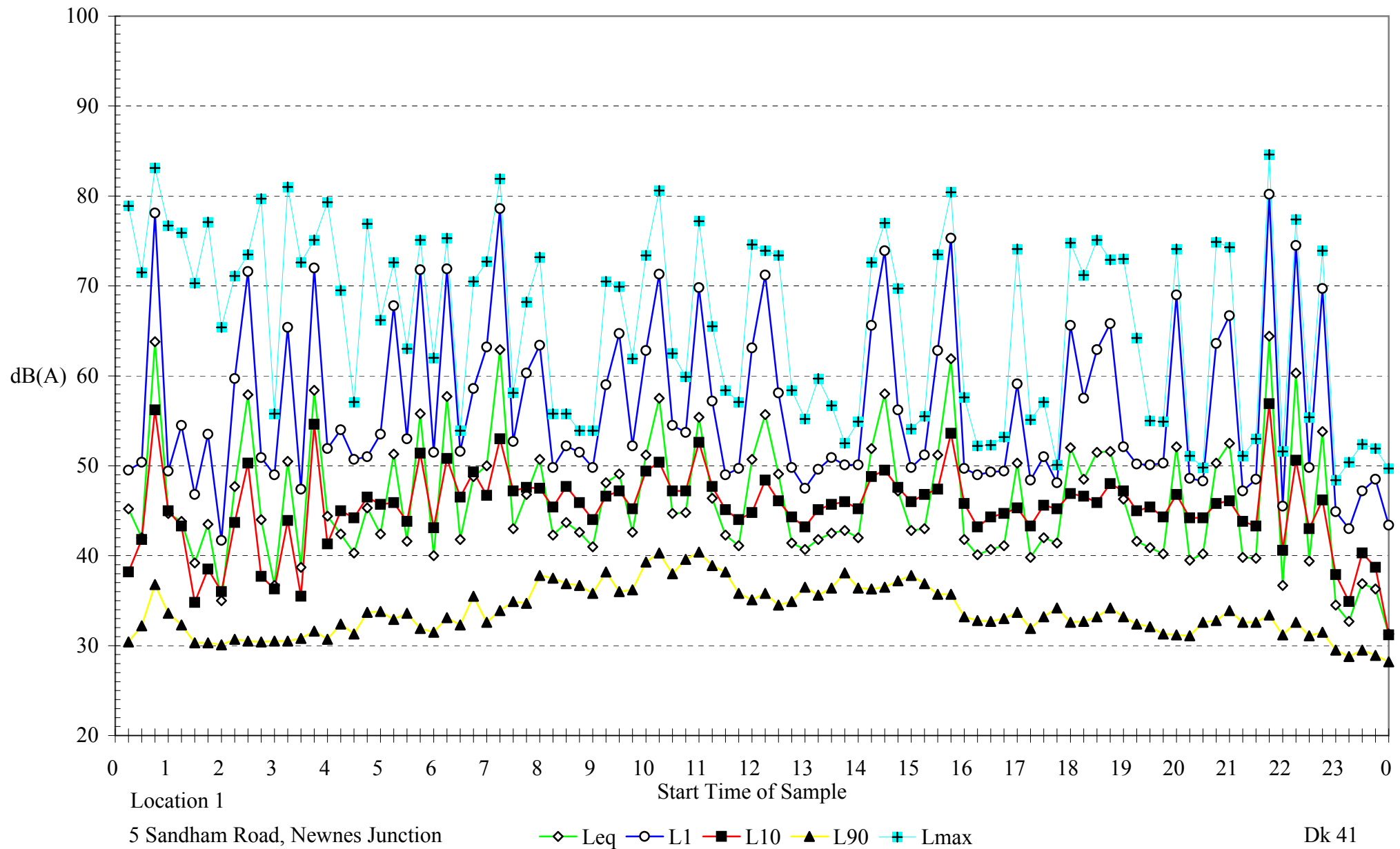
5 Sandham Road, Newnes Junction

—◇— Leq —○— L1 —■— L10 —▲— L90 —+— Lmax

Dk 40

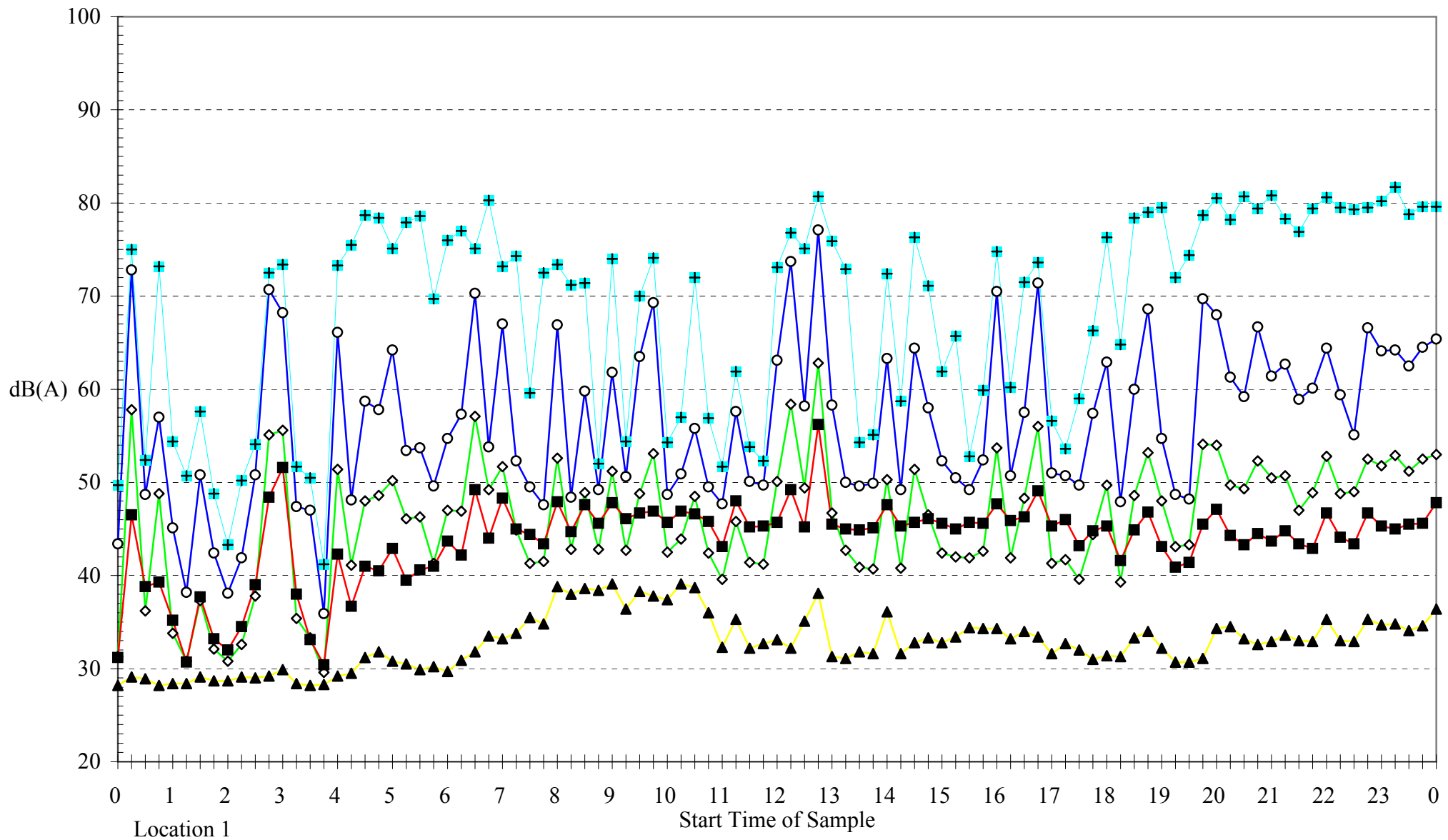
Ambient Sound Pressure Levels

Friday 7 April 2000



Ambient Sound Pressure Levels

Saturday 8 April 2000



Location 1

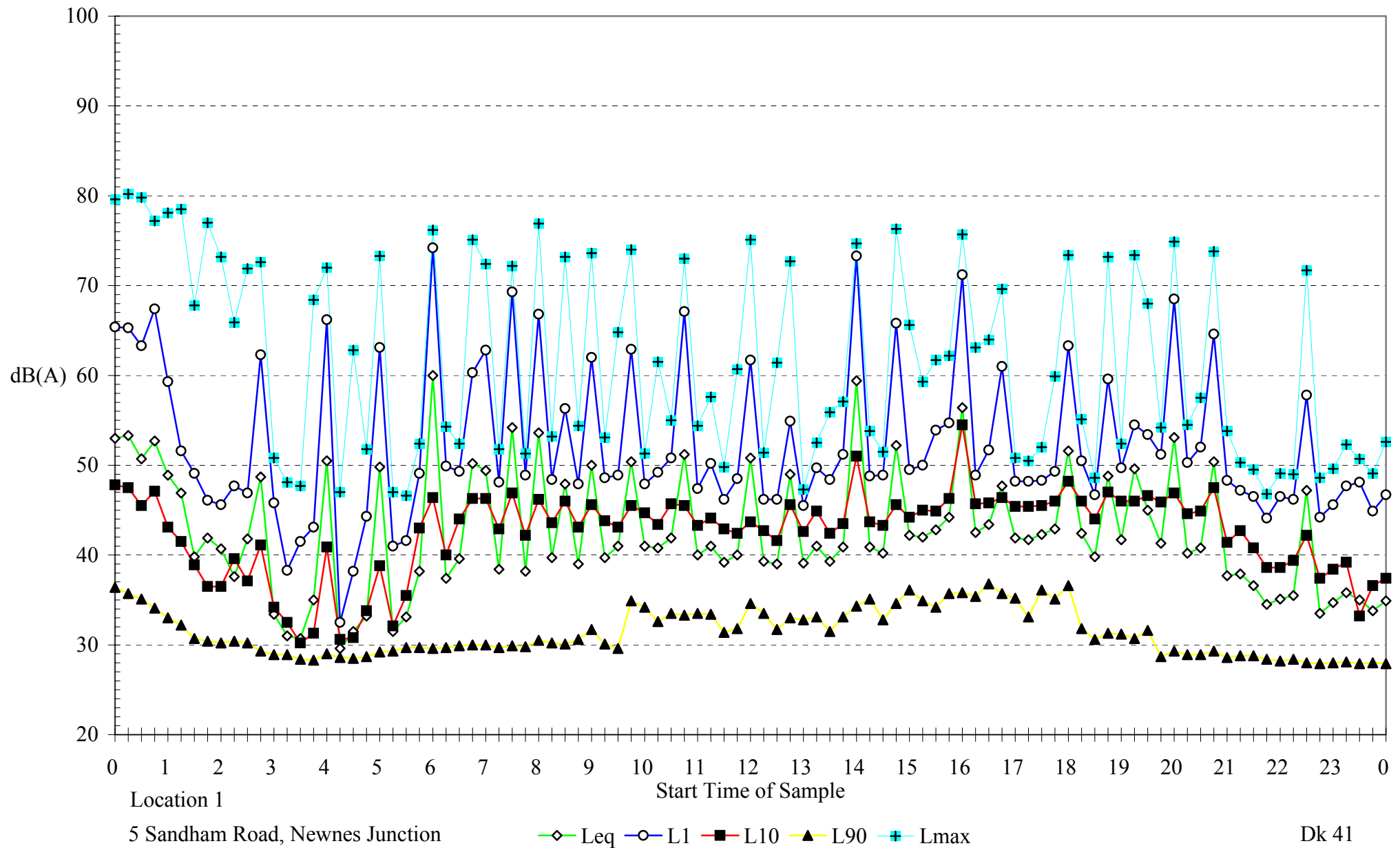
5 Sandham Road, Newnes Junction

—◇— Leq —○— L1 —■— L10 —▲— L90 —+— Lmax

Dk 41

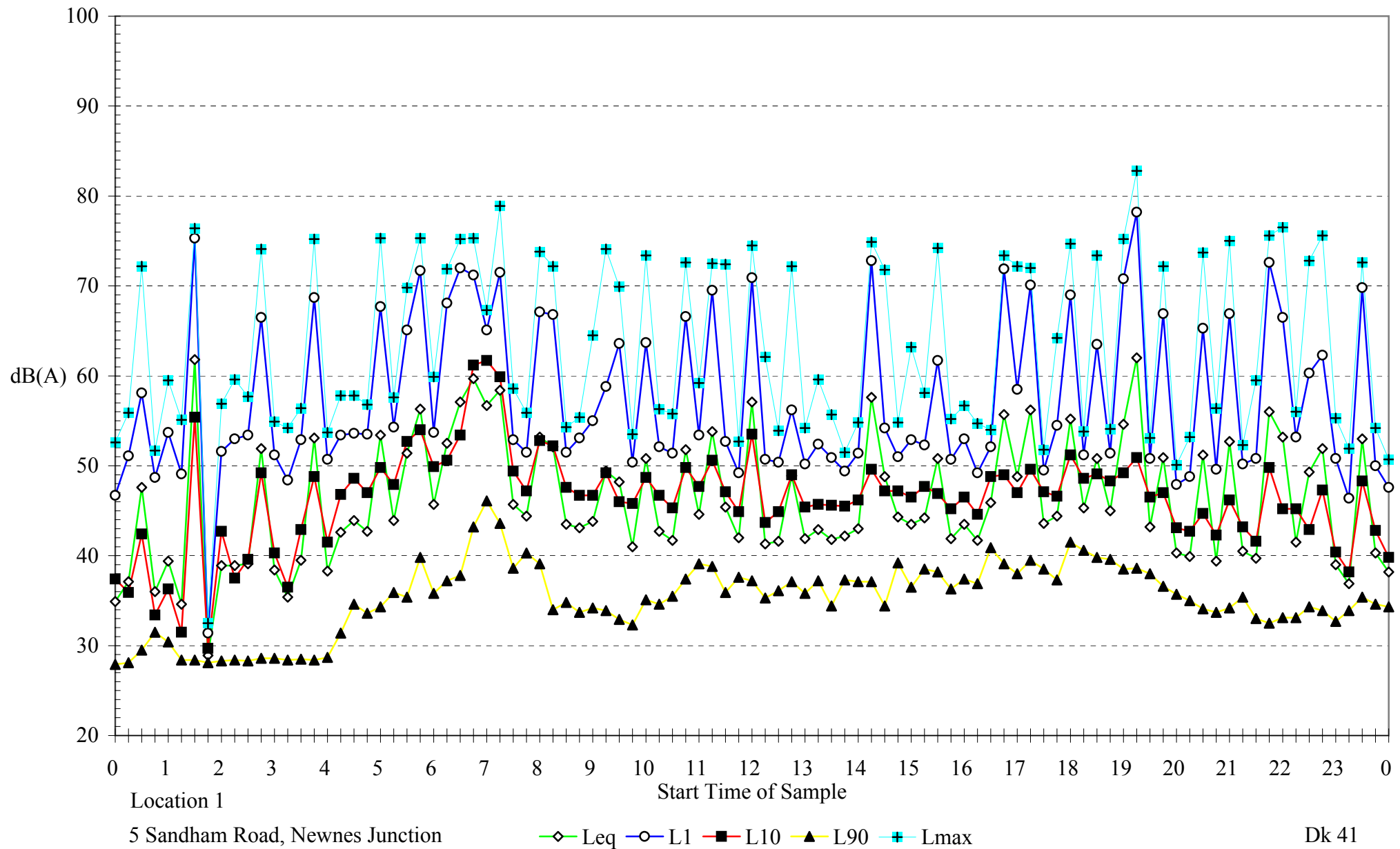
Ambient Sound Pressure Levels

Sunday 9 April 2000



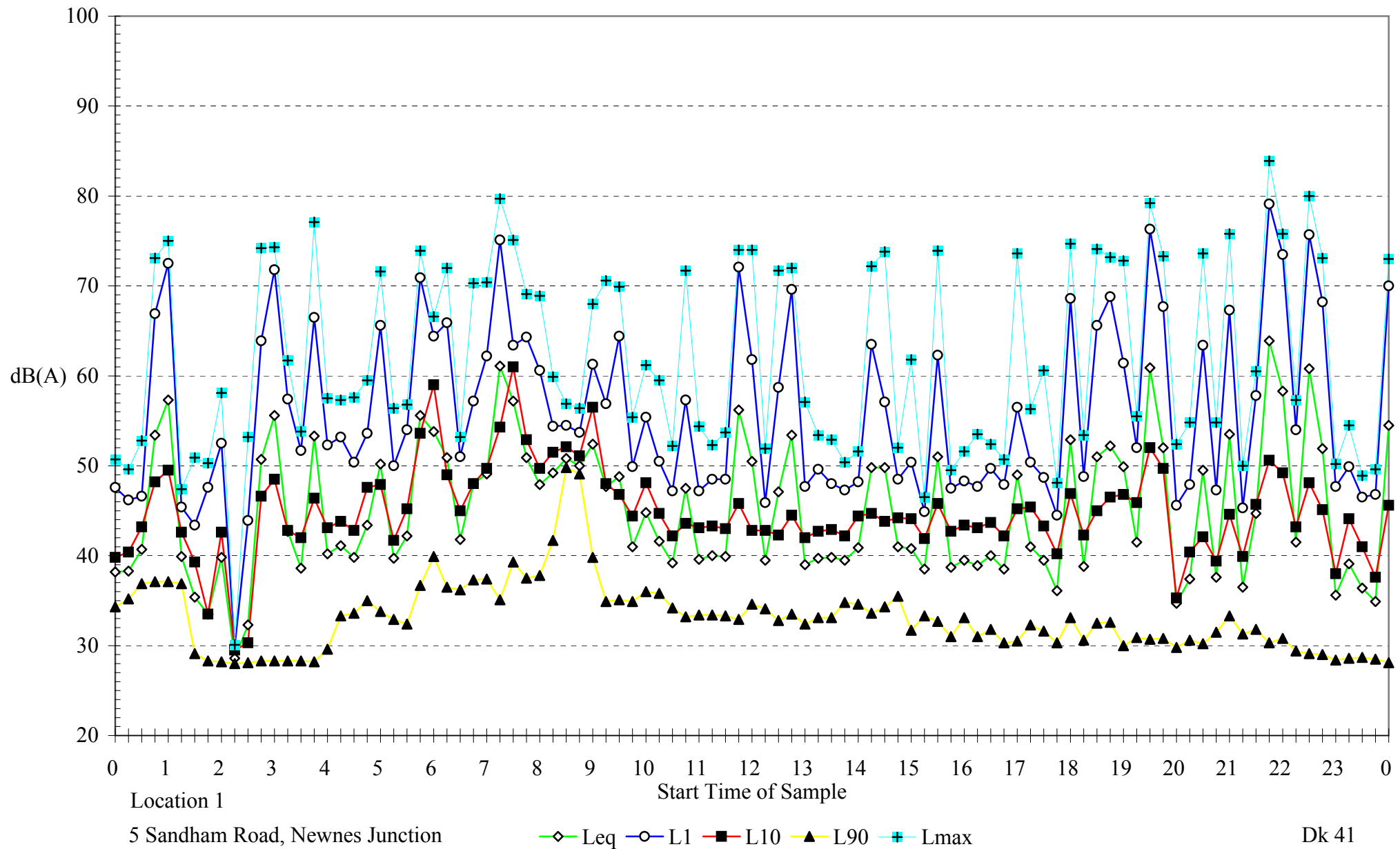
Ambient Sound Pressure Levels

Monday 10 April 2000



Ambient Sound Pressure Levels

Tuesday 11 April 2000



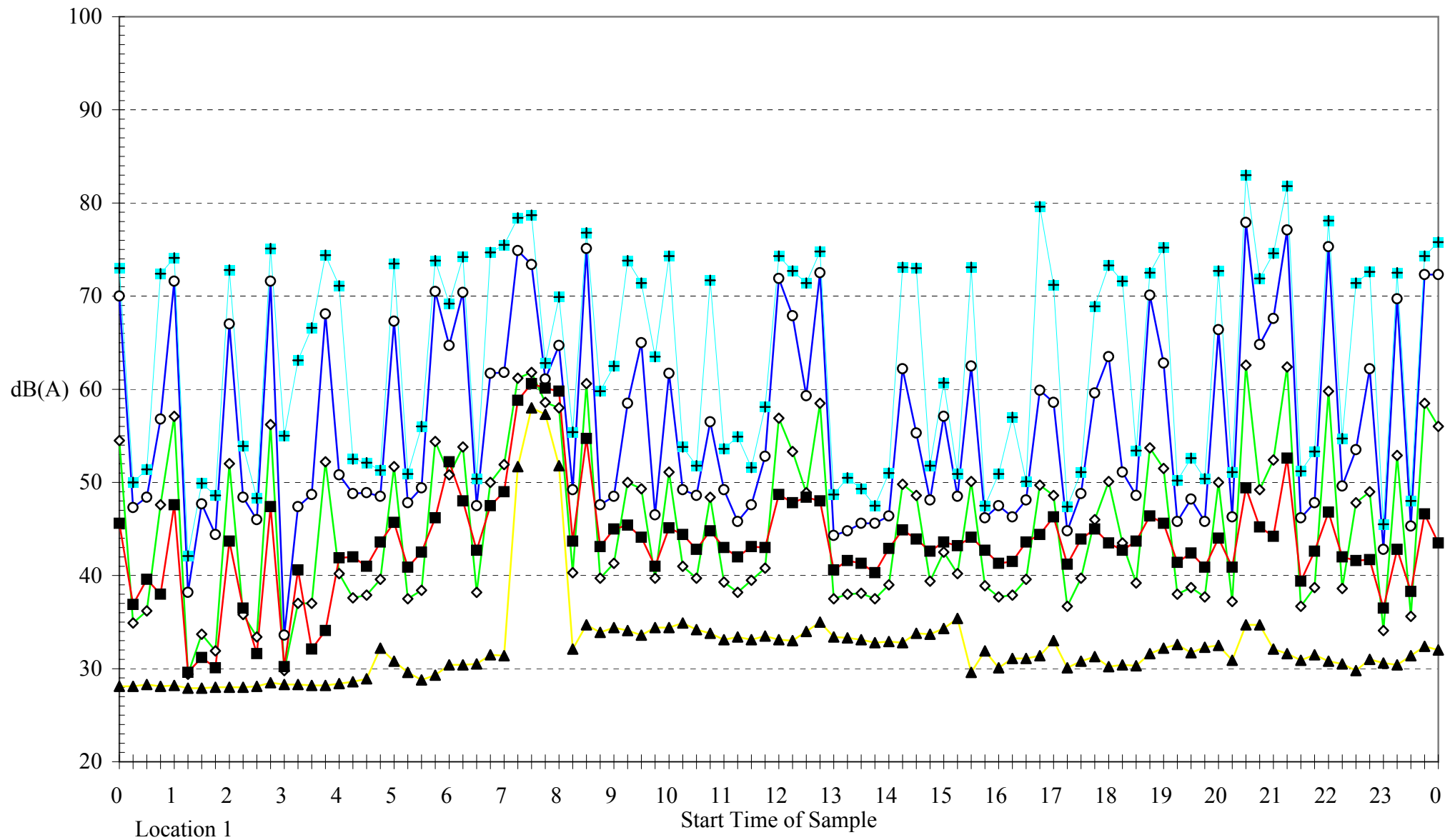
Location 1

5 Sandham Road, Newnes Junction

Dk 41

Ambient Sound Pressure Levels

Wednesday 12 April 2000



Location 1

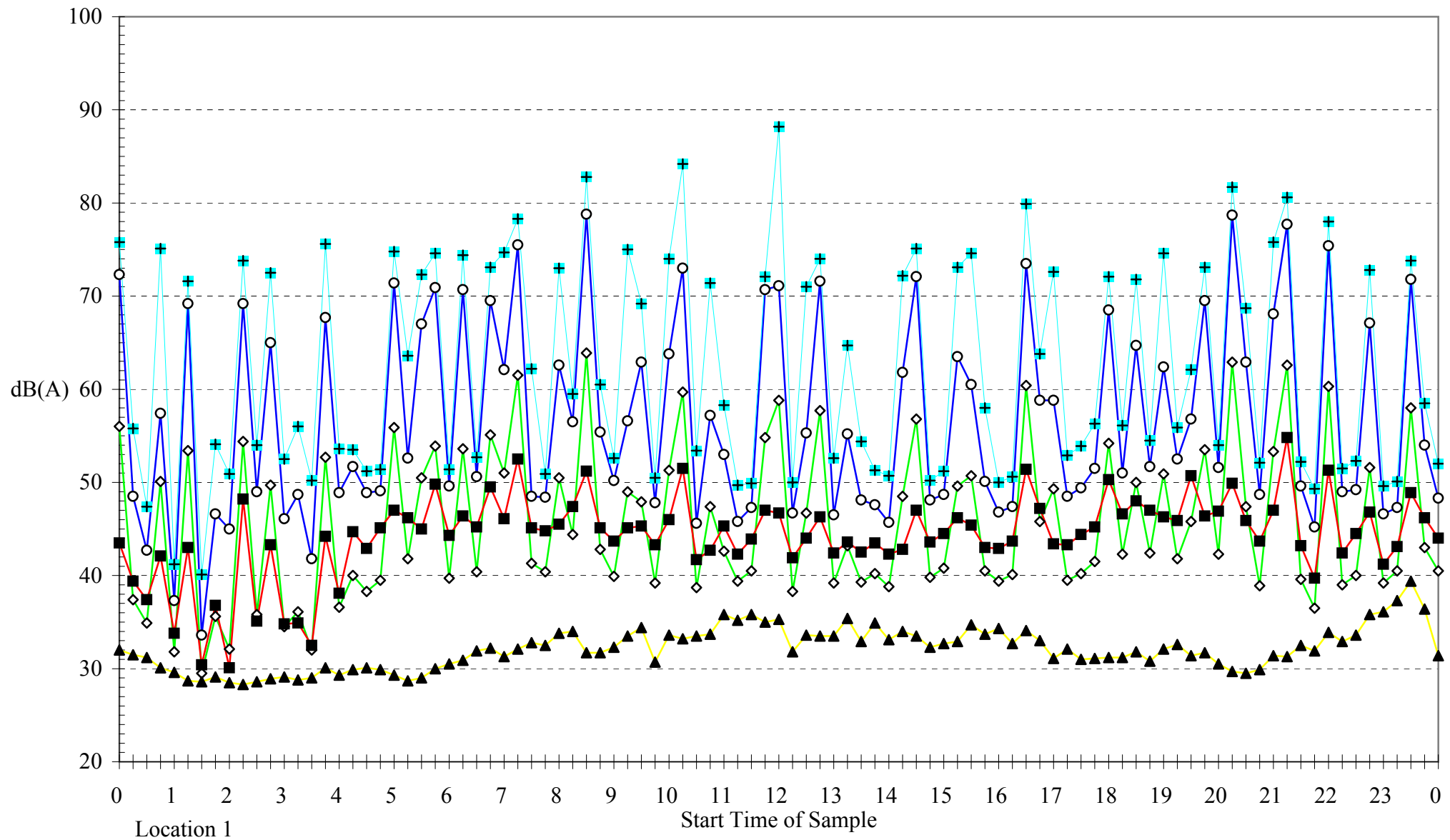
5 Sandham Road, Newnes Junction

—◇— Leq —○— L1 —■— L10 —▲— L90 —+— Lmax

Dk 41

Ambient Sound Pressure Levels

Thursday 13 April 2000



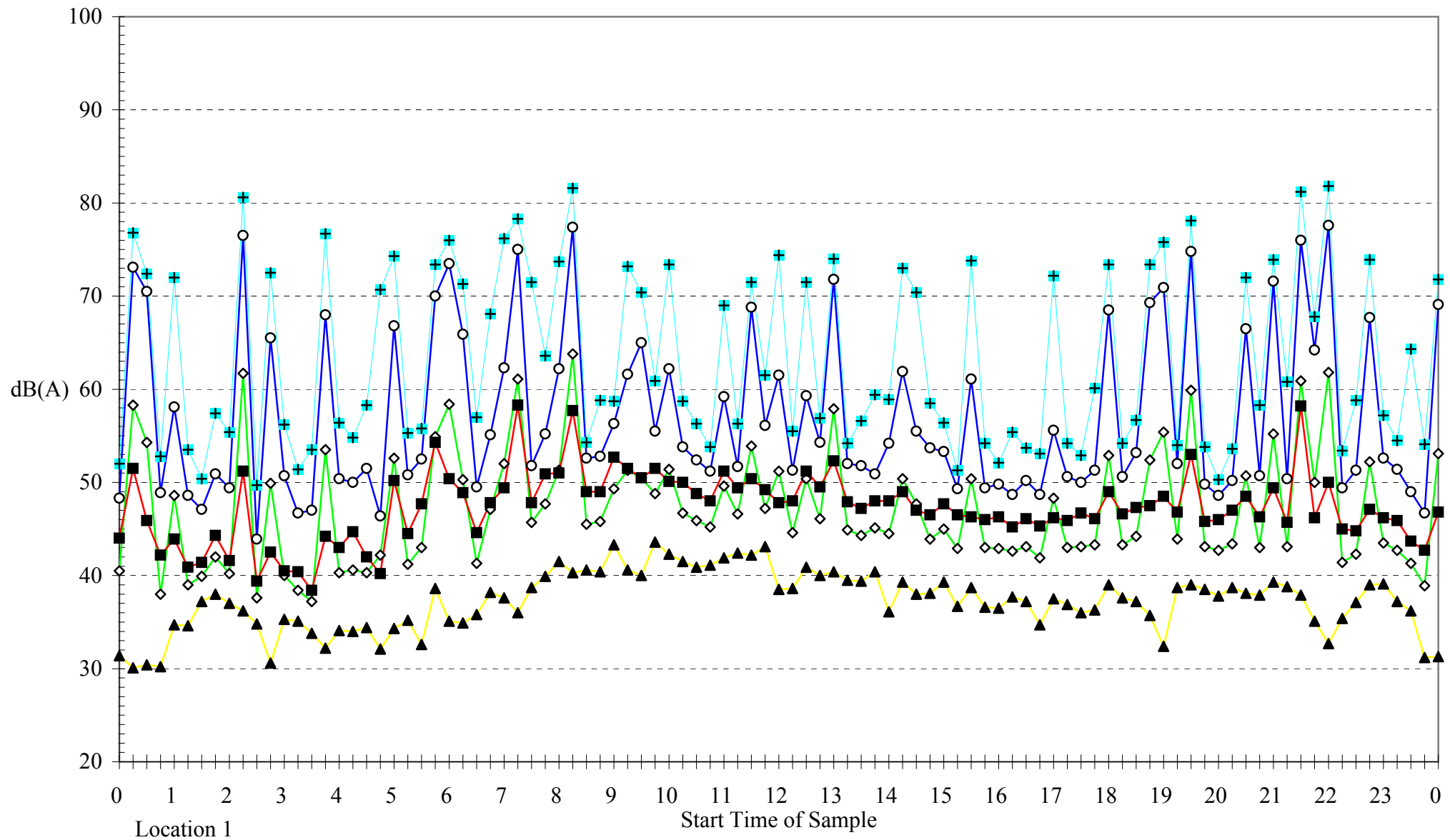
Location 1
5 Sandham Road, Newnes Junction

—◇— Leq —○— L1 —■— L10 —▲— L90 —+— Lmax

Dk 41

Ambient Sound Pressure Levels

Friday 14 April 2000



Location 1

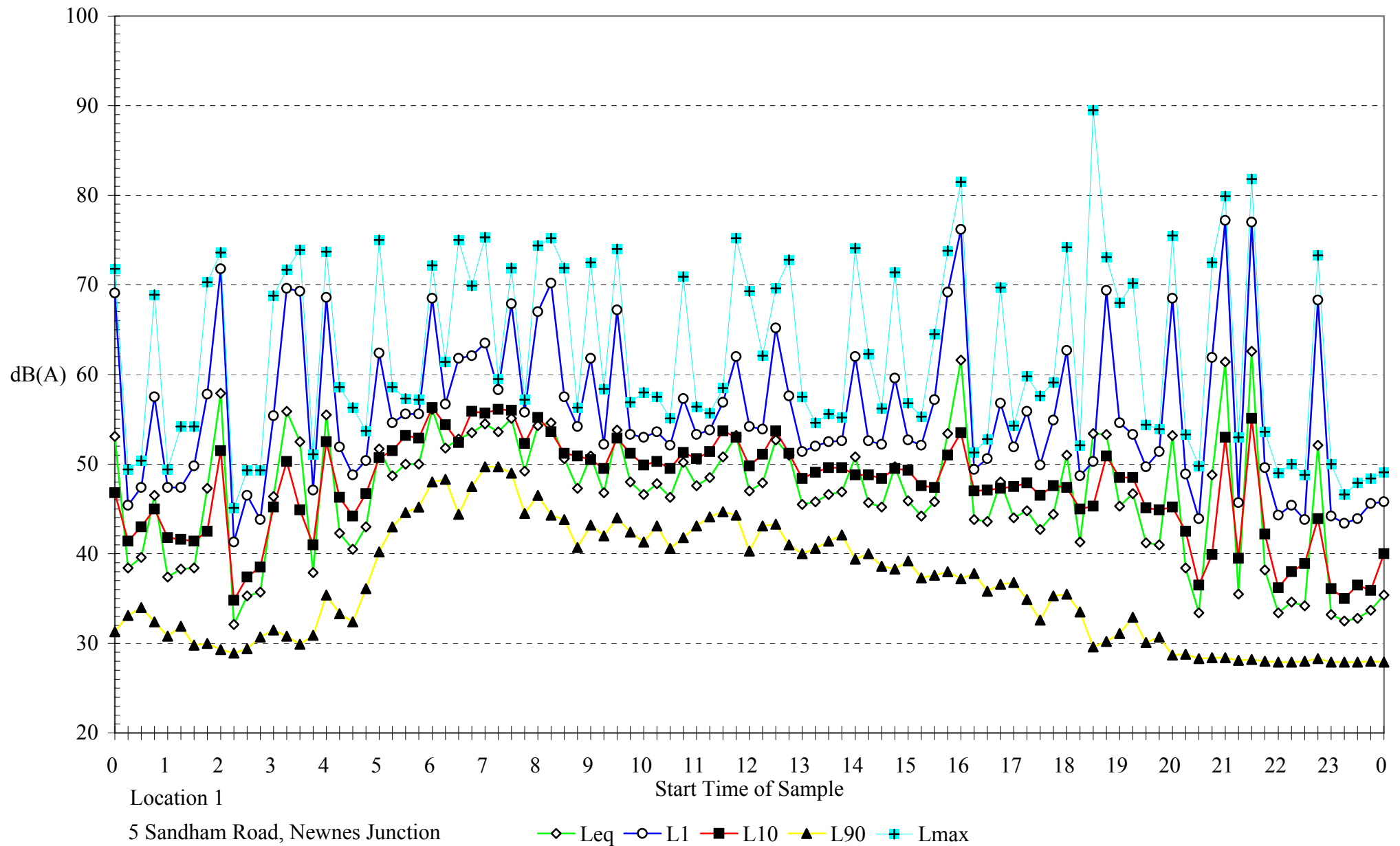
5 Sandham Road, Newnes Junction

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Dk 41

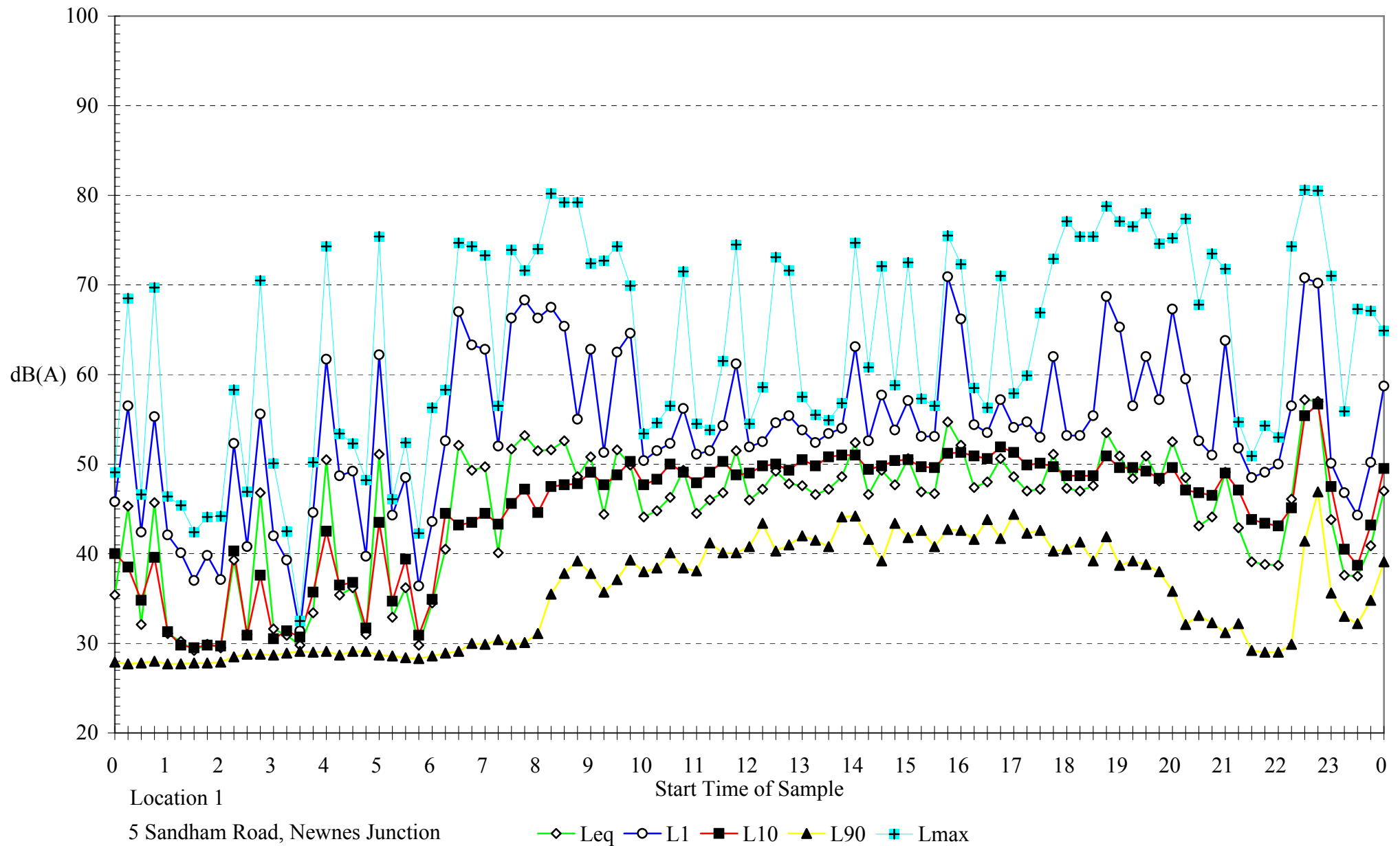
Ambient Sound Pressure Levels

Saturday 15 April 2000



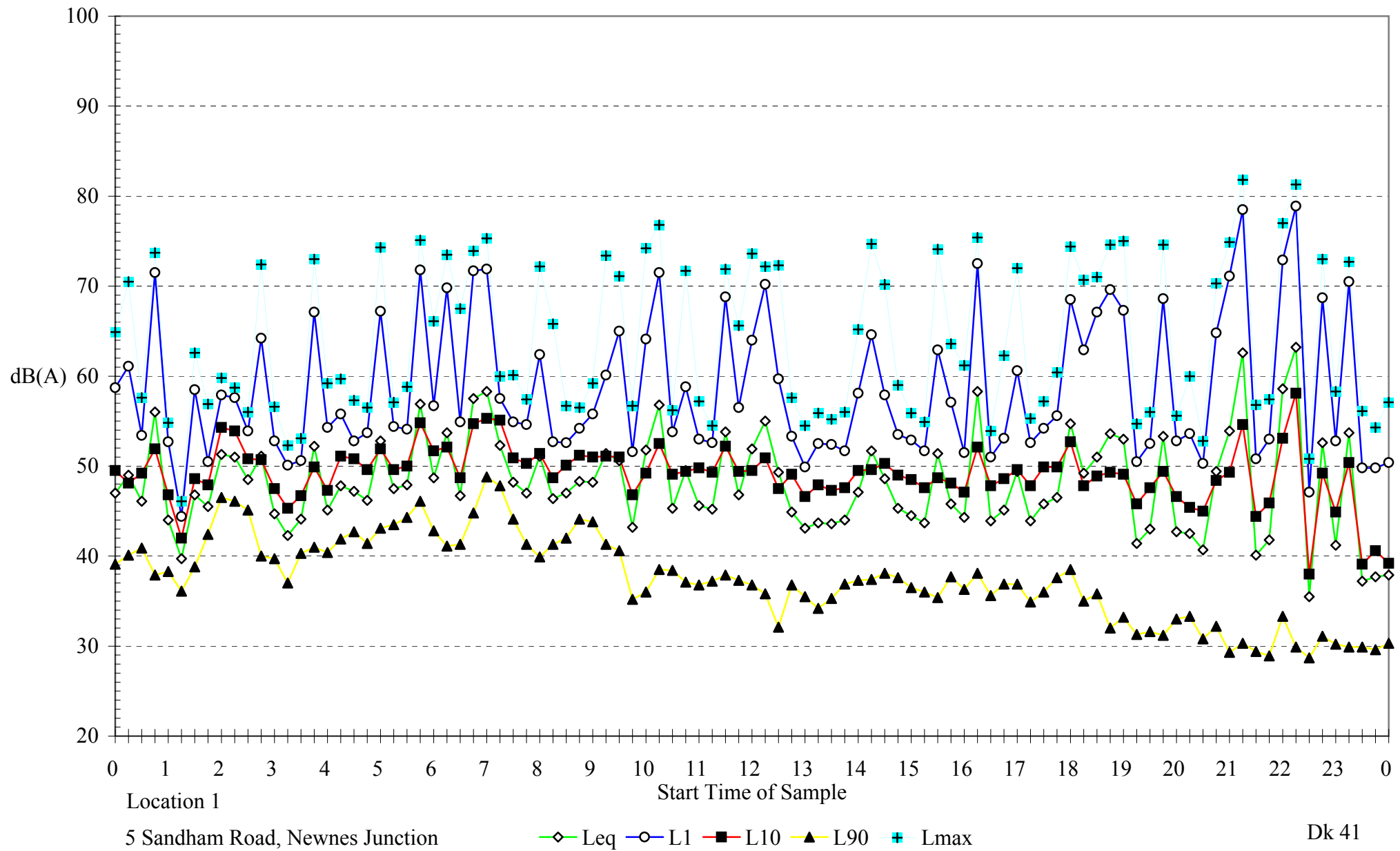
Ambient Sound Pressure Levels

Sunday 16 April 2000



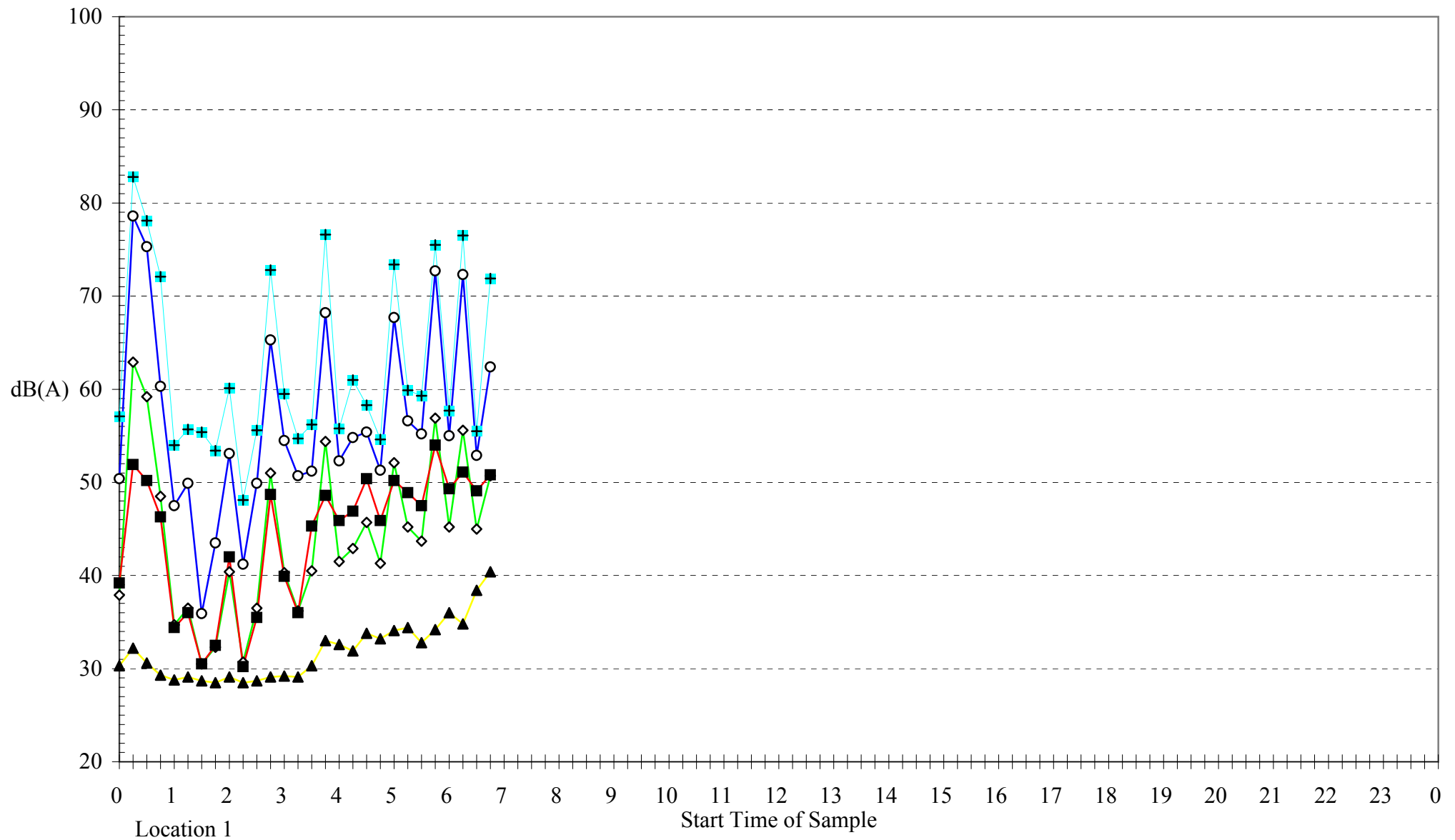
Ambient Sound Pressure Levels

Monday 17 April 2000



Ambient Sound Pressure Levels

Tuesday 18 April 2000

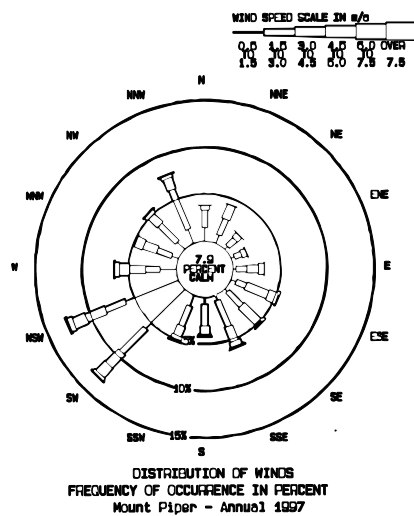


5 Sandham Road, Newnes Junction

—◇— Leq —○— L1 —■— L10 —▲— L90 —+— Lmax

Dk 41

APPENDIX 2: METEOROLOGY



Annual and Seasonal Windroses for Mount Piper 1997

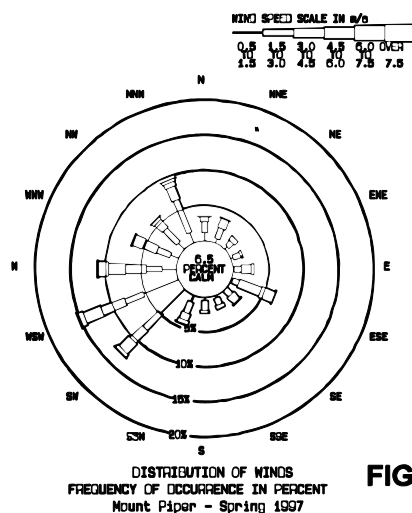
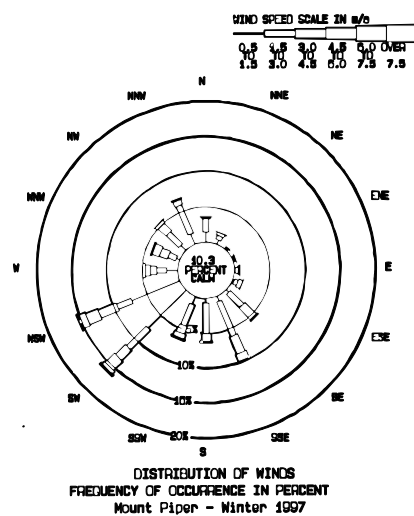
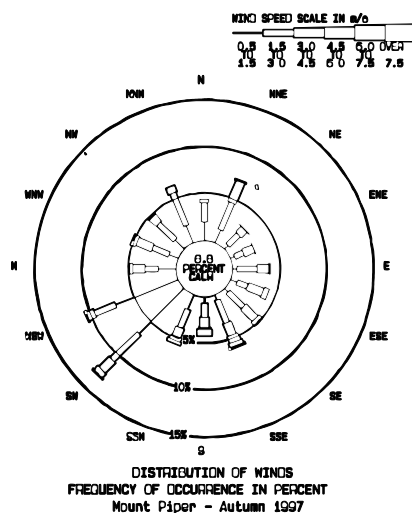
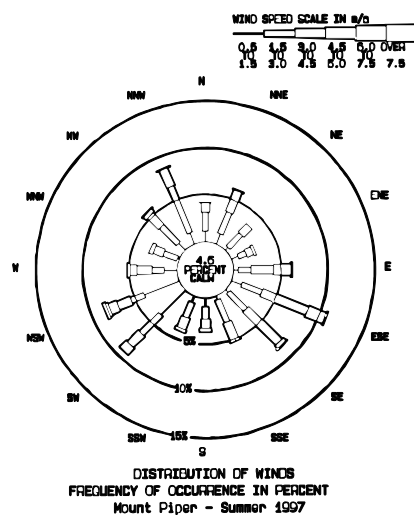
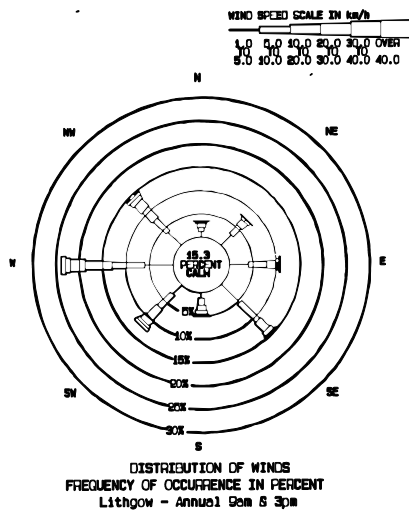


FIGURE 4



**Annual and Seasonal Windroses
for Lithgow (BoM) 9 am and 3 pm**

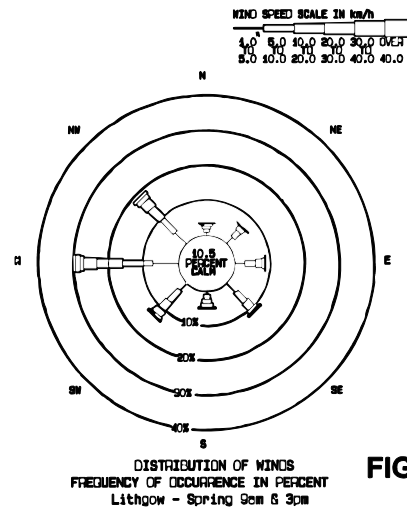
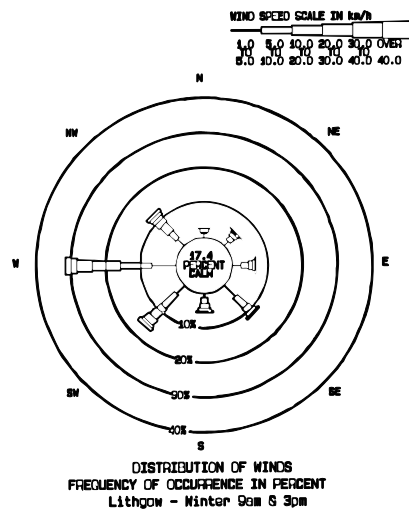
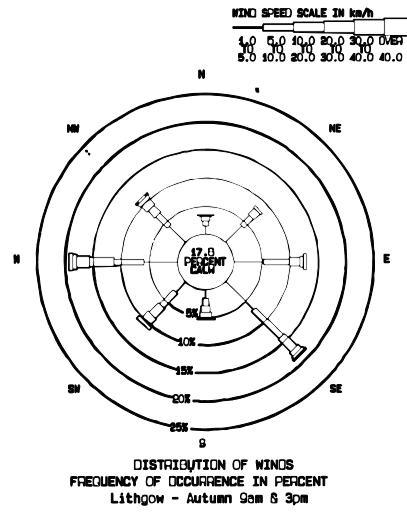
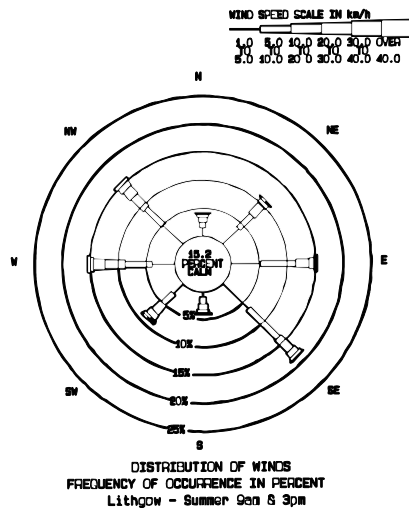


FIGURE 5

FROM 97. 1. 3 TO 97.12.31

PASQUILL STABILITY CLASS "A"

WIND SPEED CLASS (MPS)

WIND SECTOR	.51 TO 1.50	1.51 TO 3.00	3.01 TO 4.50	4.51 TO 6.00	6.01 TO 7.50	7.51 TO 9.00	9.01 TO 10.50	GREATER THAN 10.50	TOTAL	MEAN SPEED
NNE	.002869	.003142	.000820	.000000	.000000	.000000	.000000	.000000	.006831	1.91
NE	.001503	.003279	.000956	.000000	.000000	.000000	.000000	.000000	.005738	2.20
ENE	.001230	.001503	.001230	.000000	.000000	.000000	.000000	.000000	.003962	2.30
E	.001230	.002732	.000410	.000000	.000000	.000000	.000000	.000000	.004372	1.95
ESE	.001366	.001913	.000956	.000000	.000000	.000000	.000000	.000000	.004235	2.15
SE	.000410	.003415	.001776	.000000	.000000	.000000	.000000	.000000	.005601	2.53
SSE	.000683	.004645	.000956	.000000	.000000	.000000	.000000	.000000	.006284	2.35
S	.002596	.003689	.001093	.000000	.000000	.000000	.000000	.000000	.007377	2.11
SSW	.001913	.003415	.002186	.000000	.000000	.000000	.000000	.000000	.007514	2.36
SW	.000820	.003825	.001639	.000137	.000000	.000000	.000000	.000000	.006421	2.51
WSW	.001093	.002869	.002459	.000273	.000000	.000000	.000000	.000000	.006694	2.79
W	.001503	.004645	.003142	.000546	.000000	.000000	.000000	.000000	.009836	2.79
WNW	.000546	.004645	.002322	.000410	.000000	.000000	.000000	.000000	.007923	2.68
NW	.002732	.005328	.001639	.000000	.000000	.000000	.000000	.000000	.009699	2.13
NNW	.003689	.011612	.002869	.000000	.000000	.000000	.000000	.000000	.018169	2.24
N	.003142	.005738	.001639	.000000	.000000	.000000	.000000	.000000	.010519	2.10
CALM									.011749	
TOTAL	.027322	.066393	.026093	.001366	.000000	.000000	.000000	.000000	.132923	2.14
NUMBERS BELOW BASED ON ALL OBSERVATIONS										
NUMBER OF INVALID OBSERVATIONS					=	0				
NUMBER OF VALID STABILITY DEPENDENT OBSERVATIONS					=	7320				

PASQUILL STABILITY CLASS "B"

WIND SPEED CLASS (MPS)

WIND SECTOR	.51 TO 1.50	1.51 TO 3.00	3.01 TO 4.50	4.51 TO 6.00	6.01 TO 7.50	7.51 TO 9.00	9.01 TO 10.50	GREATER THAN 10.50	TOTAL	MEAN SPEED
NNE	.000683	.002596	.002186	.000000	.000000	.000000	.000000	.000000	.005464	2.66
NE	.000273	.001503	.001230	.000000	.000000	.000000	.000000	.000000	.003005	2.96
ENE	.000273	.000820	.001093	.000137	.000000	.000000	.000000	.000000	.002322	2.91
E	.000137	.000410	.000683	.000137	.000000	.000000	.000000	.000000	.001366	3.08
ESE	.000000	.001366	.001776	.000137	.000000	.000000	.000000	.000000	.003279	3.16
SE	.000137	.001503	.001093	.000000	.000000	.000000	.000000	.000000	.002732	2.90
SSE	.000137	.001776	.000956	.000137	.000000	.000000	.000000	.000000	.003005	2.95
S	.000137	.001093	.001913	.000000	.000000	.000000	.000000	.000000	.003142	3.00
SSW	.000137	.000546	.001230	.000273	.000000	.000000	.000000	.000000	.002186	3.30
SW	.000000	.001503	.002459	.000956	.000000	.000000	.000000	.000000	.004918	3.76
WSW	.000000	.000956	.003142	.001503	.000000	.000000	.000000	.000000	.005601	3.90
W	.000000	.001093	.002596	.001913	.000000	.000000	.000000	.000000	.005601	4.10
WNW	.000137	.001776	.004235	.001913	.000000	.000000	.000000	.000000	.008060	3.87
NW	.000410	.001366	.002732	.000410	.000000	.000000	.000000	.000000	.004918	3.18
NNW	.000273	.005328	.002732	.000137	.000000	.000000	.000000	.000000	.008470	2.81
N	.000956	.002869	.002049	.000000	.000000	.000000	.000000	.000000	.005874	2.57
CALM									.001366	
TOTAL	.003689	.026503	.032104	.007650	.000000	.000000	.000000	.000000	.071311	3.19
NUMBERS BELOW BASED ON ALL OBSERVATIONS										
NUMBER OF INVALID OBSERVATIONS					=	0				
NUMBER OF VALID STABILITY DEPENDENT OBSERVATIONS					=	7320				

WIND SPEED CLASS (MPS)

PASQUILL STABILITY CLASS "D"

		WIND SPEED CLASS (MPS)								
	.51	1.51	3.01	4.51	6.01	7.51	9.01	GREATER		
WIND	TO	TO	TO	TO	TO	TO	TO	THAN		MEAN
SECTOR	1.50	3.00	4.50	6.00	7.50	9.00	10.50	10.50	TOTAL	SPEED
NNE	.001776	.006557	.007514	.000273	.000000	.000000	.000000	.000000	.016120	2.95
NE	.000410	.002322	.001913	.000000	.000137	.000000	.000000	.000000	.004781	3.01
ENE	.000000	.001366	.001366	.000410	.000000	.000000	.000000	.000000	.003142	3.43
E	.000273	.005738	.008607	.004645	.000273	.000000	.000000	.000000	.019536	3.69
ESE	.000137	.004645	.017760	.009290	.000410	.000000	.000000	.000000	.032240	4.05
SE	.000000	.011066	.014754	.001913	.000137	.000000	.000000	.000000	.027869	3.32
SSE	.000273	.014071	.010109	.004918	.001366	.000410	.000000	.000000	.031148	3.51
S	.000410	.008470	.003415	.001093	.001639	.000000	.000000	.000000	.015027	3.33
SSW	.001776	.009563	.004508	.003279	.001503	.000000	.000000	.000000	.020628	3.27
SW	.019126	.015164	.006831	.007377	.002869	.000820	.000000	.000000	.052186	2.81
WSW	.015984	.008880	.012158	.007514	.004918	.001776	.000137	.000000	.051366	3.39
W	.000820	.005464	.005328	.003005	.004781	.000546	.000000	.000000	.019945	4.40
WNW	.000820	.004781	.004781	.001230	.001366	.000000	.000000	.000000	.012978	3.48
NW	.000683	.009016	.005464	.001230	.000683	.000000	.000000	.000000	.017077	3.08
NNW	.001366	.010383	.002869	.001230	.000956	.000273	.000000	.000000	.017077	3.00
N	.000683	.002049	.000956	.000273	.000137	.000000	.000000	.000000	.004098	2.82
CALM									.002869	
TOTAL	.044536	.119536	.108333	.047678	.021175	.003825	.000137	.000000	.348087	3.34
NUMBERS BELOW BASED ON ALL OBSERVATIONS										
NUMBER OF INVALID OBSERVATIONS = 0										
NUMBER OF VALID STABILITY DEPENDENT OBSERVATIONS = 7320										

PASQUILL STABILITY CLASS "E"

WIND SPEED CLASS (MPS)

WIND SECTOR	.51 TO 1.50	1.51 TO 3.00	3.01 TO 4.50	4.51 TO 6.00	6.01 TO 7.50	7.51 TO 9.00	9.01 TO 10.50	GREATER THAN 10.50	TOTAL	MEAN SPEED
NNE	.000410	.003279	.000820	.000000	.000000	.000000	.000000	.000000	.004508	2.46
NE	.000000	.001776	.000683	.000000	.000000	.000000	.000000	.000000	.002459	2.83
ENE	.000137	.002186	.000546	.000000	.000000	.000000	.000000	.000000	.002869	2.53
E	.000137	.000683	.000546	.000137	.000000	.000000	.000000	.000000	.001503	2.73
ESE	.000410	.001366	.000820	.000000	.000000	.000000	.000000	.000000	.002596	2.46
SE	.000410	.002596	.000683	.000000	.000000	.000000	.000000	.000000	.003689	2.53
SSE	.000410	.004645	.000273	.000000	.000000	.000000	.000000	.000000	.005328	2.28
S	.000546	.005464	.001093	.000273	.000000	.000000	.000000	.000000	.007377	2.46
SSW	.002596	.005328	.001230	.000000	.000000	.000000	.000000	.000000	.009153	2.07
SW	.018579	.011202	.002732	.000683	.000000	.000000	.000000	.000000	.033197	1.70
WSW	.017486	.006557	.000820	.000137	.000000	.000000	.000000	.000000	.025000	1.49
W	.003142	.002049	.000820	.000000	.000000	.000000	.000000	.000000	.006011	1.81
WNW	.001366	.001639	.000546	.000000	.000000	.000000	.000000	.000000	.003552	1.92
NW	.001366	.004372	.000000	.000000	.000000	.000000	.000000	.000000	.005738	1.85
NNW	.002596	.007377	.000137	.000000	.000000	.000000	.000000	.000000	.010109	1.82
N	.001913	.002186	.000137	.000000	.000000	.000000	.000000	.000000	.004235	1.73
CALM									.002322	
TOTAL	.051503	.062705	.011885	.001230	.000000	.000000	.000000	.000000	.129645	1.87
NUMBERS BELOW BASED ON ALL OBSERVATIONS										
NUMBER OF INVALID OBSERVATIONS					= 0					
NUMBER OF VALID STABILITY DEPENDENT OBSERVATIONS					= 7320					

PASQUILL STABILITY CLASS "F"

WIND SPEED CLASS (MPS)

WIND SECTOR	.51 TO 1.50	1.51 TO 3.00	3.01 TO 4.50	4.51 TO 6.00	6.01 TO 7.50	7.51 TO 9.00	9.01 TO 10.50	GREATER THAN 10.50	TOTAL	MEAN SPEED
NNE	.002596	.001503	.000000	.000000	.000000	.000000	.000000	.000000	.004098	1.42
NE	.001913	.001366	.000000	.000000	.000000	.000000	.000000	.000000	.003279	1.53
ENE	.002186	.001503	.000000	.000000	.000000	.000000	.000000	.000000	.003689	1.47
E	.000683	.000820	.000000	.000000	.000000	.000000	.000000	.000000	.001503	1.53
ESE	.003415	.000683	.000000	.000000	.000000	.000000	.000000	.000000	.004098	1.19
SE	.002869	.000820	.000000	.000000	.000000	.000000	.000000	.000000	.003689	1.21
SSE	.004645	.001913	.000000	.000000	.000000	.000000	.000000	.000000	.006557	1.32
S	.004098	.002869	.000000	.000000	.000000	.000000	.000000	.000000	.006967	1.44
SSW	.005874	.002322	.000000	.000000	.000000	.000000	.000000	.000000	.008197	1.30
SW	.020082	.002049	.000000	.000000	.000000	.000000	.000000	.000000	.022131	1.10
WSW	.025956	.002459	.000000	.000000	.000000	.000000	.000000	.000000	.028415	.99
W	.011339	.001639	.000000	.000000	.000000	.000000	.000000	.000000	.012978	1.01
WNW	.004508	.002049	.000000	.000000	.000000	.000000	.000000	.000000	.006557	1.36
NW	.006011	.002186	.000000	.000000	.000000	.000000	.000000	.000000	.008197	1.29
NNW	.008060	.004508	.000000	.000000	.000000	.000000	.000000	.000000	.012568	1.39
N	.007240	.003825	.000000	.000000	.000000	.000000	.000000	.000000	.011066	1.38
CALM									.058607	
TOTAL	.111475	.032514	.000000	.000000	.000000	.000000	.000000	.000000	.202596	.94
NUMBERS BELOW BASED ON ALL OBSERVATIONS										
NUMBER OF INVALID OBSERVATIONS						=	0			
NUMBER OF VALID STABILITY DEPENDENT OBSERVATIONS						=	7320			

WIND SPEED CLASS (MPS)										MEAN SPEED
WIND SECTOR	.51 TO 1.50	1.51 TO 3.00	3.01 TO 4.50	4.51 TO 6.00	6.01 TO 7.50	7.51 TO 9.00	9.01 TO 10.50	GREATER THAN 10.50	TOTAL	
NNE	.009426	.018306	.015437	.000820	.000000	.000000	.000000	.000000	.043989	2.59
NE	.004372	.010519	.006284	.000000	.000137	.000000	.000000	.000000	.021311	2.55
ENE	.003825	.007923	.005191	.000683	.000000	.000000	.000000	.000000	.017623	2.55
E	.003005	.011612	.012432	.005738	.000273	.000000	.000000	.000000	.033060	3.24
ESE	.005464	.011475	.025000	.010656	.000410	.000000	.000000	.000000	.053005	3.50
SE	.003825	.021311	.024180	.003142	.000137	.000000	.000000	.000000	.052596	3.07
SSE	.006148	.029918	.016667	.005464	.001366	.000410	.000000	.000000	.059973	3.00
S	.007787	.022951	.008743	.001503	.001639	.000000	.000000	.000000	.042623	2.62
SSW	.012432	.022678	.011066	.005055	.001503	.000000	.000000	.000000	.052732	2.66
SW	.059153	.035246	.019126	.013661	.002869	.000820	.000000	.000000	.130874	2.38
WSW	.060519	.022678	.022131	.014481	.004918	.001776	.000137	.000000	.126639	2.55
W	.017077	.015710	.016530	.010792	.004781	.000546	.000000	.000000	.065437	3.22
WNW	.007650	.016530	.015164	.008880	.001366	.000000	.000000	.000000	.049590	3.17
NW	.011339	.025546	.013661	.003415	.000683	.000000	.000000	.000000	.054645	2.61
NNW	.016257	.045628	.012842	.002596	.000956	.000273	.000000	.000000	.078552	2.41
N	.014481	.018579	.005191	.000410	.000137	.000000	.000000	.000000	.038798	2.03
CALM									.078552	
TOTAL	.242760	.336612	.229645	.087295	.021175	.003825	.000137	.000000	1.000000	2.53
NUMBERS BELOW BASED ON ALL OBSERVATIONS										
NUMBER OF INVALID OBSERVATIONS = 0										
NUMBER OF VALID OBSERVATIONS = 7320										

Date	Time	Temp. Out	Wind Chill	Hi Temp	Low Temp	Wind Speed (m/s)			Rain	Bar	Hum In
		C°	C°	C°	C°	Avg	Hi	Dir	mm	mB	%
3/16/00	2:30p	23.8	23.8	24.3	23.5	0	1.3	SW	1.4	897.6	60
3/16/00	2:45p	23.2	23.2	23.6	22.8	0.4	1.3	N	0.4	897.6	62
3/16/00	3:00p	22.9	22.9	23	22.7	0.9	1.3	N	0	897.5	62
3/16/00	3:15p	22.7	22.7	22.9	22.5	0.9	1.8	N	0	897.3	62
3/16/00	3:30p	22.7	22.7	22.9	22	0.9	2.2	N	0	897.4	63
3/16/00	3:45p	21.6	21.6	22	21.1	0.9	2.7	N	0	897.5	63
3/16/00	4:00p	20.8	20.8	21.1	20.7	0.4	2.2	N	0	897.4	63
3/16/00	4:15p	21.1	21.1	21.8	20.7	0.4	0.9	N	0	897.3	64
3/16/00	4:30p	21.2	21.2	21.7	20.9	0.4	0.9	N	0	897.2	65
3/16/00	4:45p	20.6	20.6	20.9	20.4	0.4	0.9	N	0	897.1	65
3/16/00	5:00p	20.1	20.1	20.4	19.7	0	0.9	N	0.6	897.3	64
3/16/00	5:15p	19.4	19.4	19.7	19.3	0.4	0.9	N	0.4	897.2	64
3/16/00	5:30p	19.2	19.2	19.4	19	0.4	1.3	NNW	0.6	897.3	65
3/16/00	5:45p	18.8	18.8	19	18.7	0.4	1.3	N	0	897.3	66
3/16/00	6:00p	18.6	18.6	18.7	18.5	0	0.4	N	0	897.4	66
3/16/00	6:15p	18.4	18.4	18.5	18.4	0.4	0.9	N	0	897.6	67
3/16/00	6:30p	18.6	18.6	18.6	18.4	0	0.9	N	0.2	897.9	67
3/16/00	6:45p	18.6	18.6	18.7	18.6	0	0	---	0.4	898	68
3/16/00	7:00p	18.6	18.6	18.6	18.5	0	0.4	N	0	898.2	68
3/16/00	7:15p	18.5	18.5	18.6	18.5	0	0.9	N	0	898.4	68
3/16/00	7:30p	18.5	18.5	18.6	18.4	0	6.7	N	0	898.5	69
3/16/00	7:45p	18.4	18.4	18.5	18.4	0.4	0.9	N	0	898.5	69
3/16/00	8:00p	18.5	18.5	18.5	18.4	0	0.4	N	0	898.5	69
3/16/00	8:15p	18.4	18.4	18.5	18.4	0	0.4	N	0	899	69
3/16/00	8:30p	18.4	18.4	18.4	18.4	0	0.4	N	0	899.5	70
3/16/00	8:45p	18.3	18.3	18.4	18.3	0	0.9	N	0.2	899.4	70
3/16/00	9:00p	18.4	18.4	18.4	18.3	0	0.9	N	0	899.2	70
3/16/00	9:15p	18.4	18.4	18.4	18.4	0.4	0.9	N	0	899.3	71
3/16/00	9:30p	18.4	18.4	18.4	18.4	0	0.9	N	0	899.4	71
3/16/00	9:45p	18.4	18.4	18.4	18.3	0	0.9	N	0	899.4	71
3/16/00	10:00p	18.3	18.3	18.3	18.2	0	0.4	N	0	899.5	71
3/16/00	10:15p	18.2	18.2	18.3	18.1	0	0.9	N	0	899.6	71
3/16/00	10:30p	18.3	18.3	18.3	18.2	0	0.4	N	0	899.4	71
3/16/00	10:45p	18.3	18.3	18.3	18.3	0	0.9	N	0	899.4	72
3/16/00	11:00p	18.4	18.4	18.4	18.3	0.4	0.9	N	0	899.4	72
3/16/00	11:15p	18.3	18.3	18.4	18.2	0	0.9	N	0	899.3	72
3/16/00	11:30p	18.1	18.1	18.2	18	0	0	---	0	899.4	72
3/16/00	11:45p	18	18	18.1	17.9	0	0	---	0	899.4	72
3/17/00	12:00a	18.1	18.1	18.2	18.1	0	0.9	N	0	899.4	72
3/17/00	12:15a	18.2	18.2	18.2	18.2	0	0.9	N	0	899.4	73
3/17/00	12:30a	18.3	18.3	18.3	18.2	0	0.9	N	0	899.4	73
3/17/00	12:45a	18.3	18.3	18.3	18.3	0	0.9	N	0	899.4	73
3/17/00	1:00a	18.3	18.3	18.3	18.3	0	1.3	N	0	899.4	73
3/17/00	1:15a	18.2	18.2	18.3	18.2	0	0.9	N	0	899.2	74
3/17/00	1:30a	18.2	18.2	18.2	18.2	0	1.3	N	0	899.1	74
3/17/00	1:45a	18.1	18.1	18.2	18.1	0	0.9	N	0	898.9	74
3/17/00	2:00a	18.1	18.1	18.1	18.1	0	0.4	N	0	898.9	74
3/17/00	2:15a	18.1	18.1	18.1	18.1	0	0.9	N	0	898.9	74
3/17/00	2:30a	18.1	18.1	18.1	18	0	0.9	N	0	898.6	74
3/17/00	2:45a	18	18	18	17.9	0.4	1.3	N	0	898.5	74
3/17/00	3:00a	17.9	17.9	18	17.9	0.4	1.3	N	0	898.5	75
3/17/00	3:15a	17.9	17.9	17.9	17.9	0	0.4	NNE	0	898.6	75
3/17/00	3:30a	17.9	17.9	17.9	17.8	0	0.9	N	0	898.4	75
3/17/00	3:45a	17.6	17.6	17.8	17.4	0	0	---	0	898.4	75
3/17/00	4:00a	17.3	17.3	17.4	17.2	0	0	---	0	898.5	75
3/17/00	4:15a	17.4	17.4	17.4	17.3	0	0.4	---	0	898.5	75
3/17/00	4:30a	17.2	17.2	17.3	17.1	0	0	---	0	898.5	75
3/17/00	4:45a	17	17	17.1	16.9	0	0	---	0	898.5	75

Date	Time	Temp. Out	Wind Chill	Hi Temp	Low Temp	Wind Speed (m/s)			Rain	Bar	Hum In
		C°	C°	C°	C°	Avg	Hi	Dir	mm	mB	%
3/17/00	5:00a	16.9	16.9	16.9	16.8	0	0	---	0	898.7	75
3/17/00	5:15a	16.8	16.8	16.9	16.7	0	0	---	0	898.7	75
3/17/00	5:30a	16.9	16.9	17	16.8	0	0	---	0	898.8	75
3/17/00	5:45a	16.9	16.9	17	16.8	0	0	---	0	898.9	75
3/17/00	6:00a	17.1	17.1	17.1	17	0	0	---	0	898.9	75
3/17/00	6:15a	16.9	16.9	17.1	16.9	0	0	---	0	899	75
3/17/00	6:30a	16.9	16.9	17	16.9	0	0	---	0	899.1	76
3/17/00	6:45a	16.8	16.8	16.9	16.8	0	0	---	0	899.1	75
3/17/00	7:00a	16.8	16.8	16.8	16.8	0	0	---	0	899.5	75
3/17/00	7:15a	16.8	16.8	16.8	16.7	0	0	---	0	899.6	75
3/17/00	7:30a	16.7	16.7	16.7	16.7	0	0	---	0	899.6	75
3/17/00	7:45a	16.9	16.9	17	16.7	0	0	---	0	899.8	76
3/17/00	8:00a	17.6	17.6	18.1	17	0	0	---	0	899.7	76
3/17/00	8:15a	18.3	18.3	18.5	18.1	0	0	---	0	899.9	77
3/17/00	8:30a	18.6	18.6	19	18.4	0	1.3	NNE	0	899.9	78
3/17/00	8:45a	19.3	19.3	19.4	19.1	0	0.9	NNE	0	899.9	78
3/17/00	9:00a	19.3	19.3	19.5	19.2	0	0	---	0	900	78
3/17/00	9:15a	19.5	19.5	19.8	19.4	0	0.4	NNE	0	900	77
3/17/00	9:30a	20.3	20.3	20.6	19.8	0	0.4	NNE	0	899.9	78
3/17/00	9:45a	21.1	21.1	21.5	20.6	0	0.9	NNE	0	899.9	79
3/17/00	10:00a	21.8	21.8	22.1	21.5	0	0.9	NNE	0	899.9	80
3/17/00	10:15a	21.6	21.6	22.1	21.4	0	0.9	N	0	899.9	79
3/17/00	10:30a	22	22	22.7	21.4	0.4	1.8	N	0	899.7	79
3/17/00	10:45a	21.3	21.3	21.4	21.2	0	1.3	NNW	0	899.6	77
3/17/00	11:00a	22.2	22.2	23.7	21.3	0	0.9	ESE	0	899.6	79
3/17/00	11:15a	21.2	21.2	21.5	20.9	0	0.4	ESE	0	899.6	77
3/17/00	11:30a	23	23	26.2	20.9	0	0.9	ESE	0	899.4	80
3/17/00	11:45a	26.1	26.1	27.6	23.9	0	1.8	N	0	899.3	85
3/17/00	12:00p	25.1	25.1	25.9	23.9	0.4	1.8	N	0	899.1	80
3/17/00	12:15p	23	23	23.9	22.7	0.4	1.8	N	0	899.1	74
3/17/00	12:30p	23.2	23.2	24.1	22.8	0	0.9	N	0	898.9	72
3/17/00	12:45p	24.7	24.7	26.2	23.4	0	0.9	N	0	898.7	74
3/17/00	1:00p	23.4	23.4	24.1	23.2	0	0	---	0	898.5	72
3/17/00	1:15p	23.8	23.8	25.1	22.8	0.4	1.8	SSW	0	898.4	72
3/17/00	1:30p	22.9	22.9	24.1	22.7	1.3	2.2	SSW	0	898.3	71
3/17/00	1:45p	24.9	24.9	25.4	24.1	0.9	2.2	SSW	0	898.2	73
3/17/00	2:00p	25.2	25.2	25.8	24.3	0.9	2.2	SSW	0	898.1	73
3/17/00	2:15p	24.3	24.3	25.2	23.7	0.4	1.8	SSW	0	898.1	71
3/17/00	2:30p	23.8	23.8	23.9	23.7	0	0.9	SSW	0	897.8	70
3/17/00	2:45p	23.6	23.6	24	23.2	0.4	1.3	SSW	0	897.7	70
3/17/00	3:00p	23.4	23.4	24	22.8	0	0.9	SSW	0	897.8	70
3/17/00	3:15p	22.4	22.4	22.7	22.2	0	0	---	0	898	70
3/17/00	3:30p	22.8	22.8	22.8	22.7	0.4	2.2	SSW	0	897.9	70
3/17/00	3:45p	22.7	22.7	22.8	22.6	0	0	---	0	898	71
3/17/00	4:00p	22.6	22.6	22.8	22.4	0	0	---	0	897.8	71
3/17/00	4:15p	22.9	22.9	23.2	22.7	0	0	---	0	897.9	72
3/17/00	4:30p	23.1	23.1	23.3	23	0	0	---	0	897.9	72
3/17/00	4:45p	23.1	23.1	23.3	22.9	0	0.9	ESE	0	897.6	72
3/17/00	5:00p	22.7	22.7	22.9	22.3	0.9	1.8	N	0	897.5	72
3/17/00	5:15p	22.3	22.3	22.7	22.1	0.4	1.3	N	0	897.5	72
3/17/00	5:30p	22.1	22.1	22.2	21.9	0	0.9	N	0	897.6	71
3/17/00	5:45p	22.1	22.1	22.2	21.8	0	0.9	N	0	897.6	72
3/17/00	6:00p	21.6	21.6	21.8	21.4	0.4	1.3	N	0	897.7	72
3/17/00	6:15p	21.3	21.3	21.4	21.3	0	0.9	N	0	897.8	72
3/17/00	6:30p	21.3	21.3	21.3	21.1	0	0.9	N	0	898	72
3/17/00	6:45p	21.1	21.1	21.2	20.9	0	0.4	N	0.2	898.1	72
3/17/00	7:00p	20.8	20.8	20.9	20.8	0	0	---	0	898.2	73
3/17/00	7:15p	20.7	20.7	20.8	20.5	0	0	---	0	898	73

Date	Time	Temp. Out	Wind Chill	Hi Temp	Low Temp	Wind Speed (m/s)			Rain	Bar	Hum In
		C°	C°	C°	C°	Avg	Hi	Dir	mm	mB	%
3/17/00	7:30p	20.3	20.3	20.5	20.2	0	0	---	0	897.9	73
3/17/00	7:45p	20.1	20.1	20.2	20	0	0	---	0	898.2	73
3/17/00	8:00p	20.1	20.1	20.1	19.9	0	0.9	N	0	898.5	74
3/17/00	8:15p	20.1	20.1	20.2	20.1	0	0.9	N	0	898.9	74
3/17/00	8:30p	20.2	20.2	20.2	20.1	0	0.9	N	0	898.9	75
3/17/00	8:45p	19.9	19.9	20.1	19.8	0	0	---	0	898.9	75
3/17/00	9:00p	19.7	19.7	19.8	19.7	0	0	---	0	898.9	75
3/17/00	9:15p	19.7	19.7	19.7	19.7	0	0	---	0	898.8	75
3/17/00	9:30p	19.6	19.6	19.7	19.3	0	0	---	0	898.8	75
3/17/00	9:45p	19.2	19.2	19.3	19.1	0	0	---	0	898.8	75
3/17/00	10:00p	19	19	19.1	18.9	0	0	---	0	898.8	75
3/17/00	10:15p	18.9	18.9	19.1	18.8	0	0	---	0	898.8	75
3/17/00	10:30p	19.1	19.1	19.1	19	0.4	0.9	N	0	898.6	76
3/17/00	10:45p	18.8	18.8	19	18.7	0	1.3	N	0	898.8	76
3/17/00	11:00p	18.7	18.7	18.7	18.6	0	0	---	0	898.9	76
3/17/00	11:15p	18.7	18.7	18.8	18.7	0	0.4	---	0	898.8	76
3/17/00	11:30p	19	19	19.2	18.8	0	0.4	N	0	898.8	76
3/17/00	11:45p	18.9	18.9	19.2	18.8	0	0.9	N	0	898.9	76
3/18/00	12:00a	18.8	18.8	18.8	18.8	0.4	0.9	N	0	898.8	77
3/18/00	12:15a	18.8	18.8	18.8	18.7	0	0	---	0	898.9	77
3/18/00	12:30a	18.6	18.6	18.7	18.6	0	0	---	0	898.8	77
3/18/00	12:45a	18.6	18.6	18.6	18.6	0	0	---	0	898.6	77
3/18/00	1:00a	18.7	18.7	18.8	18.6	0	0	---	0	898.5	77
3/18/00	1:15a	18.8	18.8	18.9	18.6	0	0.9	N	0	898.6	77
3/18/00	1:30a	18.7	18.7	18.8	18.6	0	0.4	N	0	898.5	77
3/18/00	1:45a	18.8	18.8	18.9	18.6	0	0	---	0	898.4	77
3/18/00	2:00a	18.3	18.3	18.6	18.2	0	0	---	0	898.4	77
3/18/00	2:15a	18.2	18.2	18.2	18.2	0	0	---	0	898.4	77
3/18/00	2:30a	18.1	18.1	18.2	18	0	0	---	0	898.2	77
3/18/00	2:45a	18.2	18.2	18.3	18.1	0	0	---	0	897.9	77
3/18/00	3:00a	18.7	18.7	18.9	18.3	0.4	0.9	WNW	0	897.8	78
3/18/00	3:15a	19.1	19.1	19.1	18.9	0.9	1.3	WSW	0	897.7	79
3/18/00	3:30a	19.1	19.1	19.1	19	0.9	1.3	WSW	0	897.6	79
3/18/00	3:45a	19.1	19.1	19.2	19.1	0.4	1.3	WSW	0	897.7	79
3/18/00	4:00a	19	19	19.1	18.9	0	0.9	SW	0	897.6	79
3/18/00	4:15a	18.7	18.7	18.9	18.6	0	0	---	0	897.7	79
3/18/00	4:30a	18.7	18.7	18.7	18.6	0.4	1.3	SW	0	897.6	80
3/18/00	4:45a	18.7	18.7	18.7	18.6	0.9	1.8	SW	0	897.6	80
3/18/00	5:00a	18.7	18.7	18.7	18.6	0.9	1.3	SSW	0	897.5	80
3/18/00	5:15a	18.6	18.6	18.6	18.4	0.9	1.3	SSW	0	897.6	81
3/18/00	5:30a	18.4	18.4	18.5	18.3	0.4	0.9	SSW	0	897.7	80
3/18/00	5:45a	18.1	18.1	18.3	17.9	0	0	---	0	897.5	80
3/18/00	6:00a	17.8	17.8	17.9	17.6	0	0	---	0	897.5	80
3/18/00	6:15a	17.8	17.8	17.8	17.8	0	0	---	0	897.6	80
3/18/00	6:30a	17.9	17.9	17.9	17.8	0.4	1.3	SSW	0	897.6	81
3/18/00	6:45a	17.9	17.9	17.9	17.9	0.9	1.3	SSW	0	897.8	81
3/18/00	7:00a	17.9	17.9	17.9	17.8	0.9	1.3	SSW	0	897.9	81
3/18/00	7:15a	17.8	17.8	17.8	17.8	0.9	1.3	SSW	0	897.9	82
3/18/00	7:30a	17.9	17.9	18.1	17.8	1.3	1.8	SSW	0	897.9	82
3/18/00	7:45a	18.2	18.2	18.3	18.1	1.3	1.8	SSW	0	898	83
3/18/00	8:00a	18.6	18.6	18.7	18.3	1.3	2.2	SSW	0	898.1	84
3/18/00	8:15a	18.9	18.9	19.2	18.7	0.9	1.8	SSW	0	898.2	84
3/18/00	8:30a	19.2	19.2	19.2	19.1	0.9	2.2	SSW	0	898.4	84
3/18/00	8:45a	19.4	19.4	19.7	19.2	0.9	1.3	SSW	0	898.4	84
3/18/00	9:00a	20	20	20.2	19.7	1.3	2.7	SSW	0	898.5	85
3/18/00	9:15a	20.3	20.3	20.5	20.2	1.8	3.1	SSW	0	898.5	85
3/18/00	9:30a	20.7	20.7	21.1	20.4	1.8	4.5	SSW	0	898.4	85
3/18/00	9:45a	21.7	21.7	22.6	21.1	1.8	3.6	SSW	0	898.5	85

Date	Time	Temp. Out	Wind Chill	Hi Temp	Low Temp	Wind Speed (m/s)			Rain	Bar	Hum In
		C°	C°	C°	C°	Avg	Hi	Dir	mm	mB	%
3/18/00	10:00a	22	21.4	22.6	21.7	2.2	4	SW	0	898.5	86
3/18/00	10:15a	22.1	22.1	22.3	21.8	1.8	3.6	SW	0	898.7	85
3/18/00	10:30a	22.8	22.8	23.5	22.3	1.3	2.2	SW	0	898.8	85
3/18/00	10:45a	24.6	24.6	25.1	23.6	1.3	2.7	SSW	0	898.6	87
3/18/00	11:00a	25.9	25.9	26.4	25.2	1.3	3.1	SW	0	898.5	88
3/18/00	11:15a	26.2	26.2	26.9	25.8	1.3	3.6	SSW	0	898.6	83
3/18/00	11:30a	27.1	27.1	27.8	25.9	1.3	2.2	SSW	0	898.7	80
3/18/00	11:45a	26.6	26.6	27.2	25.7	1.8	3.6	SSW	0	898.6	74
3/18/00	12:00p	26.9	26.6	27.4	26.2	2.2	4.5	SSW	0	898.6	70
3/18/00	12:15p	26.9	26.6	27.3	26.7	2.2	4	SSW	0	898.5	66
3/18/00	12:30p	27.2	26.9	27.5	26.8	2.2	3.6	SSW	0	898.5	63
3/18/00	12:45p	27.3	27.3	28.2	26.9	1.8	3.6	SSW	0	898.4	60
3/18/00	1:00p	26.7	26.3	27.2	26.1	2.2	4	SSW	0	898.3	56
3/18/00	1:15p	27.1	26.7	27.9	26.4	2.2	4	SSW	0	898.3	54
3/18/00	1:30p	27.8	27.6	28.3	27.2	2.2	4	SSW	0	898	54
3/18/00	1:45p	27.7	27.7	28.3	27.2	1.8	3.6	SSW	0	898	52
3/18/00	2:00p	28.6	28.6	29.4	26.9	1.3	3.1	SSW	0	897.7	51
3/18/00	2:15p	26.4	26.4	26.9	26.2	0.9	2.2	SSW	0	897.6	50
3/18/00	2:30p	26.3	26.3	26.4	26.1	1.3	2.7	SSW	0	897.2	51
3/18/00	2:45p	26.1	26.1	26.4	25.8	0.9	2.2	SSW	0	897	53
3/18/00	3:00p	25.9	25.9	26.1	25.6	0.9	1.8	S	0	896.9	54
3/18/00	3:15p	25.4	25.4	25.7	25.3	0.9	1.3	SW	0	896.7	55
3/18/00	3:30p	25.8	25.8	26.1	25.6	0.9	2.2	SSW	0	896.8	56
3/18/00	3:45p	25.7	25.7	26.4	25.1	1.3	2.7	SSW	0	896.8	56
3/18/00	4:00p	25.6	25.6	26.1	25.1	1.3	2.2	SSW	0	896.8	56
3/18/00	4:15p	26.3	26.3	26.4	26.1	1.8	2.7	SSW	0	896.8	57
3/18/00	4:30p	25.9	25.9	26.2	25.7	1.3	2.7	SSW	0	896.8	57
3/18/00	4:45p	26.8	26.8	27.5	25.9	0.9	1.8	SW	0	896.7	57
3/18/00	5:00p	26.1	26.1	27.4	25.2	0.9	2.2	SSW	0	896.7	56
3/18/00	5:15p	25.3	25.3	25.4	25	1.3	2.2	SSW	0	896.8	56
3/18/00	5:30p	25.2	25.2	25.3	25.1	1.3	2.2	SSW	0	897	56
3/18/00	5:45p	24.6	24.6	25.1	24.2	0.9	2.2	S	0	897.2	56
3/18/00	6:00p	24.2	24.2	24.5	24.1	0.9	1.8	SSW	0	897.2	57
3/18/00	6:15p	24.4	24.4	24.5	24.3	0.9	2.2	SSW	0	897.2	58
3/18/00	6:30p	23.8	23.8	24.3	23.4	0.9	1.8	SSW	0	897.3	58
3/18/00	6:45p	23.1	23.1	23.3	22.7	0.9	1.3	SSW	0	897.4	58
3/18/00	7:00p	22.4	22.4	22.7	22.1	0.9	0.9	SSW	0	897.4	58
3/18/00	7:15p	21.6	21.6	22.1	21.2	0.9	1.3	SSW	0	897.5	58
3/18/00	7:30p	21	21	21.2	20.9	1.3	1.3	SSW	0	897.6	59
3/18/00	7:45p	20.8	20.8	20.9	20.7	1.3	1.3	SSW	0	897.9	60
3/18/00	8:00p	20.8	20.8	20.9	20.8	0.9	1.3	SSW	0	897.8	61
3/18/00	8:15p	20.8	20.8	20.8	20.7	0.9	1.3	SSW	0	898.1	61
3/18/00	8:30p	20.7	20.7	20.7	20.7	0.9	1.3	SSW	0	898.1	62
3/18/00	8:45p	20.6	20.6	20.7	20.6	0.4	0.9	SSW	0	898.1	62
3/18/00	9:00p	20.4	20.4	20.6	20.2	0.4	0.9	SSW	0	898.3	63
3/18/00	9:15p	20.1	20.1	20.2	20.1	0.4	0.9	SSW	0	898.4	63
3/18/00	9:30p	20	20	20.1	19.9	0.4	0.9	SSW	0	898.4	63
3/18/00	9:45p	19.9	19.9	20	19.9	0.4	0.9	SSW	0	898.5	64
3/18/00	10:00p	19.8	19.8	19.9	19.7	0.4	0.9	SSW	0	898.5	64
3/18/00	10:15p	19.7	19.7	19.8	19.7	0.9	1.3	SSW	0	898.6	64
3/18/00	10:30p	19.8	19.8	19.9	19.8	0.4	0.9	SSW	0	898.7	65
3/18/00	10:45p	19.7	19.7	19.8	19.6	0.4	0.9	SSW	0	898.8	65
3/18/00	11:00p	19.6	19.6	19.6	19.6	0	0	---	0	898.8	65
3/18/00	11:15p	19.6	19.6	19.6	19.4	0	0	---	0	898.7	65
3/18/00	11:30p	19.3	19.3	19.4	19.3	0	0	---	0	898.8	65
3/18/00	11:45p	19.4	19.4	19.6	19.3	0	0	---	0	898.8	66
3/19/00	12:00a	19.5	19.5	19.5	19.4	0	0	---	0	898.7	66
3/19/00	12:15a	19.3	19.3	19.4	19.1	0	0	---	0	898.8	66

Date	Time	Temp. Out	Wind Chill	Hi Temp	Low Temp	Wind Speed (m/s)			Rain	Bar	Hum In
		C°	C°	C°	C°	Avg	Hi	Dir	mm	mB	%
3/19/00	12:30a	19	19	19.1	18.9	0	0	---	0	898.6	66
3/19/00	12:45a	19.2	19.2	19.4	19	0	0	---	0	898.6	67
3/19/00	1:00a	19.2	19.2	19.4	19	0	0	---	0	898.4	67
3/19/00	1:15a	19	19	19.1	18.9	0	0	---	0	898.4	68
3/19/00	1:30a	18.8	18.8	19	18.7	0	0	---	0	898.3	68
3/19/00	1:45a	18.9	18.9	19	18.8	0	0	---	0	898.1	68
3/19/00	2:00a	18.8	18.8	19	18.7	0	0	---	0	898.1	68
3/19/00	2:15a	18.7	18.7	18.8	18.7	0	0	---	0	898	68
3/19/00	2:30a	18.8	18.8	18.9	18.7	0	0	---	0	897.8	69
3/19/00	2:45a	18.8	18.8	18.9	18.8	0	0	---	0	897.7	69
3/19/00	3:00a	19	19	19	18.9	0	0	---	0	897.6	69
3/19/00	3:15a	19.1	19.1	19.2	19	0	0	---	0	897.7	69
3/19/00	3:30a	19.2	19.2	19.2	19.1	0	0	---	0	897.4	69
3/19/00	3:45a	19.1	19.1	19.2	19	0	0	---	0	897.3	70
3/19/00	4:00a	18.9	18.9	19	18.8	0	0	---	0	897.4	69
3/19/00	4:15a	18.7	18.7	18.8	18.6	0	0	---	0	897.4	70
3/19/00	4:30a	18.7	18.7	18.7	18.6	0	0	---	0	897.3	70
3/19/00	4:45a	18.5	18.5	18.6	18.4	0	0	---	0	897.3	69
3/19/00	5:00a	18.3	18.3	18.4	18.3	0	0	---	0	897.4	70
3/19/00	5:15a	18.2	18.2	18.2	18.1	0	0	---	0	897.4	70
3/19/00	5:30a	18.3	18.3	18.4	18.2	0	0	---	0	897.5	70
3/19/00	5:45a	18.5	18.5	18.5	18.4	0	0	---	0	897.7	70
3/19/00	6:00a	18.1	18.1	18.4	17.9	0	0	---	0	897.8	70
3/19/00	6:15a	18.1	18.1	18.2	18	0	0	---	0	897.8	70
3/19/00	6:30a	18.1	18.1	18.2	18	0	0	---	0	897.8	71
3/19/00	6:45a	17.9	17.9	18.1	17.9	0	0	---	0	897.8	71
3/19/00	7:00a	18.2	18.2	18.3	18.1	0	0	---	0	898	71
3/19/00	7:15a	18.2	18.2	18.3	18.2	0	0	---	0	898.1	71
3/19/00	7:30a	18.2	18.2	18.3	18.1	0	0	---	0	898.3	71
3/19/00	7:45a	18.3	18.3	18.4	18.3	0	0	---	0	898.4	72
3/19/00	8:00a	18.6	18.6	18.7	18.4	0	0	---	0	898.5	72
3/19/00	8:15a	18.9	18.9	19.1	18.7	0	0	---	0	898.7	72
3/19/00	8:30a	19.3	19.3	19.6	19.1	0	0	---	0	898.6	72
3/19/00	8:45a	20.2	20.2	20.9	19.6	0	0	---	0	898.6	73
3/19/00	9:00a	21.2	21.2	21.3	21	0	0	---	0	898.6	75
3/19/00	9:15a	21.3	21.3	21.4	21.2	0	0	---	0	898.6	74
3/19/00	9:30a	21.6	21.6	22	21.4	0	0	---	0	898.6	73
3/19/00	9:45a	22.9	22.9	23.3	22.1	0.4	1.3	E	0	898.5	74
3/19/00	10:00a	23.5	23.5	24	23.2	0.4	1.3	E	0	898.6	74
3/19/00	10:15a	23.4	23.4	23.9	22.9	0.4	1.3	NNW	0	898.7	74
3/19/00	10:30a	23.1	23.1	23.4	22.7	0	1.3	E	0	898.6	73
3/19/00	10:45a	24.7	24.7	25.9	23.5	0.4	1.3	E	0	898.5	75
3/19/00	11:00a	25.3	25.3	25.8	24.9	0.4	1.3	N	0	898.4	75
3/19/00	11:15a	27.4	27.4	28.3	26.1	0.9	2.2	N	0	898.4	75
3/19/00	11:30a	28.3	28.3	29	27.1	0.9	2.7	N	0	898.5	73
3/19/00	11:45a	28.8	28.8	29.8	28.1	0.4	2.2	N	0	898.5	70
3/19/00	12:00p	29.9	29.9	30.6	29.2	0.9	2.2	N	0	898.4	67
3/19/00	12:15p	28.9	28.9	29.6	27.6	0.9	2.2	N	0	898.4	63
3/19/00	12:30p	29.2	29.2	30.1	28.1	0.4	1.8	N	0	898.1	61
3/19/00	12:45p	28.2	28.2	30	25.6	0.9	2.7	N	0	897.8	58
3/19/00	1:00p	24.6	24.6	25.6	22.9	0.4	1.8	N	0.4	897.6	54
3/19/00	1:15p	21.6	21.6	22.8	21.1	0.4	1.3	N	3.6	897.4	52
3/19/00	1:30p	20.8	20.8	21.1	20.7	0.4	1.3	NNE	2.6	896.9	55
3/19/00	1:45p	20.9	20.9	20.9	20.7	0	1.8	SW	1	896.8	59
3/19/00	2:00p	19.2	19.2	20.5	18.2	0.4	1.8	SE	8.2	896.8	60
3/19/00	2:15p	18.2	18.2	18.3	18.1	0	0.4	---	0.6	897	62
3/19/00	2:30p	18.3	18.3	18.5	18.2	0	0	---	0.8	896.9	64
3/19/00	2:45p	18	18	18.2	17.9	0	0	---	0	897	65

Date	Time	Temp. Out	Wind Chill	Hi Temp	Low Temp	Wind Speed (m/s)			Rain	Bar	Hum In
		C°	C°	C°	C°	Avg	Hi	Dir	mm	mB	%
3/19/00	3:00p	17.7	17.7	18	17.3	0	0	---	0	896.9	66
3/19/00	3:15p	17.3	17.3	17.4	17.3	0	0	---	0	897	67
3/19/00	3:30p	17.4	17.4	17.8	17.3	0	0	---	0	896.5	68
3/19/00	3:45p	18.1	18.1	18.1	17.8	0	0	---	0	896.3	69
3/19/00	4:00p	18.2	18.2	18.3	18.1	0	0	---	0	896.4	69
3/19/00	4:15p	18.4	18.4	18.6	18.3	0	0	---	0.2	896.6	70
3/19/00	4:30p	18.4	18.4	18.7	17.9	0.4	1.8	SSE	0	896.8	71
3/19/00	4:45p	17.7	17.7	17.9	17.2	0.9	2.2	SSE	0	896.9	72
3/19/00	5:00p	17.1	17.1	17.3	16.9	1.3	3.1	S	0	896.8	73
3/19/00	5:15p	16.9	16.9	17.1	16.9	0.4	1.3	SSE	0.2	896.9	73
3/19/00	5:30p	17.1	17.1	17.1	17	0.4	0.9	SSE	0.6	897	74
3/19/00	5:45p	17.1	17.1	17.1	17	0	0	---	0	897	74
3/19/00	6:00p	17.2	17.2	17.2	17.1	0	0	---	0.8	897.4	74
3/19/00	6:15p	17.2	17.2	17.3	17.2	0	0	---	0.4	897.4	74
3/19/00	6:30p	17.2	17.2	17.3	17.2	0	0	---	0	897.5	75
3/19/00	6:45p	17.2	17.2	17.3	17.2	0	0.9	SSE	0	897.4	75
3/19/00	7:00p	17.2	17.2	17.2	17.2	0	0.9	SSE	0.6	897.4	75
3/19/00	7:15p	17.3	17.3	17.3	17.2	0	0	---	0.4	897.1	75
3/19/00	7:30p	17.2	17.2	17.3	17.2	0	0.4	SSE	0	897.4	75
3/19/00	7:45p	17.2	17.2	17.2	17.2	0	0.9	SSE	0	897.5	76
3/19/00	8:00p	17.2	17.2	17.2	17.2	0	0.9	SSE	0	897.3	76
3/19/00	8:15p	17.2	17.2	17.2	17.2	0	0	---	0	897.2	76
3/19/00	8:30p	17.2	17.2	17.2	17.2	0	0	---	0	897.5	76
3/19/00	8:45p	17.2	17.2	17.2	17.2	0	0	---	0	897.3	76
3/19/00	9:00p	17.2	17.2	17.2	17.2	0	0	---	0	897.4	76
3/19/00	9:15p	17.1	17.1	17.2	17.1	0	0	---	0	897.4	76
3/19/00	9:30p	17.1	17.1	17.2	17.1	0	0	---	0	897.4	76
3/19/00	9:45p	17.2	17.2	17.3	17.1	0	0	---	0	897.5	76
3/19/00	10:00p	17.2	17.2	17.3	17.2	0	0	---	0	897.6	76
3/19/00	10:15p	17.2	17.2	17.3	17.2	0	0	---	0	897.5	76
3/19/00	10:30p	17.1	17.1	17.2	17	0	0	---	0.2	897.3	77
3/19/00	10:45p	16.9	16.9	17.1	16.9	0	0.9	SSE	0	897.1	77
3/19/00	11:00p	16.8	16.8	16.9	16.7	0	0.9	SSE	0	897	77
3/19/00	11:15p	16.6	16.6	16.7	16.6	0	0.4	SSE	0	896.8	77
3/19/00	11:30p	16.6	16.6	16.7	16.6	0	0.9	SSE	0	896.6	77
3/19/00	11:45p	16.7	16.7	16.7	16.6	0.4	1.8	SSE	0	896.6	78
3/20/00	12:00a	16.6	16.6	16.7	16.6	0.4	1.3	SSE	0	896.4	78
3/20/00	12:15a	16.6	16.6	16.6	16.6	0.4	1.3	S	0	896.1	79
3/20/00	12:30a	16.5	16.5	16.6	16.4	0	0.4	S	0	895.9	78
3/20/00	12:45a	16.6	16.6	16.6	16.4	0	0.9	S	0	895.9	79
3/20/00	1:00a	16.6	16.6	16.7	16.6	0	0.9	S	0	895.7	79
3/20/00	1:15a	16.4	16.4	16.6	16.3	0.4	0.9	S	0	895.6	79
3/20/00	1:30a	16.2	16.2	16.3	16	0	0	---	0	895.5	79
3/20/00	1:45a	15.9	15.9	16	15.9	0	0	---	0	895.4	79
3/20/00	2:00a	15.8	15.8	15.9	15.7	0	0	---	0	895.2	79
3/20/00	2:15a	15.7	15.7	15.7	15.7	0	0	---	0	895.2	80
3/20/00	2:30a	15.8	15.8	15.9	15.7	0	0	---	0	895	80
3/20/00	2:45a	15.9	15.9	15.9	15.9	0	1.3	S	0	895	81
3/20/00	3:00a	16	16	16	15.9	0.9	1.3	S	0	894.8	81
3/20/00	3:15a	16	16	16.1	16	0.9	1.3	SSW	0	894.7	81
3/20/00	3:30a	15.9	15.9	16	15.9	0.9	1.3	SSW	0	894.6	82
3/20/00	3:45a	15.9	15.9	16	15.9	0.9	1.3	SSW	0	894.4	82
3/20/00	4:00a	15.9	15.9	16	15.9	0.9	1.3	SSW	0	894.4	82
3/20/00	4:15a	15.9	15.9	16	15.9	0.9	1.8	SSW	0	894.4	82
3/20/00	4:30a	16	16	16	15.9	1.3	1.8	SSW	0	894.4	82
3/20/00	4:45a	16.1	16.1	16.1	16	1.3	1.8	SSW	0	894.4	83
3/20/00	5:00a	16	16	16.1	16	0.9	1.3	SSW	0	894.4	83
3/20/00	5:15a	16	16	16.1	16	0.9	1.8	SSW	0	894.5	83

Date	Time	Temp. Out	Wind Chill	Hi Temp	Low Temp	Wind Speed (m/s)			Rain	Bar	Hum In
		C°	C°	C°	C°	Avg	Hi	Dir	mm	mB	%
3/20/00	5:30a	16.2	16.2	16.3	16.1	1.3	1.8	SSW	0	894.7	83
3/20/00	5:45a	16.2	16.2	16.2	16.2	0.9	1.8	SSW	0	894.5	83
3/20/00	6:00a	16.2	16.2	16.2	16.1	0.9	1.3	SSW	0	894.6	83
3/20/00	6:15a	16.2	16.2	16.3	16.1	0.9	1.3	SSW	0	894.5	84
3/20/00	6:30a	16.3	16.3	16.4	16.3	0.9	1.3	SSW	0	894.7	84
3/20/00	6:45a	16.4	16.4	16.5	16.4	1.3	2.2	SSW	0	894.7	84
3/20/00	7:00a	16.6	16.6	16.7	16.5	1.8	2.7	SSW	0	894.7	85
3/20/00	7:15a	16.7	15.8	16.8	16.7	2.2	3.1	SSW	0	894.8	85
3/20/00	7:30a	16.8	15.9	16.9	16.7	2.2	3.6	SSW	0	895	86
3/20/00	7:45a	16.9	16.9	16.9	16.9	1.8	3.6	SSW	0	895	86
3/20/00	8:00a	16.9	16.9	16.9	16.8	1.8	2.7	SSW	0	895.2	86
3/20/00	8:15a	17	17	17.2	16.9	1.8	3.1	SSW	0	895.3	86
3/20/00	8:30a	17.2	17.2	17.2	17.2	1.8	2.7	SSW	0	895.4	87
3/20/00	8:45a	17.3	17.3	17.4	17.3	1.3	2.7	SSW	0	895.3	87
3/20/00	9:00a	17.6	17.6	17.8	17.3	1.8	2.2	SSW	0	895.4	87
3/20/00	9:15a	17.9	17.9	17.9	17.8	1.8	3.1	SSW	0	895.6	88
3/20/00	9:30a	17.5	17.5	17.8	17.2	1.8	2.2	SSW	0	895.6	87
3/20/00	9:45a	17.1	17.1	17.2	17	1.8	2.7	SSW	0	895.5	87
3/20/00	10:00a	17.4	17.4	17.5	17.3	1.8	2.7	SSW	0	895.3	87
3/20/00	10:15a	17.7	17.7	17.8	17.4	1.8	2.7	SSW	0	895.3	88
3/20/00	10:30a	17.9	17.9	17.9	17.8	1.3	2.2	SSW	0	895.2	88
3/20/00	10:45a	18.1	18.1	18.5	17.8	1.3	2.7	SSW	0	895.3	88
3/20/00	11:00a	18.9	18.9	19.1	18.6	0.9	1.8	SSW	0	895.4	89
3/20/00	11:15a	18.6	18.6	19.1	18.3	1.3	2.7	SSW	0	895.4	89
3/20/00	11:30a	18.3	18.3	18.4	18.3	1.3	2.7	SSW	0	895.5	88
3/20/00	11:45a	18.6	18.6	18.7	18.4	1.3	3.6	SSW	0	895.5	88
3/20/00	12:00p	18.4	18.4	18.5	18.3	1.3	2.2	SSW	0	895.4	87
3/20/00	12:15p	18.3	18.3	18.4	18.3	0.4	1.8	SSW	0	895.4	87
3/20/00	12:30p	18	18	18.2	17.8	0.9	1.8	SSW	0	895.2	86
3/20/00	12:45p	17.8	17.8	18	17.6	0.9	1.8	SSW	0	895.2	86
3/20/00	1:00p	17.8	17.8	18.1	17.6	0.9	1.8	SSW	0	895.2	87
3/20/00	1:15p	17.6	17.6	17.7	17.5	0.4	1.8	SSW	0.8	894.7	87
3/20/00	1:30p	17.7	17.7	17.8	17.6	0.9	1.3	SSW	0	894.7	87
3/20/00	1:45p	17.9	17.9	18	17.8	0.9	1.8	SSW	0	894.6	87
3/20/00	2:00p	17.9	17.9	17.9	17.8	0.4	1.3	SSW	0	894.6	88
3/20/00	2:15p	17.7	17.7	17.8	17.6	0.9	1.8	SSW	0.2	894.7	88
3/20/00	2:30p	17.7	17.7	17.7	17.6	0.4	0.9	SSW	0	894.5	88
3/20/00	2:45p	17.7	17.7	17.8	17.4	0	0.9	SSW	0.2	894.3	88
3/20/00	3:00p	17.4	17.4	17.5	17.4	0	0	---	0.6	894.3	88
3/20/00	3:15p	17.4	17.4	17.5	17.4	0	0	---	0.4	894.2	88
3/20/00	3:30p	17.3	17.3	17.4	17.2	0	1.3	SSW	0.4	894.3	88
3/20/00	3:45p	17.2	17.2	17.2	17.1	0	0.9	SSW	1	894.2	87
3/20/00	4:00p	17.1	17.1	17.1	17	0	0	---	1	893.9	87
3/20/00	4:15p	17.1	17.1	17.1	17.1	0	0.4	SSW	0.4	894.1	88
3/20/00	4:30p	17	17	17.1	16.8	0.4	1.8	SSW	1.8	894.2	88
3/20/00	4:45p	16.8	16.8	16.9	16.7	0.4	2.2	S	2.2	894.3	88
3/20/00	5:00p	16.4	16.4	16.7	16.3	0.9	1.8	SSW	2.2	894.6	88
3/20/00	5:15p	15.5	15.5	16.4	14.6	0.4	1.8	ENE	1.8	894.9	87
3/20/00	5:30p	14.3	14.3	14.6	14.2	0.4	1.8	ESE	1.6	894.8	85
3/20/00	5:45p	14.1	14.1	14.2	14.1	0.4	1.8	NW	0.4	895.2	85
3/20/00	6:00p	14	14	14.1	13.9	0.4	1.3	ENE	3	895.3	86
3/20/00	6:15p	13.9	13.9	14	13.9	0	1.3	N	1.6	895.7	86
3/20/00	6:30p	13.8	13.8	13.9	13.7	0.9	3.6	N	0.6	895.2	87
3/20/00	6:45p	13.7	13.7	13.7	13.6	0.4	1.3	NNW	0.2	895.7	87
3/20/00	7:00p	13.7	13.7	13.8	13.6	0.4	1.8	N	0	895.8	87
3/20/00	7:15p	13.6	13.6	13.7	13.6	0.4	1.8	ENE	0.2	896	88
3/20/00	7:30p	13.5	13.5	13.6	13.4	0.9	2.2	N	0	896.4	88
3/20/00	7:45p	13.5	13.5	13.5	13.4	0.9	1.8	ESE	0	896.8	88

Date	Time	Temp. Out	Wind Chill	Hi Temp	Low Temp	Wind Speed (m/s)			Rain	Bar	Hum In
		C°	C°	C°	C°	Avg	Hi	Dir	mm	mB	%
3/20/00	8:00p	13.2	13.2	13.4	13.1	0.9	1.3	ESE	0	896.8	88
3/20/00	8:15p	12.9	12.9	13.1	12.8	0.4	2.2	E	0.2	896.8	88
3/20/00	8:30p	12.6	12.6	12.8	12.4	1.3	3.1	N	0	896.2	88
3/20/00	8:45p	12.4	12.4	12.6	12.3	0.9	4	E	0	896.7	88
3/20/00	9:00p	12.3	12.3	12.3	12.2	0.9	2.2	SE	0	897.7	88
3/20/00	9:15p	12.2	12.2	12.3	12.2	1.3	3.1	E	0	897.8	88
3/20/00	9:30p	12.2	12.2	12.2	12.2	0.4	1.8	ESE	0	897.8	89
3/20/00	9:45p	12.2	12.2	12.2	12.1	0	1.3	ESE	0	898.1	89
3/20/00	10:00p	12.2	12.2	12.3	12.2	0	0.4	ESE	0	898	89
3/20/00	10:15p	12.1	12.1	12.2	12.1	0.4	1.8	N	0.2	897.5	89
3/20/00	10:30p	12.1	12.1	12.1	12	0.9	1.8	E	0	897.9	89
3/20/00	10:45p	11.9	11.9	12.1	11.9	0.9	1.8	ENE	0	897.9	89
3/20/00	11:00p	11.9	11.9	12.1	11.9	0.4	1.3	ENE	0	897.5	89
3/20/00	11:15p	11.8	11.8	11.9	11.8	0.4	3.1	NW	0	897.7	89
3/20/00	11:30p	11.8	11.8	11.9	11.8	0.4	2.2	ENE	0	897.7	89
3/20/00	11:45p	11.7	11.7	11.8	11.7	0.9	2.2	ENE	0	897.9	89
3/21/00	12:00a	11.7	11.7	11.8	11.6	0.4	1.3	ENE	0	897.7	89
3/21/00	12:15a	11.6	11.6	11.6	11.5	0.4	1.8	E	0	897.9	89
3/21/00	12:30a	11.5	11.5	11.6	11.4	0.4	1.8	E	0	897.4	89
3/21/00	12:45a	11.4	11.4	11.4	11.3	0.9	1.8	E	0	897.6	89
3/21/00	1:00a	11.4	11.4	11.4	11.4	0.9	1.8	SE	0	897.9	89
3/21/00	1:15a	11.4	11.4	11.4	11.3	0.4	1.8	ENE	0.2	897.1	90
3/21/00	1:30a	11.3	11.3	11.4	11.3	0.9	2.2	ESE	0	897.6	90
3/21/00	1:45a	11.3	11.3	11.3	11.3	0.4	1.8	E	0	896.6	90
3/21/00	2:00a	11.3	11.3	11.4	11.2	0.4	1.3	SE	0	897.5	90
3/21/00	2:15a	11.3	11.3	11.3	11.2	0.4	1.3	SE	0	896.8	90
3/21/00	2:30a	11.2	11.2	11.3	11.2	0.4	1.3	NE	0	897.3	90
3/21/00	2:45a	11.2	11.2	11.3	11.2	0.4	1.3	ENE	0	897.4	90
3/21/00	3:00a	11.1	11.1	11.2	10.9	0.9	1.8	E	0	897.1	90
3/21/00	3:15a	10.9	10.9	10.9	10.8	0.9	2.2	E	0	897.2	90
3/21/00	3:30a	10.8	10.8	10.8	10.7	0.9	1.8	ESE	0	897.3	90
3/21/00	3:45a	10.8	10.8	10.8	10.7	0.9	1.8	E	0	897.5	90
3/21/00	4:00a	10.7	10.7	10.7	10.7	0.9	1.8	SE	0	897.2	90
3/21/00	4:15a	10.7	10.7	10.7	10.7	0.4	1.3	E	0	897.1	90
3/21/00	4:30a	10.8	10.8	10.9	10.7	0.4	1.8	E	0	897.1	90
3/21/00	4:45a	10.9	10.9	10.9	10.8	0.9	2.2	ESE	0	897.1	90
3/21/00	5:00a	10.9	10.9	10.9	10.9	0.9	1.8	E	0.2	897.3	91
3/21/00	5:15a	11	11	11	10.9	0.9	1.8	ESE	0	897.4	91
3/21/00	5:30a	10.9	10.9	11	10.9	1.3	3.6	ESE	0	897.4	91
3/21/00	5:45a	10.9	10.9	10.9	10.8	0.9	2.2	SE	0.4	897.4	91
3/21/00	6:00a	10.8	10.8	10.8	10.8	0.4	1.8	E	0.6	897.5	91
3/21/00	6:15a	10.7	10.7	10.8	10.7	0.9	2.2	E	0.2	897.5	91
3/21/00	6:30a	10.7	10.7	10.7	10.6	0	1.8	E	0.4	897.7	91
3/21/00	6:45a	10.6	10.6	10.6	10.5	0.9	1.8	ESE	0.6	897.9	91
3/21/00	7:00a	10.6	10.6	10.7	10.5	0.9	1.8	E	0	898	91
3/21/00	7:15a	10.7	10.7	10.8	10.7	0.9	1.8	ESE	0	898.3	91
3/21/00	7:30a	10.7	10.7	10.8	10.6	0.9	1.8	SE	0	898.3	91
3/21/00	7:45a	10.6	10.6	10.7	10.6	1.3	2.2	SSE	0.2	898.5	91
3/21/00	8:00a	10.8	10.8	10.8	10.7	0.9	1.8	SSE	0	898.6	91
3/21/00	8:15a	10.8	10.8	10.9	10.8	0.4	1.8	SSE	0	898.8	91
3/21/00	8:30a	10.9	10.9	10.9	10.8	0.9	1.8	SE	0.2	898.7	92
3/21/00	8:45a	11.1	11.1	11.2	10.9	1.3	3.1	ESE	0.4	898.9	92
3/21/00	9:00a	11.2	11.2	11.2	11.1	1.3	2.7	ESE	0.6	899	92
3/21/00	9:15a	11.2	11.2	11.2	11.1	1.3	4.9	ESE	0.6	899.1	92
3/21/00	9:30a	11.2	11.2	11.3	11.2	1.3	4	SE	0.4	899.3	92
3/21/00	9:45a	11.2	11.2	11.3	11.2	1.8	4.5	SSE	0.4	899.5	92
3/21/00	10:00a	11.2	11.2	11.3	11.2	1.8	3.1	SE	0.4	899.6	92
3/21/00	10:15a	11.2	11.2	11.3	11.2	1.3	3.1	SE	1	899.7	92

Date	Time	Temp. Out	Wind Chill	Hi Temp	Low Temp	Wind Speed (m/s)			Rain	Bar	Hum In
		C°	C°	C°	C°	Avg	Hi	Dir	mm	mB	%
3/21/00	10:30a	11.3	11.3	11.3	11.2	1.3	2.7	SE	1	900	92
3/21/00	10:45a	11.3	11.3	11.3	11.3	1.3	2.7	SE	0.4	900	93
3/21/00	11:00a	11.4	11.4	11.4	11.3	1.3	3.1	SE	0.6	899.9	93
3/21/00	11:15a	11.4	11.4	11.5	11.4	1.3	2.2	SSE	0.4	900.1	93
3/21/00	11:30a	11.5	11.5	11.6	11.5	1.3	2.2	ESE	0.6	899.9	93
3/21/00	11:45a	11.6	11.6	11.7	11.6	1.3	2.7	SE	0.4	900	93
3/21/00	12:00p	11.6	11.6	11.6	11.5	1.3	2.7	ESE	0.4	900.1	93
3/21/00	12:15p	11.6	11.6	11.7	11.6	1.3	2.2	ESE	0.2	900	93
3/21/00	12:30p	11.7	11.7	11.8	11.7	0.9	2.2	SE	0.4	899.7	93
3/21/00	12:45p	11.9	11.9	11.9	11.8	0.4	1.3	E	0.4	899.7	93
3/21/00	1:00p	11.9	11.9	12.1	11.9	0.9	1.3	E	0.2	899.4	93
3/21/00	1:15p	11.9	11.9	12.1	11.8	0.9	2.2	SE	0.6	899.5	93
3/21/00	1:30p	11.9	11.9	12	11.8	0.4	1.3	ESE	0.8	899.6	93
3/21/00	1:45p	11.8	11.8	12	11.7	1.3	3.1	ESE	0.4	899.6	93
3/21/00	2:00p	11.6	11.6	11.7	11.6	0.9	2.2	E	0.2	899.5	93
3/21/00	2:15p	11.5	11.5	11.6	11.4	0.9	1.8	E	0.4	899.5	93
3/21/00	2:30p	11.4	11.4	11.5	11.4	0.9	2.7	ENE	0.2	899.5	93
3/21/00	2:45p	11.4	11.4	11.5	11.4	0.9	1.8	E	0.6	899.2	93
3/21/00	3:00p	11.6	11.6	11.7	11.5	0.9	2.2	E	0.4	899.2	93
3/21/00	3:15p	11.5	11.5	11.6	11.4	1.3	2.2	ENE	0.4	899.2	93
3/21/00	3:30p	11.4	11.4	11.5	11.4	0.9	2.2	E	0.4	899.2	93
3/21/00	3:45p	11.4	11.4	11.5	11.3	0.9	2.7	E	0.4	899.4	93
3/21/00	4:00p	11.2	11.2	11.3	11.2	1.3	2.7	E	0.2	899.2	93
3/21/00	4:15p	11.2	11.2	11.3	11.2	0.9	1.8	E	0.4	899.4	93
3/21/00	4:30p	11.2	11.2	11.3	11.1	1.3	2.7	E	0.6	899.4	93
3/21/00	4:45p	10.8	10.8	11.1	10.6	1.3	4	E	0.4	899.7	93
3/21/00	5:00p	10.4	10.4	10.6	10.2	1.3	4	ENE	0	899.8	92
3/21/00	5:15p	10.2	10.2	10.3	10.2	1.3	3.1	ENE	0.2	899.9	92
3/21/00	5:30p	10.2	10.2	10.2	10.1	0.9	3.1	ENE	0.2	900	92
3/21/00	5:45p	10.2	10.2	10.2	10.2	1.3	4	E	0	900.1	92
3/21/00	6:00p	10.2	10.2	10.2	10.2	1.3	4.5	E	0.2	900.3	93
3/21/00	6:15p	10.1	10.1	10.2	10	1.3	4	ENE	0	900.5	93
3/21/00	6:30p	10	10	10.1	10	1.3	3.1	E	0.2	900.5	93
3/21/00	6:45p	9.9	9.9	9.9	9.8	1.3	3.1	ENE	0	900.7	93
3/21/00	7:00p	9.8	9.8	9.8	9.7	0.9	2.7	ENE	0	900.7	93
3/21/00	7:15p	9.7	9.7	9.7	9.6	0.9	3.6	E	0.2	900.7	92
3/21/00	7:30p	9.7	9.7	9.7	9.7	0.9	2.7	ENE	0.2	900.8	93
3/21/00	7:45p	9.7	9.7	9.7	9.6	0.9	3.1	ENE	0	901	93
3/21/00	8:00p	9.4	9.4	9.6	9.3	0.9	2.2	E	0	901.1	93
3/21/00	8:15p	9.3	9.3	9.3	9.2	0.9	3.1	ENE	0.2	901.1	92
3/21/00	8:30p	9.3	9.3	9.4	9.2	0.9	3.1	N	0	901.1	92
3/21/00	8:45p	9.5	9.5	9.6	9.4	0.9	2.7	E	0	901.1	93
3/21/00	9:00p	9.6	9.6	9.6	9.6	0.9	2.7	ENE	0.2	901.1	93
3/21/00	9:15p	9.6	9.6	9.7	9.6	0.9	2.7	NE	0	901.1	93
3/21/00	9:30p	9.7	9.7	9.7	9.7	0.9	2.7	ENE	0.2	901.3	93
3/21/00	9:45p	9.7	9.7	9.8	9.7	1.3	3.6	ENE	0.2	901.5	94
3/21/00	10:00p	9.7	9.7	9.7	9.7	0.9	3.1	ENE	0	901.5	94
3/21/00	10:15p	9.7	9.7	9.7	9.6	0.9	3.1	ENE	0.2	901.4	94
3/21/00	10:30p	9.7	9.7	9.7	9.7	1.3	3.6	ENE	0	901.5	94
3/21/00	10:45p	9.7	9.7	9.7	9.6	0.9	3.6	ENE	0	901.3	94
3/21/00	11:00p	9.5	9.5	9.6	9.4	0.9	3.6	E	0	901.4	94
3/21/00	11:15p	9.4	9.4	9.5	9.4	0.9	2.2	E	0	901.3	94
3/21/00	11:30p	9.4	9.4	9.4	9.4	0.9	2.7	ENE	0	901.2	94
3/21/00	11:45p	9.4	9.4	9.5	9.4	0.9	2.7	ENE	0	901	94
3/22/00	12:00a	9.5	9.5	9.5	9.4	1.3	3.1	E	0	900.9	94
3/22/00	12:15a	9.4	9.4	9.5	9.3	1.3	2.2	E	0	900.5	94
3/22/00	12:30a	9.3	9.3	9.4	9.3	0.9	2.7	ENE	0	900.5	94
3/22/00	12:45a	9.3	9.3	9.3	9.3	0.9	2.7	ENE	0	900.2	94

Date	Time	Temp. Out	Wind Chill	Hi Temp	Low Temp	Wind Speed (m/s)			Rain	Bar	Hum In
		C°	C°	C°	C°	Avg	Hi	Dir	mm	mB	%
3/22/00	1:00a	9.3	9.3	9.3	9.2	0.9	2.2	E	0	900.1	94
3/22/00	1:15a	9.3	9.3	9.3	9.2	0.9	2.2	E	0	900	93
3/22/00	1:30a	9.3	9.3	9.3	9.3	0.4	2.2	W	0	899.9	94
3/22/00	1:45a	9.3	9.3	9.3	9.3	0.9	2.2	ENE	0	899.7	94
3/22/00	2:00a	9.4	9.4	9.4	9.3	0.9	4.5	N	0	899.7	94
3/22/00	2:15a	9.4	9.4	9.4	9.4	0.9	2.7	E	0	899.6	94
3/22/00	2:30a	9.4	9.4	9.5	9.4	0.9	3.1	ENE	0	899.4	94
3/22/00	2:45a	9.6	9.6	9.6	9.6	1.3	4	ENE	0	899.1	94
3/22/00	3:00a	9.7	9.7	9.7	9.6	1.3	3.6	ENE	0	899.1	94
3/22/00	3:15a	9.7	9.7	9.7	9.6	1.3	2.7	ENE	0	899.1	94
3/22/00	3:30a	9.5	9.5	9.6	9.4	1.3	4.5	ENE	0.2	899	94
3/22/00	3:45a	9.4	9.4	9.4	9.4	1.3	4.5	E	0	898.9	94
3/22/00	4:00a	9.3	9.3	9.4	9.2	0.9	2.7	ENE	0	898.7	94
3/22/00	4:15a	9.2	9.2	9.2	9.2	0.9	3.6	E	0	898.5	94
3/22/00	4:30a	9.1	9.1	9.2	9	0.9	2.2	ENE	0	898.5	94
3/22/00	4:45a	9	9	9.1	8.9	0.9	1.8	ENE	0	898.3	94
3/22/00	5:00a	8.9	8.9	8.9	8.8	1.3	2.2	E	0.2	898.2	94
3/22/00	5:15a	8.9	8.9	8.9	8.8	1.3	2.7	E	0	898.1	94
3/22/00	5:30a	9	9	9.1	8.9	0.9	2.2	E	0.2	898.2	94
3/22/00	5:45a	9	9	9	9	0.9	2.7	E	0	898.2	94
3/22/00	6:00a	9	9	9	9	0.9	2.2	ENE	0	898	94
3/22/00	6:15a	9.1	9.1	9.1	9	1.3	3.1	E	0.2	897.9	94
3/22/00	6:30a	9.1	9.1	9.1	9.1	1.3	2.2	E	0	898	94
3/22/00	6:45a	9.2	9.2	9.3	9.1	0.9	2.7	E	0	898	94
3/22/00	7:00a	9.4	9.4	9.6	9.3	1.3	2.2	E	0.2	897.8	94
3/22/00	7:15a	9.7	9.7	9.8	9.6	1.3	2.7	E	0.2	897.8	95
3/22/00	7:30a	9.7	9.7	9.8	9.7	1.3	2.7	E	0	897.9	95
3/22/00	7:45a	9.8	9.8	9.8	9.7	1.3	2.2	E	0	897.8	95
3/22/00	8:00a	9.9	9.9	9.9	9.8	1.3	2.7	E	0.2	897.7	95
3/22/00	8:15a	10	10	10.1	9.9	1.3	2.2	E	0	897.7	95
3/22/00	8:30a	10.1	10.1	10.2	10.1	1.3	2.2	ESE	0	897.7	95
3/22/00	8:45a	10.2	10.2	10.3	10.1	1.3	2.2	E	0	897.7	95
3/22/00	9:00a	10.3	10.3	10.4	10.3	1.3	2.2	E	0	897.7	95
3/22/00	9:15a	10.4	10.4	10.6	10.4	1.3	2.2	E	0	897.5	95
3/22/00	9:30a	10.6	10.6	10.7	10.6	1.3	2.2	E	0	897.5	96
3/22/00	9:45a	10.8	10.8	10.9	10.7	1.3	2.7	E	0	897.5	96
3/22/00	10:00a	10.9	10.9	11	10.9	0.9	2.2	E	0.2	897.6	96
3/22/00	10:15a	11.1	11.1	11.1	11	0.9	2.2	ENE	1	897.5	96
3/22/00	10:30a	11.2	11.2	11.2	11.1	0.9	2.2	ENE	1	897.4	96
3/22/00	10:45a	11.4	11.4	11.6	11.3	0.9	2.2	E	0.4	897.3	96
3/22/00	11:00a	11.6	11.6	11.6	11.5	1.3	2.7	E	0	897.2	96
3/22/00	11:15a	11.7	11.7	11.8	11.6	0.9	1.8	ENE	0.4	897.2	96
3/22/00	11:30a	11.9	11.9	12.1	11.8	0.9	2.7	ENE	0	897	96
3/22/00	11:45a	12.1	12.1	12.2	12	1.3	3.1	ENE	0.2	896.8	96
3/22/00	12:00p	12.3	12.3	12.3	12.1	1.3	4	N	0	896.6	96
3/22/00	12:15p	12.4	12.4	12.5	12.3	1.3	3.1	N	0	896.5	96
3/22/00	12:30p	12.6	12.6	12.8	12.5	0.9	3.1	NE	0.2	896.1	97
3/22/00	12:45p	12.7	12.7	12.7	12.6	1.8	4.9	NNE	0	896	97
3/22/00	1:00p	12.6	12.6	12.8	12.6	1.3	3.6	E	0	895.8	96
3/22/00	1:15p	12.6	12.6	12.7	12.4	1.8	3.6	E	0.2	895.5	96
3/22/00	1:30p	12.5	12.5	12.6	12.4	1.3	3.6	ENE	0	895.3	96
3/22/00	1:45p	12.4	12.4	12.6	12.3	1.8	4	ENE	0	895	96
3/22/00	2:00p	12.6	12.6	12.7	12.4	1.3	2.7	E	0	894.5	96
3/22/00	2:15p	12.7	12.7	12.7	12.6	1.3	3.1	ENE	0.2	894.2	96
3/22/00	2:30p	12.7	12.7	12.8	12.6	1.3	4	E	0	894	96
3/22/00	2:45p	12.8	12.8	12.8	12.7	1.3	4	ENE	0.2	893.9	96
3/22/00	3:00p	12.8	12.8	12.9	12.8	1.3	4	E	0.2	893.7	96
3/22/00	3:15p	12.9	12.9	12.9	12.8	1.3	3.6	E	0.2	893.6	96

Date	Time	Temp. Out	Wind Chill	Hi Temp	Low Temp	Wind Speed (m/s)			Rain	Bar	Hum In
		C°	C°	C°	C°	Avg	Hi	Dir	mm	mB	%
3/22/00	3:30p	13.1	13.1	13.2	12.9	1.8	3.6	E	0.2	893.5	96
3/22/00	3:45p	13.2	13.2	13.2	13.1	1.3	4	E	0.2	893.2	96
3/22/00	4:00p	13.2	13.2	13.2	13.1	1.8	4	E	0	893	97
3/22/00	4:15p	13.2	13.2	13.3	13.1	1.3	4.5	NE	0	892.8	96
3/22/00	4:30p	13.1	13.1	13.2	13	1.3	3.6	ENE	0.2	892.6	96
3/22/00	4:45p	12.9	12.9	13	12.9	0.9	2.7	E	1	892.5	96
3/22/00	5:00p	13	13	13	13	0.9	3.6	ENE	3	892.5	96
3/22/00	5:15p	13.1	13.1	13.1	13	0.9	2.2	N	1	892.5	96
3/22/00	5:30p	13.1	13.1	13.2	13.1	1.3	4	N	0.2	892.4	96
3/22/00	5:45p	13	13	13.1	12.9	1.3	4	NNE	0	892.4	96
3/22/00	6:00p	13	13	13	12.9	1.3	3.1	N	0	892.2	96
3/22/00	6:15p	12.9	12.9	12.9	12.8	1.3	3.6	N	0	892.1	96
3/22/00	6:30p	12.8	12.8	12.9	12.8	0.9	2.2	N	0.2	892	96
3/22/00	6:45p	12.9	12.9	12.9	12.8	0.9	2.2	N	0	891.9	96
3/22/00	7:00p	12.8	12.8	12.9	12.7	1.3	2.7	NNE	0.2	891.8	96
3/22/00	7:15p	12.6	12.6	12.7	12.6	1.3	4	N	0	891.9	96
3/22/00	7:30p	12.6	12.6	12.7	12.6	0.9	2.2	N	0.2	892.1	96
3/22/00	7:45p	12.7	12.7	12.7	12.7	0.9	2.7	N	0.2	892	96
3/22/00	8:00p	12.6	12.6	12.7	12.6	1.3	2.7	N	0	891.9	96
3/22/00	8:15p	12.6	12.6	12.6	12.5	0.9	2.2	N	0.2	891.9	96
3/22/00	8:30p	12.6	12.6	12.6	12.6	0.4	1.8	N	0.4	891.9	96
3/22/00	8:45p	12.6	12.6	12.6	12.5	0.9	1.8	NNW	0.4	892	96
3/22/00	9:00p	12.5	12.5	12.5	12.5	0.9	2.2	N	0.2	892.1	96
3/22/00	9:15p	12.5	12.5	12.5	12.5	0.4	1.3	N	0	892.2	96
3/22/00	9:30p	12.5	12.5	12.5	12.4	0.4	2.2	N	0.2	892.1	96
3/22/00	9:45p	12.2	12.2	12.4	12	0.9	2.7	N	0	892.2	96
3/22/00	10:00p	11.9	11.9	11.9	11.8	0.4	1.3	N	0	892.2	96
3/22/00	10:15p	11.9	11.9	11.9	11.8	0	1.3	NNE	0	892.1	96
3/22/00	10:30p	11.9	11.9	12	11.9	0.4	1.3	NNW	0	891.9	96
3/22/00	10:45p	12.1	12.1	12.1	12	0.4	2.2	N	0	891.8	96
3/22/00	11:00p	12.2	12.2	12.2	12.1	0.4	1.3	NNW	0	891.6	96
3/22/00	11:15p	12.2	12.2	12.3	12.2	0.4	0.9	N	0	891.4	96
3/22/00	11:30p	12.3	12.3	12.3	12.3	0.4	1.3	N	0	891.3	96
3/22/00	11:45p	12.3	12.3	12.4	12.3	0.4	1.8	N	0	891	97
3/23/00	12:00a	12.4	12.4	12.4	12.3	0.4	1.3	N	0	890.9	97
3/23/00	12:15a	12.4	12.4	12.4	12.4	0	1.3	N	0	890.7	97
3/23/00	12:30a	12.4	12.4	12.4	12.4	0	1.3	N	0	890.4	97
3/23/00	12:45a	12.4	12.4	12.4	12.4	0	0.9	N	0	890.4	97
3/23/00	1:00a	12.3	12.3	12.4	12.3	0	0.9	N	0	890.5	97
3/23/00	1:15a	12.4	12.4	12.4	12.4	0	0	---	0	890.3	97
3/23/00	1:30a	12.4	12.4	12.4	12.3	0	0	---	0	890	97
3/23/00	1:45a	12.2	12.2	12.3	12.2	0	0	---	0	890	96
3/23/00	2:00a	12.2	12.2	12.2	12.2	0	0	---	0	889.9	96
3/23/00	2:15a	12.2	12.2	12.2	12.1	0	0.4	N	0	889.7	96
3/23/00	2:30a	12.1	12.1	12.2	12.1	0	0.4	N	0	889.5	96
3/23/00	2:45a	12.1	12.1	12.1	12.1	0	0	---	0	889.2	96
3/23/00	3:00a	12.1	12.1	12.2	12.1	0	0	---	0	889	96
3/23/00	3:15a	12.2	12.2	12.2	12.1	0.9	1.8	SSW	0	889	97
3/23/00	3:30a	12.1	12.1	12.2	12.1	0.9	1.3	SSW	0	888.7	97
3/23/00	3:45a	12.1	12.1	12.1	12.1	0.4	1.3	SSW	0	888.7	97
3/23/00	4:00a	12	12	12.1	12	0.4	1.3	SSW	0	888.6	97
3/23/00	4:15a	12.1	12.1	12.2	12.1	0.9	2.2	SSW	0	888.6	97
3/23/00	4:30a	12.3	12.3	12.3	12.2	0.9	2.2	SSW	0	889	97
3/23/00	4:45a	12.3	12.3	12.3	12.3	1.3	1.8	SSW	0	889	97
3/23/00	5:00a	12.3	12.3	12.3	12.2	1.3	2.7	SSW	0	889	97
3/23/00	5:15a	12.2	12.2	12.2	12.2	0.9	1.8	SSW	0	889.1	97
3/23/00	5:30a	12.2	12.2	12.3	12.2	0.9	1.8	SSW	0	889.1	97
3/23/00	5:45a	12.3	12.3	12.3	12.3	0.9	1.3	SSW	0	889.2	97

Date	Time	Temp. Out	Wind Chill	Hi Temp	Low Temp	Wind Speed (m/s)			Rain	Bar	Hum In
		C°	C°	C°	C°	Avg	Hi	Dir	mm	mB	%
3/23/00	6:00a	12.3	12.3	12.3	12.2	0.9	1.8	SSW	0	889.3	97
3/23/00	6:15a	12.3	12.3	12.3	12.2	0.9	1.8	SSW	0	889.4	97
3/23/00	6:30a	12.3	12.3	12.3	12.3	0.9	1.8	SSW	0	889.5	97
3/23/00	6:45a	12.3	12.3	12.4	12.3	1.3	1.8	SSW	0	889.6	97
3/23/00	7:00a	12.4	12.4	12.4	12.4	0.9	1.8	SSW	0	889.7	97
3/23/00	7:15a	12.4	12.4	12.4	12.4	0.9	1.8	SSW	0	889.8	98
3/23/00	7:30a	12.4	12.4	12.4	12.4	1.3	1.8	SSW	0	889.8	97
3/23/00	7:45a	12.5	12.5	12.5	12.4	1.3	2.2	SSW	0	889.8	98
3/23/00	8:00a	12.6	12.6	12.6	12.5	0.9	1.8	SSW	0	889.9	98
3/23/00	8:15a	12.7	12.7	12.7	12.6	0.9	2.2	SSW	0	890.2	98
3/23/00	8:30a	12.8	12.8	13	12.7	0.9	2.7	SSW	0	890.3	98
3/23/00	8:45a	13.1	13.1	13.1	13	1.3	3.1	SSW	0	890.2	98
3/23/00	9:00a	13.3	13.3	13.7	13.1	1.8	2.7	SSW	0	890.2	98
3/23/00	9:15a	13.8	13.8	13.8	13.7	1.8	3.6	SSW	0	890.5	99
3/23/00	9:30a	13.8	13.8	14	13.7	1.8	3.1	SSW	0	890.5	99
3/23/00	9:45a	13.9	13.9	14	13.9	1.8	3.1	SSW	0	890.6	99
3/23/00	10:00a	13.8	12.8	13.9	13.7	2.2	3.1	SSW	0	890.8	99
3/23/00	10:15a	13.7	13.7	13.8	13.7	1.8	3.1	SSW	0	890.9	99
3/23/00	10:30a	13.9	13.9	14.3	13.7	1.8	2.7	SSW	0	890.7	98
3/23/00	10:45a	15.7	15.7	17.3	14.4	1.3	3.1	SSW	0	890.6	100
3/23/00	11:00a	16.4	16.4	17.1	15.7	1.3	2.7	SSW	0	890.6	100
3/23/00	11:15a	15.8	15.8	15.9	15.7	0.9	1.8	SSW	0	890.8	100
3/23/00	11:30a	15.7	15.7	16.1	15.4	1.3	2.2	SSW	0	890.9	100
3/23/00	11:45a	16.2	16.2	16.5	15.9	0.9	2.7	SSW	0	890.8	99
3/23/00	12:00p	16.6	16.6	16.9	16.1	0.9	1.8	SSW	0	890.9	99
3/23/00	12:15p	16.6	16.6	16.9	16.3	0.9	1.8	SSW	0	891	99
3/23/00	12:30p	16.3	16.3	16.9	16.2	0.9	1.8	SSW	0.2	891.1	97
3/23/00	12:45p	17.2	17.2	17.3	17.1	0.4	1.3	SSW	0	891.2	84
3/23/00	1:00p	16.7	16.7	17.1	16.6	0.9	1.8	SSW	0	891.3	90
3/23/00	1:15p	16.8	16.8	17.3	16.5	0.4	1.8	S	0	891.2	91
3/23/00	1:30p	16.8	16.8	17.2	16.4	0.9	1.3	S	0	891	90
3/23/00	1:45p	17.7	17.7	17.9	17	0.4	1.8	S	0	890.9	91
3/23/00	2:00p	17.4	17.4	17.8	17.2	0.4	1.3	S	0	890.8	90
3/23/00	2:15p	17.5	17.5	17.9	17.3	0.4	2.2	SE	0	890.7	89
3/23/00	2:30p	18.3	18.3	18.4	17.9	0	0.9	SSE	0	890.6	89
3/23/00	2:45p	18.6	18.6	18.8	18.4	0.4	1.3	SSE	0	890.5	90
3/23/00	3:00p	18	18	18.4	17.6	0.4	2.2	SSE	0	890.6	88
3/23/00	3:15p	17.3	17.3	17.5	17.2	0.9	1.8	SE	0	890.7	86
3/23/00	3:30p	16.3	16.3	17.2	15	0.9	3.1	NE	0	891	85
3/23/00	3:45p	14.7	14.7	14.9	14.4	0.9	2.7	E	0	891.2	83
3/23/00	4:00p	14.3	14.3	14.4	14.1	0.9	2.2	N	0.2	891.4	83
3/23/00	4:15p	13.9	13.9	14.1	13.6	0.4	3.1	N	0	891.5	83
3/23/00	4:30p	12.8	12.8	13.5	12.3	1.3	3.6	ENE	0	891.8	83
3/23/00	4:45p	12.1	12.1	12.3	11.9	0.9	3.1	E	0	892.1	83
3/23/00	5:00p	12	12	12.1	11.8	0.9	2.2	E	0	892.3	84
3/23/00	5:15p	11.8	11.8	11.9	11.8	0.9	1.8	E	0	892.6	86
3/23/00	5:30p	11.8	11.8	11.8	11.6	0.9	2.2	N	0.2	892.7	86
3/23/00	5:45p	11.4	11.4	11.6	11.3	0.9	2.7	NE	0	892.9	87
3/23/00	6:00p	11.2	11.2	11.3	11.1	1.3	3.1	ENE	0	893.1	87
3/23/00	6:15p	11.1	11.1	11.1	11	0.9	3.6	E	0	893.4	87
3/23/00	6:30p	11	11	11.1	10.9	0.9	3.1	E	0	893.6	88
3/23/00	6:45p	10.8	10.8	10.9	10.7	0.9	2.2	E	0	893.9	88
3/23/00	7:00p	10.7	10.7	10.8	10.6	0.9	2.2	ENE	0	894.2	88
3/23/00	7:15p	10.5	10.5	10.6	10.3	0.9	2.7	E	0	894.3	89
3/23/00	7:30p	10.2	10.2	10.3	10.2	0.9	3.1	ENE	0	894.7	89
3/23/00	7:45p	10.1	10.1	10.2	10	0.4	2.2	E	0	894.9	89
3/23/00	8:00p	9.9	9.9	10	9.9	0.4	1.8	ENE	0	895.1	89
3/23/00	8:15p	9.9	9.9	9.9	9.8	0.4	1.8	N	0	895.4	89

Date	Time	Temp. Out	Wind Chill	Hi Temp	Low Temp	Wind Speed (m/s)			Rain	Bar	Hum In
		C°	C°	C°	C°	Avg	Hi	Dir	mm	mB	%
3/23/00	8:30p	9.8	9.8	9.8	9.7	0.9	2.2	E	0	895.7	89
3/23/00	8:45p	9.8	9.8	9.8	9.7	0.4	1.3	E	0	895.8	90
3/23/00	9:00p	9.7	9.7	9.7	9.7	0.4	1.8	E	0	896.1	90
3/23/00	9:15p	9.8	9.8	9.8	9.7	0.4	1.8	E	0.2	896.3	90
3/23/00	9:30p	9.8	9.8	9.8	9.7	0.4	1.3	E	0	896.3	90
3/23/00	9:45p	9.7	9.7	9.7	9.7	0	1.3	NE	0	896.5	90
3/23/00	10:00p	9.7	9.7	9.7	9.6	0.4	1.3	ENE	0	896.7	91
3/23/00	10:15p	9.7	9.7	9.7	9.6	0.4	1.3	ENE	0	896.7	91
3/23/00	10:30p	9.7	9.7	9.7	9.6	0.4	1.3	ENE	0	896.6	91
3/23/00	10:45p	9.6	9.6	9.6	9.6	0.4	1.3	ENE	0	896.8	91
3/23/00	11:00p	9.6	9.6	9.6	9.5	0.4	1.3	ENE	0.2	896.6	91
3/23/00	11:15p	9.6	9.6	9.6	9.5	0	1.3	NW	0	896.7	91
3/23/00	11:30p	9.6	9.6	9.6	9.6	0.4	0.9	N	0	896.9	91
3/23/00	11:45p	9.4	9.4	9.6	9.3	0.9	1.8	E	0.2	896.9	91
3/24/00	12:00a	9.2	9.2	9.3	9.1	0.9	1.8	E	0	896.8	91
3/24/00	12:15a	9.2	9.2	9.2	9.1	0.9	2.2	E	0.2	896.8	91
3/24/00	12:30a	9.1	9.1	9.2	9.1	0.9	1.8	E	0	896.8	91
3/24/00	12:45a	9.1	9.1	9.1	9.1	0.4	1.3	E	0	896.8	91
3/24/00	1:00a	9.1	9.1	9.2	9.1	0.4	1.3	E	0	896.8	92
3/24/00	1:15a	9.1	9.1	9.2	9	0.4	1.3	E	0	896.8	92
3/24/00	1:30a	9	9	9.1	8.9	0.4	1.3	E	0	896.7	92
3/24/00	1:45a	8.8	8.8	8.9	8.7	0.9	1.8	ENE	0	896.7	92
3/24/00	2:00a	8.7	8.7	8.8	8.6	0.4	1.8	ENE	0	896.8	92
3/24/00	2:15a	8.5	8.5	8.6	8.4	0.4	1.3	ENE	0	896.7	92
3/24/00	2:30a	8.4	8.4	8.5	8.4	0.4	1.3	ENE	0	896.8	92
3/24/00	2:45a	8.4	8.4	8.4	8.3	0.4	0.9	NE	0	896.7	92
3/24/00	3:00a	8.4	8.4	8.4	8.3	0.4	0.9	N	0	896.7	92
3/24/00	3:15a	8.3	8.3	8.4	8.3	0.9	1.8	ENE	0	896.7	92
3/24/00	3:30a	8.3	8.3	8.4	8.3	0.9	1.3	ENE	0	896.8	92
3/24/00	3:45a	8.3	8.3	8.4	8.2	0.9	1.8	ESE	0	896.6	92
3/24/00	4:00a	8.3	8.3	8.3	8.2	0.9	1.8	SE	0	896.7	92
3/24/00	4:15a	8.3	8.3	8.4	8.2	0.9	1.8	ESE	0	896.7	92
3/24/00	4:30a	8.3	8.3	8.4	8.1	0.9	1.8	ESE	0	896.7	92
3/24/00	4:45a	8.1	8.1	8.2	7.9	0.9	2.2	SE	0	896.8	92
3/24/00	5:00a	7.9	7.9	8	7.7	0.9	2.2	SSE	0	896.8	92
3/24/00	5:15a	7.7	7.7	7.8	7.7	0.9	1.8	SE	0	896.8	92
3/24/00	5:30a	7.7	7.7	7.8	7.7	0.9	2.7	SE	0	897	92
3/24/00	5:45a	7.7	7.7	7.8	7.7	0.9	1.8	SE	0.2	897	92
3/24/00	6:00a	7.7	7.7	7.8	7.7	0.9	1.8	SE	0	897.2	92
3/24/00	6:15a	7.7	7.7	7.8	7.6	0.4	1.3	SE	0	897.4	93
3/24/00	6:30a	7.6	7.6	7.7	7.6	0.9	1.3	SE	0	897.4	93
3/24/00	6:45a	7.7	7.7	7.8	7.6	0.4	0.9	SE	0	897.6	93
3/24/00	7:00a	7.7	7.7	7.8	7.6	0.4	1.3	SE	0	897.8	93
3/24/00	7:15a	7.6	7.6	7.6	7.6	0.4	1.3	SE	0	897.9	93
3/24/00	7:30a	7.6	7.6	7.6	7.5	0.4	0.9	SE	0	897.9	93
3/24/00	7:45a	7.7	7.7	7.7	7.6	0.4	1.3	SE	0	898.1	93
3/24/00	8:00a	7.7	7.7	7.7	7.6	0.4	1.3	SE	0	898.2	93
3/24/00	8:15a	7.7	7.7	7.8	7.6	0.4	1.3	SE	0	898.5	93
3/24/00	8:30a	7.7	7.7	7.8	7.6	0.9	1.8	SE	0	898.7	93
3/24/00	8:45a	7.7	7.7	7.8	7.6	0.9	1.8	SE	0	898.7	93
3/24/00	9:00a	7.8	7.8	7.9	7.7	0.9	1.8	SE	0	898.8	93
3/24/00	9:15a	8.1	8.1	8.2	7.9	0.9	2.2	SE	0	898.9	94
3/24/00	9:30a	8.2	8.2	8.3	8.1	0.9	2.2	SE	0	898.9	94
3/24/00	9:45a	8.3	8.3	8.4	8.2	0.9	1.8	SE	0	898.9	94
3/24/00	10:00a	8.5	8.5	8.8	8.3	0.9	2.2	SE	0	899	94
3/24/00	10:15a	8.8	8.8	9.1	8.6	0.9	2.7	SE	0	899	94
3/24/00	10:30a	9.2	9.2	9.4	9	0.9	2.2	SE	0	898.8	95
3/24/00	10:45a	9.4	9.4	9.6	9.3	0.9	1.8	SE	0	898.7	95

Date	Time	Temp. Out	Wind Chill	Hi Temp	Low Temp	Wind Speed (m/s)			Rain	Bar	Hum In
		C°	C°	C°	C°	Avg	Hi	Dir	mm	mB	%
3/24/00	11:00a	10	10	10.3	9.6	0.9	1.8	ESE	0	898.5	95
3/24/00	11:15a	10.1	10.1	10.1	9.9	1.3	2.2	ESE	0	898.6	95
3/24/00	11:30a	10.2	10.2	10.3	10.1	0.9	2.2	ESE	0	898.4	95
3/24/00	11:45a	10.6	10.6	10.7	10.4	0.9	1.8	E	0	898.5	95
3/24/00	12:00p	10.6	10.6	10.7	10.4	0.9	1.8	SE	0	898.5	95
3/24/00	12:15p	10.7	10.7	10.8	10.4	0.9	2.2	ESE	0	898.3	95
3/24/00	12:30p	10.9	10.9	11.2	10.7	0.4	1.8	ESE	0	898.3	95
3/24/00	12:45p	11.1	11.1	11.2	10.9	0.4	1.3	ESE	0	898.1	94
3/24/00	1:00p	10.9	10.9	11	10.8	0.4	1.3	ESE	0	897.9	94
3/24/00	1:15p	10.9	10.9	11.1	10.8	0	0.9	ESE	0	897.8	94
3/24/00	1:30p	10.7	10.7	11	10.5	0.4	1.8	N	0	897.7	93
3/24/00	1:45p	10.7	10.7	10.8	10.6	0.4	1.3	ENE	0	897.7	93
3/24/00	2:00p	10.7	10.7	10.8	10.6	0	1.3	SE	0	897.7	93
3/24/00	2:15p	10.3	10.3	10.6	10.1	0.9	1.3	SE	0	897.7	92
3/24/00	2:30p	10.2	10.2	10.3	10.1	0.9	1.8	SE	0	897.6	92
3/24/00	2:45p	10.2	10.2	10.3	10.1	0.9	1.8	SE	0	897.8	92
3/24/00	3:00p	10.3	10.3	10.3	10.2	0.4	1.3	ESE	0	897.6	92
3/24/00	3:15p	10.3	10.3	10.4	10.2	0.4	1.3	SE	0	897.7	92
3/24/00	3:30p	10.2	10.2	10.4	10.1	0.4	1.8	E	0	897.7	92
3/24/00	3:45p	10.2	10.2	10.2	10.1	0.4	1.3	SE	0	897.5	92
3/24/00	4:00p	10.2	10.2	10.3	10.2	0.9	1.3	SE	0	897.6	92
3/24/00	4:15p	10.1	10.1	10.2	10	0.9	1.8	SE	0	897.6	92
3/24/00	4:30p	9.9	9.9	10	9.8	0.4	1.3	SE	0	897.5	92
3/24/00	4:45p	9.8	9.8	9.8	9.7	0.4	1.3	ESE	0	897.7	92
3/24/00	5:00p	9.7	9.7	9.8	9.6	0.4	1.3	E	0	897.6	92
3/24/00	5:15p	9.7	9.7	9.7	9.7	0.4	1.3	E	0	897.8	92
3/24/00	5:30p	9.7	9.7	9.8	9.7	0.4	0.9	E	0	897.8	92
3/24/00	5:45p	9.7	9.7	9.8	9.7	0.4	0.9	E	0	898	92
3/24/00	6:00p	9.5	9.5	9.7	9.4	0.4	1.3	NE	0	898.1	93
3/24/00	6:15p	9.3	9.3	9.4	9.2	0.4	1.8	E	0	898.2	92
3/24/00	6:30p	9.2	9.2	9.3	9.1	0.4	1.3	E	0	898.3	92
3/24/00	6:45p	9.1	9.1	9.1	9	0.4	1.8	E	0	898.5	92
3/24/00	7:00p	8.9	8.9	9	8.8	0.4	0.9	E	0	898.5	92
3/24/00	7:15p	8.9	8.9	8.9	8.8	0	0.9	E	0	898.7	92
3/24/00	7:30p	8.9	8.9	9	8.9	0	0.9	E	0	898.8	92
3/24/00	7:45p	9	9	9	9	0.4	0.9	E	0	898.9	92
3/24/00	8:00p	9.1	9.1	9.1	9	0	0.9	ENE	0	899	92
3/24/00	8:15p	9.1	9.1	9.1	9	0.4	1.3	ENE	0	899.2	93
3/24/00	8:30p	9	9	9	9	0.4	1.3	E	0	899.3	93
3/24/00	8:45p	9	9	9	9	0	0	---	0	899.4	93
3/24/00	9:00p	9	9	9.1	9	0.4	1.3	E	0	899.6	93
3/24/00	9:15p	9	9	9.1	8.8	0.4	1.8	E	0	899.7	93
3/24/00	9:30p	8.8	8.8	8.9	8.8	0.4	1.3	E	0	899.8	93
3/24/00	9:45p	8.8	8.8	8.8	8.7	0	0.9	E	0	899.7	93
3/24/00	10:00p	8.8	8.8	8.8	8.7	0	0	---	0	899.6	93
3/24/00	10:15p	8.6	8.6	8.6	8.6	0	0	---	0	899.5	93
3/24/00	10:30p	8.6	8.6	8.6	8.6	0	0.9	E	0	899.5	93
3/24/00	10:45p	8.7	8.7	8.7	8.6	0	0.9	E	0	899.6	93
3/24/00	11:00p	8.8	8.8	8.8	8.7	0.4	1.3	E	0	899.5	93
3/24/00	11:15p	8.8	8.8	8.8	8.8	0	0.9	E	0	899.5	93
3/24/00	11:30p	8.8	8.8	8.8	8.7	0	0.9	E	0	899.3	94
3/24/00	11:45p	8.7	8.7	8.8	8.7	0.4	0.9	E	0	899.3	94
3/25/00	12:00a	8.7	8.7	8.8	8.7	0.4	1.3	ESE	0	899	94
3/25/00	12:15a	8.7	8.7	8.8	8.6	0.9	1.8	SE	0	898.9	94
3/25/00	12:30a	8.6	8.6	8.6	8.5	0.4	1.8	SE	0	898.8	94
3/25/00	12:45a	8.6	8.6	8.6	8.5	0.9	1.8	ESE	0	898.7	94
3/25/00	1:00a	8.6	8.6	8.6	8.6	0.9	1.8	SE	0	898.5	94
3/25/00	1:15a	8.7	8.7	8.7	8.6	0.4	1.3	ESE	0	898.6	94

Date	Time	Temp. Out	Wind Chill	Hi Temp	Low Temp	Wind Speed (m/s)			Rain	Bar	Hum In
		C°	C°	C°	C°	Avg	Hi	Dir	mm	mB	%
3/25/00	1:30a	8.6	8.6	8.7	8.6	0.4	1.8	SE	0	898.6	94
3/25/00	1:45a	8.6	8.6	8.6	8.5	0.9	1.3	SE	0	898.6	94
3/25/00	2:00a	8.6	8.6	8.6	8.6	0	1.3	SE	0	898.4	94
3/25/00	2:15a	8.5	8.5	8.6	8.4	0	0.4	SE	0	898.4	94
3/25/00	2:30a	8.6	8.6	8.6	8.6	0	0	---	0	898.4	94
3/25/00	2:45a	8.6	8.6	8.7	8.6	0.4	1.3	SE	0	898.3	94
3/25/00	3:00a	8.7	8.7	8.7	8.7	0.4	0.9	SE	0	898	94
3/25/00	3:15a	8.7	8.7	8.7	8.7	0.4	1.3	SE	0	897.9	94
3/25/00	3:30a	8.7	8.7	8.7	8.7	0.4	1.3	SE	0	897.8	94
3/25/00	3:45a	8.6	8.6	8.7	8.6	0.4	2.2	E	0	897.7	94
3/25/00	4:00a	8.6	8.6	8.6	8.6	0.4	0.9	E	0	897.7	94
3/25/00	4:15a	8.6	8.6	8.6	8.6	0	0.4	---	0	897.7	94
3/25/00	4:30a	8.6	8.6	8.6	8.5	0.4	1.3	ENE	0	897.7	94
3/25/00	4:45a	8.5	8.5	8.5	8.4	0	0.9	ENE	0	897.8	94
3/25/00	5:00a	8.4	8.4	8.5	8.4	0	1.3	ENE	0	897.7	94
3/25/00	5:15a	8.4	8.4	8.4	8.4	0	1.3	ENE	0	897.6	94
3/25/00	5:30a	8.4	8.4	8.4	8.3	0	0.9	ENE	0	897.7	94
3/25/00	5:45a	8.4	8.4	8.4	8.3	0	1.3	ENE	0	897.8	94
3/25/00	6:00a	8.4	8.4	8.4	8.4	0.4	1.3	ENE	0	897.8	94
3/25/00	6:15a	8.4	8.4	8.4	8.4	0	0	---	0	897.9	94
3/25/00	6:30a	8.4	8.4	8.5	8.4	0	0	---	0	898	94
3/25/00	6:45a	8.6	8.6	8.6	8.5	0	0	---	0	898.1	94
3/25/00	7:00a	8.6	8.6	8.6	8.6	0.4	1.8	ENE	0	898.2	94
3/25/00	7:15a	8.6	8.6	8.6	8.6	0.4	1.3	ENE	0	898.4	94
3/25/00	7:30a	8.7	8.7	8.7	8.6	0.4	1.3	ENE	0	898.6	94
3/25/00	7:45a	8.7	8.7	8.8	8.7	0.4	1.8	E	0	898.6	95
3/25/00	8:00a	8.9	8.9	9	8.8	0.4	1.3	E	0	898.6	95
3/25/00	8:15a	9.1	9.1	9.2	9	0.4	1.3	E	0	898.8	95
3/25/00	8:30a	9.4	9.4	9.6	9.2	0	0.9	E	0	898.8	95
3/25/00	8:45a	9.7	9.7	9.8	9.6	0.4	1.3	ENE	0	898.7	95
3/25/00	9:00a	9.9	9.9	10.2	9.8	0.4	1.3	E	0	898.8	95
3/25/00	9:15a	10.3	10.3	10.4	10.2	0.4	1.3	E	0	899	96
3/25/00	9:30a	10.5	10.5	10.8	10.2	0.4	1.8	ENE	0	898.9	96
3/25/00	9:45a	10.9	10.9	11.1	10.8	0.4	1.3	ENE	0	899	96
3/25/00	10:00a	10.8	10.8	10.9	10.7	0.4	1.3	ENE	0	899.2	96
3/25/00	10:15a	10.7	10.7	10.8	10.6	0.4	1.3	E	0	899.1	96
3/25/00	10:30a	11	11	11.2	10.8	0.4	0.9	NE	0	899.1	96
3/25/00	10:45a	11.3	11.3	11.6	11.1	0.4	1.3	ENE	0	899.1	96
3/25/00	11:00a	11.8	11.8	11.9	11.6	0.4	1.8	E	0	899	96
3/25/00	11:15a	12	12	12.3	11.8	0	1.3	NNW	0	899	96
3/25/00	11:30a	12.4	12.4	12.8	12.1	0.4	1.3	N	0	899	96
3/25/00	11:45a	12.8	12.8	13.1	12.6	0.4	1.8	E	0	898.7	97
3/25/00	12:00p	12.8	12.8	12.9	12.7	0.4	1.3	ENE	0	898.5	96
3/25/00	12:15p	13.1	13.1	13.3	12.7	0	1.8	NW	0	898.5	96
3/25/00	12:30p	13.5	13.5	13.7	13.1	0.4	1.3	NNE	0	898.3	96
3/25/00	12:45p	13.9	13.9	14.2	13.7	0.4	1.8	N	0	898.2	96
3/25/00	1:00p	13.7	13.7	13.9	13.6	0.4	1.3	N	0	898.1	95
3/25/00	1:15p	13.8	13.8	14.1	13.6	0.4	1.3	N	0	897.9	95
3/25/00	1:30p	13.7	13.7	13.9	13.5	0.4	1.3	N	0	897.9	94
3/25/00	1:45p	13.7	13.7	13.8	13.6	0.4	2.2	N	0	897.7	94
3/25/00	2:00p	14.2	14.2	14.4	13.9	0	0.9	N	0	897.5	94
3/25/00	2:15p	14.3	14.3	14.4	14.2	0.4	1.8	NNE	0	897.3	94
3/25/00	2:30p	14.6	14.6	14.8	14.3	0.4	1.3	N	0	897.2	94
3/25/00	2:45p	14.5	14.5	14.8	14.3	0	1.3	N	0	897.1	94
3/25/00	3:00p	14.6	14.6	14.8	14.4	0.4	1.3	NW	0	896.7	93
3/25/00	3:15p	14.6	14.6	14.9	14.3	0.4	1.8	N	0	896.7	93
3/25/00	3:30p	14.8	14.8	15	14.6	0.4	1.8	N	0	896.7	93
3/25/00	3:45p	15.1	15.1	15.2	14.9	0.4	1.3	N	0	896.7	93

Date	Time	Temp. Out	Wind Chill	Hi Temp	Low Temp	Wind Speed (m/s)			Rain	Bar	Hum In
		C°	C°	C°	C°	Avg	Hi	Dir	mm	mB	%
3/25/00	4:00p	15.1	15.1	15.3	14.8	0.4	2.2	NNW	0	896.7	92
3/25/00	4:15p	14.6	14.6	14.8	14.5	0.4	1.3	NNW	0	896.6	92
3/25/00	4:30p	14.6	14.6	15.1	14.4	0.4	1.8	N	0	896.5	91
3/25/00	4:45p	14.3	14.3	14.8	14	0.4	1.3	N	0	896.4	90
3/25/00	5:00p	14.3	14.3	14.7	14	0.4	1.3	N	0	896.5	89
3/25/00	5:15p	14.4	14.4	15.1	14.2	0.4	1.8	NW	0	896.4	89
3/25/00	5:30p	14.1	14.1	14.3	13.8	0.4	1.8	N	0	896.4	89
3/25/00	5:45p	13.8	13.8	14.1	13.5	0.4	1.3	N	0	896.5	89
3/25/00	6:00p	13.4	13.4	13.5	13.2	0.4	1.8	N	0	896.6	89
3/25/00	6:15p	12.9	12.9	13.2	12.7	0.4	1.8	N	0	896.7	88
3/25/00	6:30p	12.6	12.6	12.7	12.5	0.4	1.8	N	0	896.7	88
3/25/00	6:45p	12.4	12.4	12.5	12.3	0.4	1.8	N	0	896.9	89
3/25/00	7:00p	12.3	12.3	12.3	12.1	0	1.3	N	0	896.8	89
3/25/00	7:15p	12	12	12.1	11.9	0.4	1.3	NNW	0	896.8	89
3/25/00	7:30p	11.8	11.8	11.9	11.8	0	1.3	N	0	897	89
3/25/00	7:45p	11.8	11.8	11.8	11.8	0	1.3	N	0	897.1	90
3/25/00	8:00p	11.8	11.8	11.8	11.8	0	1.3	N	0	897.3	90
3/25/00	8:15p	11.8	11.8	11.8	11.7	0	1.3	N	0	897.3	90
3/25/00	8:30p	11.7	11.7	11.8	11.7	0	1.3	N	0	897.6	91
3/25/00	8:45p	11.6	11.6	11.7	11.6	0.4	1.3	N	0	897.5	91
3/25/00	9:00p	11.6	11.6	11.6	11.6	0.4	1.8	NNW	0	897.6	91
3/25/00	9:15p	11.6	11.6	11.6	11.6	0	0.9	NNW	0	897.8	91
3/25/00	9:30p	11.6	11.6	11.6	11.5	0.4	1.3	N	0	897.9	91
3/25/00	9:45p	11.5	11.5	11.6	11.5	0	0.9	NNW	0	897.9	91
3/25/00	10:00p	11.5	11.5	11.6	11.5	0.4	1.3	NNW	0	897.9	91
3/25/00	10:15p	11.5	11.5	11.5	11.4	0	1.3	N	0	898	92
3/25/00	10:30p	11.4	11.4	11.5	11.4	0	0	---	0	897.9	91
3/25/00	10:45p	11.3	11.3	11.4	11.2	0	0	---	0	897.8	91
3/25/00	11:00p	11.2	11.2	11.3	11.2	0	0	---	0	897.7	92
3/25/00	11:15p	11.2	11.2	11.2	11.2	0	0	---	0	897.7	92
3/25/00	11:30p	11.2	11.2	11.2	11.2	0	0.9	N	0	897.7	92
3/25/00	11:45p	11.2	11.2	11.2	11.1	0	0.9	N	0	897.5	92
3/26/00	12:00a	11.2	11.2	11.2	11.1	0	0.4	---	0	897.7	92
3/26/00	12:15a	11.2	11.2	11.2	11.1	0	0	---	0	897.5	92
3/26/00	12:30a	11.1	11.1	11.2	11.1	0	0	---	0	897.5	92
3/26/00	12:45a	11	11	11.1	10.8	0	0	---	0	897.3	92
3/26/00	1:00a	10.7	10.7	10.8	10.5	0	0	---	0	897.2	92
3/26/00	1:15a	10.3	10.3	10.4	10.2	0	0	---	0	897.1	91
3/26/00	1:30a	10	10	10.1	9.8	0	0	---	0	896.9	91
3/26/00	1:45a	9.7	9.7	9.8	9.7	0	0	---	0	897	91
3/26/00	2:00a	9.8	9.8	10.1	9.6	0	0	---	0	896.8	91
3/26/00	2:15a	10.1	10.1	10.2	10	0	0	---	0	896.7	91
3/26/00	2:30a	9.6	9.6	10	9.2	0	0	---	0	896.7	91
3/26/00	2:45a	8.8	8.8	9.2	8.7	0	0	---	0	896.5	91
3/26/00	3:00a	8.6	8.6	8.7	8.5	0	0	---	0	896.4	90
3/26/00	3:15a	8.4	8.4	8.5	8.3	0	0	---	0	896.2	90
3/26/00	3:30a	8.4	8.4	8.5	8.3	0	0	---	0	896.2	90
3/26/00	3:45a	8.3	8.3	8.3	8.3	0	0	---	0	896.2	91
3/26/00	4:00a	8.3	8.3	8.4	8.3	0	0	---	0	896.2	91
3/26/00	4:15a	8.3	8.3	8.3	8.3	0	0	---	0	896.1	91
3/26/00	4:30a	8.1	8.1	8.3	7.8	0	0	---	0	896.2	91
3/26/00	4:45a	7.8	7.8	7.8	7.7	0	0	---	0	896.1	91
3/26/00	5:00a	7.7	7.7	7.7	7.6	0	0	---	0	896.2	91
3/26/00	5:15a	7.6	7.6	7.7	7.5	0	0	---	0	896.1	91
3/26/00	5:30a	7.7	7.7	7.7	7.6	0	0	---	0	896.1	91
3/26/00	5:45a	7.9	7.9	8	7.7	0	0	---	0	896.2	91
3/26/00	6:00a	7.9	7.9	8	7.9	0	0	---	0	896.2	92
3/26/00	6:15a	7.8	7.8	7.9	7.7	0	0	---	0	896.4	92

Date	Time	Temp. Out	Wind Chill	Hi Temp	Low Temp	Wind Speed (m/s)			Rain	Bar	Hum In
		C°	C°	C°	C°	Avg	Hi	Dir	mm	mB	%
3/26/00	6:30a	7.7	7.7	7.9	7.5	0	0	---	0	896.6	92
3/26/00	6:45a	7.7	7.7	8.1	7.3	0	0	---	0	896.7	92
3/26/00	7:00a	7.3	7.3	7.5	7.2	0	0	---	0	896.8	92
3/26/00	7:15a	7.4	7.4	7.5	7.4	0	0	---	0	896.8	92
3/26/00	7:30a	7.6	7.6	7.7	7.5	0	0	---	0	897	92
3/26/00	7:45a	8.1	8.1	8.4	7.7	0	0	---	0	897	92
3/26/00	8:00a	8.6	8.6	9	8.4	0	0	---	0	897	93
3/26/00	8:15a	9.8	9.8	10.7	9	0	1.3	N	0	897	94
3/26/00	8:30a	11	11	11.4	10.7	0	0.9	N	0	897	95
3/26/00	8:45a	11.6	11.6	11.8	11.4	0	0.4	N	0	897	96
3/26/00	9:00a	11.9	11.9	12.1	11.8	0.4	1.3	NNW	0	897	96
3/26/00	9:15a	12.2	12.2	12.3	12	0.4	1.3	N	0	897	96
3/26/00	9:30a	12.5	12.5	12.8	12.3	0.4	1.3	N	0	897	96
3/26/00	9:45a	12.8	12.8	12.9	12.7	0.4	1.8	N	0	897	96
3/26/00	10:00a	13.1	13.1	13.2	12.9	0.4	1.8	N	0	897.1	96
3/26/00	10:15a	13.3	13.3	13.6	13.2	0.4	1.3	N	0	897.1	96
3/26/00	10:30a	13.5	13.5	13.9	13.3	0.4	1.3	N	0	897	96
3/26/00	10:45a	14.2	14.2	14.4	14	0.4	1.8	N	0	896.8	96
3/26/00	11:00a	14.3	14.3	14.7	14	0.4	2.2	N	0	896.7	96
3/26/00	11:15a	15.2	15.2	16.4	14.3	0.9	1.8	N	0	896.7	97
3/26/00	11:30a	16.1	16.1	18.7	14.6	0.4	2.2	N	0	896.5	97
3/26/00	11:45a	16.3	16.3	18.7	15.4	0.4	1.8	N	0	896.5	98
3/26/00	12:00p	18.4	18.4	20.8	15.8	0.4	2.2	N	0	896.2	99
3/26/00	12:15p	18.3	18.3	20	17.2	0.4	1.8	N	0	896.1	96
3/26/00	12:30p	19.3	19.3	21.5	16.8	0.4	1.8	N	0	895.6	93
3/26/00	12:45p	20.8	20.8	22.4	19.6	0.4	2.7	NNW	0	895.6	91
3/26/00	1:00p	19.6	19.6	20.6	18.7	0.9	2.2	E	0	895.5	81
3/26/00	1:15p	18.2	18.2	20.2	17.3	0.4	1.8	N	0	895.3	71
3/26/00	1:30p	18.2	18.2	19.3	17.2	0.4	2.2	N	0	895.1	71
3/26/00	1:45p	17.6	17.6	18.7	16.7	0.4	1.8	NNW	0	895	70
3/26/00	2:00p	16.7	16.7	16.9	16.5	0	1.3	N	0	894.9	70
3/26/00	2:15p	17.2	17.2	17.4	16.9	0.4	2.2	N	0	894.6	73
3/26/00	2:30p	17.3	17.3	17.7	17.2	0.9	1.8	N	0	894.5	76
3/26/00	2:45p	17.3	17.3	17.7	17	0.9	2.2	N	0	894.5	77
3/26/00	3:00p	17.2	17.2	17.4	17	0.9	1.8	N	0	894.4	78
3/26/00	3:15p	17.6	17.6	17.7	17.3	0.9	2.2	ENE	0	894.3	79
3/26/00	3:30p	17.7	17.7	17.9	17.2	0	1.3	N	0	894.4	79
3/26/00	3:45p	16.9	16.9	17.3	16.6	0	1.3	ENE	0	894.3	80
3/26/00	4:00p	17.5	17.5	17.9	17.2	0.4	1.8	N	0	894.1	79
3/26/00	4:15p	17.6	17.6	18.3	16.8	0	1.3	ENE	0	894.1	79
3/26/00	4:30p	16.7	16.7	18.1	16.2	0	1.3	E	0	894.1	78
3/26/00	4:45p	17.8	17.8	18.3	17.6	0.9	2.7	N	0	894.1	79
3/26/00	5:00p	17.4	17.4	17.8	17.2	0.4	1.8	N	0	894.1	79
3/26/00	5:15p	18.4	18.4	19.8	17.1	0.4	2.2	N	0	894	77
3/26/00	5:30p	16.4	16.4	17.1	16.1	0.4	1.8	N	0	894.2	73
3/26/00	5:45p	15.8	15.8	16.3	15.5	0.4	1.8	N	0	894.3	73
3/26/00	6:00p	15.3	15.3	15.5	15.1	0	0.9	NW	0	894.3	73
3/26/00	6:15p	14.9	14.9	15.1	14.8	0	1.3	N	0	894.5	74
3/26/00	6:30p	14.6	14.6	14.8	14.4	0.4	1.3	NNW	0	894.6	75
3/26/00	6:45p	14.2	14.2	14.4	13.8	0	1.3	N	0	894.7	76
3/26/00	7:00p	13.7	13.7	13.8	13.4	0	0.4	N	0	894.9	76
3/26/00	7:15p	13.3	13.3	13.4	13.2	0	0.4	N	0	894.8	77
3/26/00	7:30p	12.9	12.9	13.2	12.8	0	0.4	N	0	894.8	77
3/26/00	7:45p	12.8	12.8	12.8	12.7	0	0.4	N	0	895	78
3/26/00	8:00p	12.6	12.6	12.7	12.4	0	0	---	0	895.1	78
3/26/00	8:15p	12.3	12.3	12.5	12.1	0	0	---	0	895.4	79
3/26/00	8:30p	11.8	11.8	12	11.6	0	0	---	0	895.6	79
3/26/00	8:45p	11.6	11.6	11.7	11.5	0	0	---	0	895.5	79

Date	Time	Temp. Out	Wind Chill	Hi Temp	Low Temp	Wind Speed (m/s)			Rain	Bar	Hum In
		C°	C°	C°	C°	Avg	Hi	Dir	mm	mB	%
3/26/00	9:00p	11.7	11.7	11.9	11.7	0	0	---	0	895.6	79
3/26/00	9:15p	11.8	11.8	12	11.6	0	0.9	N	0	895.6	80
3/26/00	9:30p	12	12	12.1	11.9	0	0.9	N	0	895.9	80
3/26/00	9:45p	12.3	12.3	12.3	12.2	0	0.9	N	0	895.9	81
3/26/00	10:00p	12.2	12.2	12.3	12.1	0	0.9	N	0	895.8	82
3/26/00	10:15p	12	12	12.1	11.9	0	0.9	N	0	895.8	82
3/26/00	10:30p	12.1	12.1	12.2	12	0	0.4	---	0	895.8	82
3/26/00	10:45p	12.2	12.2	12.2	12.2	0	0.9	N	0	895.6	82
3/26/00	11:00p	12.2	12.2	12.2	12.1	0	0.9	N	0	895.6	82
3/26/00	11:15p	11.9	11.9	12.1	11.8	0	1.3	N	0	895.5	82
3/26/00	11:30p	11.8	11.8	11.9	11.8	0	0.9	N	0	895.4	82
3/26/00	11:45p	11.7	11.7	11.8	11.6	0	0	---	0	895.3	82
3/27/00	12:00a	11.7	11.7	11.7	11.6	0	0	---	0	895.2	82
3/27/00	12:15a	11.8	11.8	11.8	11.7	0	0	---	0	895.3	83
3/27/00	12:30a	11.8	11.8	11.8	11.7	0	0.9	N	0	895.2	83
3/27/00	12:45a	11.7	11.7	11.8	11.7	0	0.4	N	0	895.3	83
3/27/00	1:00a	11.8	11.8	11.8	11.7	0	0	---	0	895.1	83
3/27/00	1:15a	11.6	11.6	11.8	11.2	0	0	---	0	894.9	83
3/27/00	1:30a	11	11	11.2	10.7	0	0	---	0	895	82
3/27/00	1:45a	10.8	10.8	10.8	10.7	0	0.4	---	0	894.8	82
3/27/00	2:00a	10.8	10.8	10.8	10.7	0	0	---	0	894.6	82
3/27/00	2:15a	10.6	10.6	10.8	10.4	0	0	---	0	894.6	82
3/27/00	2:30a	10.3	10.3	10.4	10.3	0	0	---	0	894.5	82
3/27/00	2:45a	10.2	10.2	10.3	10	0	0	---	0	894.4	82
3/27/00	3:00a	9.7	9.7	10.1	9.5	0	0	---	0	894.1	82
3/27/00	3:15a	9.8	9.8	10	9.5	0	0	---	0	894.1	82
3/27/00	3:30a	10.1	10.1	10.3	9.7	0	0.4	N	0	893.9	83
3/27/00	3:45a	10.2	10.2	10.3	10.1	0	0.4	---	0	893.9	83
3/27/00	4:00a	10	10	10.1	9.9	0	0	---	0	893.8	83
3/27/00	4:15a	9.9	9.9	10.1	9.8	0	0	---	0	893.8	83
3/27/00	4:30a	10.3	10.3	10.7	10.1	0.4	1.3	N	0	893.6	84
3/27/00	4:45a	10.6	10.6	10.7	10.4	0	0.4	N	0	893.7	84
3/27/00	5:00a	10.4	10.4	10.4	10.3	0	0.9	N	0	893.7	84
3/27/00	5:15a	10.3	10.3	10.4	10.2	0	0	---	0	893.8	84
3/27/00	5:30a	10.1	10.1	10.3	9.9	0	0	---	0	893.9	84
3/27/00	5:45a	10.2	10.2	10.3	10.1	0	0.4	---	0	894.2	84
3/27/00	6:00a	10.1	10.1	10.1	9.9	0	0	---	0	894.1	84
3/27/00	6:15a	10	10	10.3	9.9	0	0	---	0	894	84
3/27/00	6:30a	10.4	10.4	10.4	10.3	0	0.4	N	0	894	85
3/27/00	6:45a	10.4	10.4	10.5	10.2	0	0	---	0	894.2	85
3/27/00	7:00a	10	10	10.2	9.8	0	0	---	0	894.6	84
3/27/00	7:15a	9.7	9.7	9.8	9.7	0	0	---	0	894.7	84
3/27/00	7:30a	9.7	9.7	9.8	9.7	0	0	---	0	894.8	84
3/27/00	7:45a	9.8	9.8	10	9.8	0	0	---	0	894.9	85
3/27/00	8:00a	10.2	10.2	10.4	10	0	0	---	0	894.8	85
3/27/00	8:15a	11	11	11.5	10.5	0	0.4	N	0	894.8	86
3/27/00	8:30a	11.6	11.6	11.9	11.6	0	0.4	N	0	895.2	87
3/27/00	8:45a	12.5	12.5	12.8	11.9	0	0.9	N	0	895.1	88
3/27/00	9:00a	12.2	12.2	12.4	12.1	0	0.9	N	0	895.1	88
3/27/00	9:15a	12.2	12.2	12.6	11.9	0.4	1.8	N	0	895.1	87
3/27/00	9:30a	12.6	12.6	12.8	12.4	0.4	2.2	N	0	895	87
3/27/00	9:45a	13.2	13.2	13.8	12.6	0.4	2.7	NNE	0	895.1	87
3/27/00	10:00a	14.2	14.2	14.7	13.7	0.4	1.8	N	0	895	88
3/27/00	10:15a	15.1	15.1	15.5	14.5	0.4	1.3	N	0	894.9	89
3/27/00	10:30a	15.8	15.8	16.6	15.2	0.9	1.8	NNE	0	894.8	89
3/27/00	10:45a	17.6	17.6	19.2	16.2	0.4	2.2	N	0	894.6	92
3/27/00	11:00a	19.2	19.2	20.1	18.4	0.4	1.8	N	0	894.3	94
3/27/00	11:15a	18.8	18.8	20.1	16.8	0.4	2.2	N	0	894.3	87

Date	Time	Temp. Out	Wind Chill	Hi Temp	Low Temp	Wind Speed (m/s)			Rain	Bar	Hum In
		C°	C°	C°	C°	Avg	Hi	Dir	mm	mB	%
3/27/00	11:30a	20.4	20.4	21.9	19	0.4	1.8	N	0	894.2	86
3/27/00	11:45a	21.2	21.2	21.9	20.6	0.4	1.8	NNE	0	894.3	82
3/27/00	12:00p	21.6	21.6	22.3	20.9	0.4	2.7	N	0	894.2	77
3/27/00	12:15p	22.5	22.5	23.1	21.8	0.4	1.8	N	0	894.1	73
3/27/00	12:30p	22.8	22.8	23.8	21.7	0.4	2.2	N	0	894.1	68
3/27/00	12:45p	22.1	22.1	22.8	21.3	0.4	2.2	NW	0	894.2	63
3/27/00	1:00p	21.8	21.8	22.5	20.3	0.4	2.2	N	0	893.9	59
3/27/00	1:15p	21.5	21.5	22.8	20.6	0	1.3	N	0	893.7	58
3/27/00	1:30p	19.5	19.5	20.9	18.6	0.4	1.8	N	0	893.5	56
3/27/00	1:45p	20	20	21.5	19.1	0.4	1.8	N	0	893.3	58
3/27/00	2:00p	19.4	19.4	19.8	18.9	0	0.9	ENE	0	893	58
3/27/00	2:15p	18.9	18.9	19.2	18.7	0.4	1.3	ENE	0	892.9	59
3/27/00	2:30p	18.9	18.9	19.2	18.6	0.4	1.8	N	0	892.8	62
3/27/00	2:45p	18.6	18.6	19	18.3	0.4	1.8	N	0	892.7	63
3/27/00	3:00p	18.5	18.5	18.7	18.3	0.4	1.8	N	0	892.7	64
3/27/00	3:15p	18.3	18.3	18.5	18.2	0.4	1.3	NNW	0	892.7	65
3/27/00	3:30p	18	18	18.2	17.9	0.4	1.3	N	0	892.6	65
3/27/00	3:45p	18.6	18.6	18.8	18.2	0.9	2.7	N	0	892.5	67
3/27/00	4:00p	18.7	18.7	19.1	18.3	0.9	1.8	N	0	892.4	67
3/27/00	4:15p	17.9	17.9	18.3	17.6	0.4	1.3	N	0	892.5	66
3/27/00	4:30p	18.2	18.2	19.1	17.7	0.4	1.8	N	0	892.4	66
3/27/00	4:45p	18.6	18.6	19.3	18.2	0.9	2.2	N	0	892.3	67
3/27/00	5:00p	18.1	18.1	18.6	17.6	0.4	2.2	N	0	892.2	67
3/27/00	5:15p	17.3	17.3	17.6	17.1	0.4	1.8	NNW	0	892.4	66
3/27/00	5:30p	17.2	17.2	17.3	17.1	0.4	1.8	NNW	0	892.5	66
3/27/00	5:45p	16.8	16.8	17.2	16.6	0	1.3	N	0	892.7	66
3/27/00	6:00p	16.3	16.3	16.6	16.1	0.4	1.3	NNW	0	892.8	66
3/27/00	6:15p	15.9	15.9	16.1	15.9	0	0.9	N	0	892.9	66
3/27/00	6:30p	15.7	15.7	16	15.5	0	0.9	N	0	893.2	67
3/27/00	6:45p	15.3	15.3	15.4	15	0	0	---	0	893.4	67
3/27/00	7:00p	14.9	14.9	15	14.8	0	0	---	0	893.5	68
3/27/00	7:15p	14.6	14.6	14.7	14.4	0	0	---	0	893.5	68
3/27/00	7:30p	14.4	14.4	14.4	14.3	0	0	---	0	893.8	68
3/27/00	7:45p	14.2	14.2	14.3	14	0	0	---	0	893.8	69
3/27/00	8:00p	13.9	13.9	14.1	13.9	0	0	---	0	893.9	69
3/27/00	8:15p	13.9	13.9	14	13.8	0	0	---	0	893.9	70
3/27/00	8:30p	13.8	13.8	13.8	13.7	0	0	---	0	894.1	70
3/27/00	8:45p	13.8	13.8	13.8	13.7	0	0	---	0	894.1	71
3/27/00	9:00p	13.7	13.7	13.7	13.6	0	0	---	0	894.2	71
3/27/00	9:15p	13.6	13.6	13.7	13.6	0	0	---	0	894.3	71
3/27/00	9:30p	13.6	13.6	13.7	13.6	0	0	---	0	894.3	71
3/27/00	9:45p	13.5	13.5	13.6	13.4	0	0	---	0	894.4	72
3/27/00	10:00p	13.4	13.4	13.5	13.3	0	0	---	0	894.3	72
3/27/00	10:15p	13.3	13.3	13.4	13.3	0	0	---	0	894.4	72
3/27/00	10:30p	13.2	13.2	13.4	13.1	0	0	---	0	894.4	72
3/27/00	10:45p	13.3	13.3	13.3	13.2	0	0	---	0	894.6	72
3/27/00	11:00p	13.4	13.4	13.5	13.3	0	0	---	0	894.8	73
3/27/00	11:15p	13.3	13.3	13.5	13.2	0	0	---	0	894.7	73
3/27/00	11:30p	13.3	13.3	13.3	13.2	0	0	---	0	894.6	73
3/27/00	11:45p	13.2	13.2	13.3	13.1	0	0	---	0	894.3	74
3/28/00	12:00a	12.9	12.9	13.1	12.7	0	0	---	0	894.3	73
3/28/00	12:15a	12.7	12.7	12.8	12.6	0	0	---	0	894.3	73
3/28/00	12:30a	12.7	12.7	12.9	12.4	0	0	---	0	894.2	74
3/28/00	12:45a	12.3	12.3	12.4	12.3	0	0	---	0	894.2	74
3/28/00	1:00a	12.4	12.4	12.5	12.4	0	0	---	0	894	74
3/28/00	1:15a	12.4	12.4	12.4	12.4	0	0	---	0	893.9	74
3/28/00	1:30a	12.2	12.2	12.4	12	0	0	---	0	893.9	74
3/28/00	1:45a	12	12	12.2	11.9	0	0	---	0	894.1	75

Date	Time	Temp. Out	Wind Chill	Hi Temp	Low Temp	Wind Speed (m/s)			Rain	Bar	Hum In
		C°	C°	C°	C°	Avg	Hi	Dir	mm	mB	%
3/28/00	2:00a	12.2	12.2	12.2	12.1	0	0	---	0	893.8	75
3/28/00	2:15a	11.9	11.9	12.1	11.7	0	0	---	0	893.9	75
3/28/00	2:30a	11.7	11.7	11.8	11.7	0	0	---	0	894	75
3/28/00	2:45a	11.7	11.7	11.7	11.7	0	0	---	0	894.1	75
3/28/00	3:00a	11.7	11.7	11.8	11.7	0	0	---	0	893.9	76
3/28/00	3:15a	11.8	11.8	11.8	11.7	0	0	---	0	893.9	76
3/28/00	3:30a	11.8	11.8	11.8	11.7	0	0	---	0	893.9	76
3/28/00	3:45a	11.9	11.9	12.1	11.8	0	0	---	0	893.9	77
3/28/00	4:00a	12	12	12.1	12	0	0	---	0	893.8	77
3/28/00	4:15a	12.2	12.2	12.2	12.1	0	0	---	0	893.8	77
3/28/00	4:30a	12.1	12.1	12.2	12	0	0	---	0	893.7	77
3/28/00	4:45a	12	12	12.1	12	0	0	---	0	893.6	77
3/28/00	5:00a	12.1	12.1	12.2	12	0	0	---	0	893.6	77
3/28/00	5:15a	11.9	11.9	12	11.8	0	0	---	0	893.7	77
3/28/00	5:30a	11.7	11.7	11.8	11.6	0	0	---	0	893.8	77
3/28/00	5:45a	11.6	11.6	11.7	11.6	0	0	---	0	894.1	77
3/28/00	6:00a	11.7	11.7	11.8	11.6	0	0	---	0	894.1	77
3/28/00	6:15a	11.5	11.5	11.8	11.3	0	0	---	0	894	77
3/28/00	6:30a	11.1	11.1	11.3	11.1	0	0	---	0	894	77
3/28/00	6:45a	11.3	11.3	11.4	11.1	0	0	---	0	894.1	78
3/28/00	7:00a	11.5	11.5	11.6	11.4	0	0	---	0	894.2	78
3/28/00	7:15a	11.7	11.7	11.8	11.6	0	0	---	0	894.1	78
3/28/00	7:30a	11.8	11.8	12.1	11.6	0	0	---	0	894.2	79
3/28/00	7:45a	12.3	12.3	12.4	12.1	0	0	---	0	894.3	79
3/28/00	8:00a	12.7	12.7	12.9	12.4	0	0	---	0	894.5	79
3/28/00	8:15a	13.3	13.3	13.8	12.9	0	0	---	0	894.5	80
3/28/00	8:30a	14.2	14.2	14.6	13.8	0	0	---	0	894.5	81
3/28/00	8:45a	15.7	15.7	16.6	14.6	0	0	---	0	894.7	83
3/28/00	9:00a	16.6	16.6	16.8	16.4	0	0	---	0	894.6	85
3/28/00	9:15a	16.8	16.8	17.1	16.7	0	0	---	0	894.7	84
3/28/00	9:30a	17.2	17.2	17.8	16.9	0	0	---	0	894.8	82
3/28/00	9:45a	18.1	18.1	18.3	17.9	0	0	---	0	894.8	82
3/28/00	10:00a	18.7	18.7	18.8	18.4	0	0	---	0	894.8	82
3/28/00	10:15a	18.9	18.9	19.6	18.6	0	0	---	0	894.6	82
3/28/00	10:30a	20.3	20.3	21.1	19.5	0	1.3	SW	0	894.7	81
3/28/00	10:45a	20.9	20.9	22.1	20.1	0.4	1.3	SW	0	894.5	80
3/28/00	11:00a	23.7	23.7	24.4	22.1	0.4	1.3	SW	0	894.4	82
3/28/00	11:15a	24.4	24.4	25.1	23.8	0.9	2.2	SSW	0	894.4	75
3/28/00	11:30a	25.3	25.3	26.2	24.4	0.4	2.7	SSW	0	894.4	70
3/28/00	11:45a	24.4	24.4	24.8	23.7	0.9	2.2	SW	0	894.3	65
3/28/00	12:00p	24.9	24.9	25.6	24.1	0.4	1.8	SW	0	894.2	61
3/28/00	12:15p	24.5	24.5	24.9	23.9	0.9	2.2	SSW	0	894.4	57
3/28/00	12:30p	24.2	24.2	24.8	23.6	0.9	1.8	SW	0	894.2	53
3/28/00	12:45p	24.5	24.5	25	23.9	0.9	1.8	SW	0	894	51
3/28/00	1:00p	22.8	22.8	24.4	21.4	1.3	2.7	SW	0	893.9	47
3/28/00	1:15p	20.9	20.9	21.4	20.5	0.9	2.2	SSW	0	893.7	45
3/28/00	1:30p	20.8	20.8	20.9	20.6	0.9	2.2	SSW	0	893.3	47
3/28/00	1:45p	20.9	20.9	21	20.8	0.9	2.7	SSW	0	893.1	48
3/28/00	2:00p	20.9	20.9	21.2	20.7	1.3	2.7	SSW	0	893.1	49
3/28/00	2:15p	20.8	20.8	21	20.4	1.3	2.7	SSW	0	893	49
3/28/00	2:30p	20.6	20.6	20.8	20.3	1.3	3.1	SW	0	893	50
3/28/00	2:45p	20.4	20.4	20.5	20.3	0.9	1.8	SW	0	892.8	51
3/28/00	3:00p	20.7	20.7	21.4	20.4	1.3	2.7	SW	0	892.7	52
3/28/00	3:15p	20.9	20.9	21.4	20.7	1.3	3.1	SSW	0	892.8	53
3/28/00	3:30p	20.9	20.9	21.1	20.7	1.3	2.7	SSW	0	892.7	53
3/28/00	3:45p	21	21	21.3	20.9	1.8	3.1	SSW	0	892.6	54
3/28/00	4:00p	21.4	21.4	21.9	21.2	1.3	2.7	SSW	0	892.5	53
3/28/00	4:15p	20.8	20.8	21.2	20.5	1.3	2.2	SSW	0	892.5	53

Date	Time	Temp. Out	Wind Chill	Hi Temp	Low Temp	Wind Speed (m/s)			Rain	Bar	Hum In
		C°	C°	C°	C°	Avg	Hi	Dir	mm	mB	%
3/28/00	4:30p	20.3	20.3	20.8	19.8	1.3	2.7	SSW	0	892.4	54
3/28/00	4:45p	19.9	19.9	20.1	19.7	1.3	2.7	SSW	0	892.4	54
3/28/00	5:00p	19.5	19.5	20	19.2	1.3	3.1	SSW	0	892.5	55
3/28/00	5:15p	19.5	19.5	19.7	19.3	0.9	2.2	SSW	0	892.5	55
3/28/00	5:30p	19.6	19.6	20	19.4	0.9	1.8	SW	0	892.6	56
3/28/00	5:45p	20.2	20.2	20.4	20	0.9	2.2	SW	0	892.6	57
3/28/00	6:00p	19.3	19.3	20	19.1	1.3	2.2	SW	0	892.6	57
3/28/00	6:15p	19.1	19.1	19.2	18.8	1.3	3.6	SSW	0	892.6	57
3/28/00	6:30p	18.6	18.6	18.8	18.6	1.3	1.8	SSW	0	892.7	58
3/28/00	6:45p	18.3	18.3	18.6	18	0.9	1.8	SSW	0	892.9	58
3/28/00	7:00p	17.8	17.8	18	17.6	0.9	1.8	SSW	0	893.1	58
3/28/00	7:15p	17.4	17.4	17.6	17.2	0.4	1.3	SSW	0	893.3	59
3/28/00	7:30p	17.1	17.1	17.2	17.1	0	0.9	SSW	0	893.5	59
3/28/00	7:45p	17.1	17.1	17.1	17	0	0	---	0	893.6	60
3/28/00	8:00p	16.8	16.8	17	16.6	0.4	1.3	SSW	0	893.7	61
3/28/00	8:15p	16.6	16.6	16.6	16.5	0.9	1.3	SSW	0	893.9	62
3/28/00	8:30p	16.4	16.4	16.5	16.3	0.9	1.3	SSW	0	893.9	62
3/28/00	8:45p	16.3	16.3	16.4	16.2	0.9	1.8	SSW	0	894	63
3/28/00	9:00p	16.3	16.3	16.4	16.1	0.9	1.3	SSW	0	894.1	64
3/28/00	9:15p	16.1	16.1	16.1	16.1	0.9	1.3	SSW	0	894.1	65
3/28/00	9:30p	16	16	16.2	15.9	0.9	2.2	SSW	0	894.1	66
3/28/00	9:45p	16.2	16.2	16.3	16.1	1.3	1.8	SSW	0	894.1	67
3/28/00	10:00p	16.2	16.2	16.3	16.1	1.3	1.8	SSW	0	894.1	67
3/28/00	10:15p	16.4	16.4	16.4	16.3	1.3	1.8	SSW	0	894.1	68
3/28/00	10:30p	16.4	16.4	16.4	16.4	1.8	2.2	SSW	0	894.1	68
3/28/00	10:45p	16.5	16.5	16.5	16.4	1.8	2.7	SSW	0	894	69
3/28/00	11:00p	16.5	16.5	16.6	16.4	1.8	3.1	SSW	0	894	69
3/28/00	11:15p	16.6	16.6	16.6	16.4	1.8	2.7	SSW	0	893.9	69
3/28/00	11:30p	16.6	16.6	16.6	16.5	1.8	2.7	SSW	0	893.8	69
3/28/00	11:45p	16.6	16.6	16.7	16.5	1.8	2.7	SSW	0	893.5	69
3/29/00	12:00a	16.7	16.7	16.7	16.7	1.8	3.1	SSW	0	893.5	69
3/29/00	12:15a	16.8	16.8	16.9	16.7	1.8	3.1	SSW	0	893.4	69
3/29/00	12:30a	16.9	16.9	16.9	16.8	1.8	3.1	SSW	0	893.5	69
3/29/00	12:45a	16.7	16.7	16.8	16.7	1.8	3.1	SSW	0	893.5	69
3/29/00	1:00a	16.6	15.7	16.7	16.6	2.2	3.1	SSW	0	893.6	69
3/29/00	1:15a	16.4	16.4	16.5	16.3	1.8	3.6	SSW	0	893.8	69
3/29/00	1:30a	16.1	16.1	16.3	15.8	1.8	3.1	SSW	0	894	70
3/29/00	1:45a	15.7	15.7	15.8	15.4	1.8	3.1	SSW	0	893.9	70
3/29/00	2:00a	15.2	14.3	15.4	15.1	2.2	4	SSW	0	893.9	70
3/29/00	2:15a	14.8	13.1	15.1	14.6	2.7	4.5	SSW	0	893.9	71
3/29/00	2:30a	14.4	13.4	14.6	14.3	2.2	4	SSW	0	893.8	72
3/29/00	2:45a	14.1	13	14.3	13.9	2.2	3.1	SSW	0	893.8	73
3/29/00	3:00a	14	12.9	14.1	13.9	2.2	4.5	SSW	0	893.6	74
3/29/00	3:15a	13.8	13.8	13.9	13.7	1.8	2.7	SSW	0	893.4	75
3/29/00	3:30a	13.6	13.6	13.6	13.6	1.8	3.1	SSW	0	893.4	76
3/29/00	3:45a	13.6	13.6	13.6	13.4	1.8	3.1	SSW	0	893.2	77
3/29/00	4:00a	13.5	13.5	13.6	13.4	1.8	2.7	SSW	0	893.1	78
3/29/00	4:15a	13.5	12.4	13.6	13.4	2.2	4	SSW	0	893.1	78
3/29/00	4:30a	13.6	12.6	13.7	13.6	2.2	3.1	SSW	0	893.1	78
3/29/00	4:45a	13.6	12.5	13.6	13.5	2.2	3.1	SSW	0	893.2	79
3/29/00	5:00a	13.4	13.4	13.6	13.3	1.8	2.7	SSW	0	893.3	79
3/29/00	5:15a	13.2	13.2	13.3	13.1	1.8	2.7	SSW	0	893.4	79
3/29/00	5:30a	12.9	12.9	13.1	12.8	1.8	3.1	SSW	0	893.7	80
3/29/00	5:45a	12.6	12.6	12.8	12.5	1.3	2.2	SSW	0	894	80
3/29/00	6:00a	12.4	12.4	12.5	12.4	1.8	2.2	SSW	0	894.1	81
3/29/00	6:15a	12.3	12.3	12.4	12.2	0.4	1.8	SSW	0	894.6	80
3/29/00	6:30a	12	12	12.2	11.9	0.9	1.3	SSW	0	894.5	80
3/29/00	6:45a	11.9	11.9	12	11.9	1.3	2.2	SSW	0	894.7	81

Date	Time	Temp. Out	Wind Chill	Hi Temp	Low Temp	Wind Speed (m/s)			Rain	Bar	Hum In
		C°	C°	C°	C°	Avg	Hi	Dir	mm	mB	%
3/29/00	7:00a	12	10.8	12.1	12	2.2	2.7	SSW	0	894.6	82
3/29/00	7:15a	12.1	10.9	12.1	12.1	2.2	3.1	SSW	0	894.8	83
3/29/00	7:30a	12.2	12.2	12.3	12.1	1.3	2.7	SSW	0	895.1	83
3/29/00	7:45a	12.4	12.4	12.4	12.3	0.9	1.3	SSW	0	895.4	83
3/29/00	8:00a	12.6	12.6	13.1	12.4	0.4	1.3	SSW	0	895.6	83
3/29/00	8:15a	13	13	13.1	12.9	0.4	1.3	SSW	0	895.7	84
3/29/00	8:30a	13.3	13.3	13.4	13.2	0.9	1.8	SSW	0	895.8	84
3/29/00	8:45a	14.1	14.1	14.7	13.4	0.9	1.8	SSW	0	895.8	86
3/29/00	9:00a	14.2	14.2	14.5	14.1	1.3	2.2	SSW	0	896	87
3/29/00	9:15a	14.3	14.3	14.5	14.2	1.3	2.2	SSW	0	896.2	86
3/29/00	9:30a	14.8	14.8	14.9	14.5	1.3	2.7	SSW	0	896.5	84
3/29/00	9:45a	15.2	15.2	15.6	14.8	0.9	2.2	SSW	0	896.7	84
3/29/00	10:00a	15.7	15.7	16	15.5	0.9	2.2	SE	0	896.8	83
3/29/00	10:15a	16.7	16.7	17.3	16.1	0.4	1.8	S	0	896.7	83
3/29/00	10:30a	17.3	17.3	17.8	16.9	0.9	1.8	SE	0	896.7	83
3/29/00	10:45a	19.4	19.4	20.6	17.8	0.4	1.8	SE	0	896.6	87
3/29/00	11:00a	20.5	20.5	20.7	20.2	0.9	2.2	SE	0	896.7	85
3/29/00	11:15a	21.8	21.8	22.4	20.6	0.4	1.3	SE	0	896.6	81
3/29/00	11:30a	22.7	22.7	23.6	22.1	0.4	1.8	SE	0	896.7	76
3/29/00	11:45a	23.3	23.3	24.3	22.7	0.9	1.8	SE	0	896.8	71
3/29/00	12:00p	23.6	23.6	24.4	22.9	0.9	1.8	SSE	0	896.9	66
3/29/00	12:15p	24.6	24.6	26.1	23.7	0.4	1.8	SE	0	896.9	63
3/29/00	12:30p	24.6	24.6	25.4	23.7	0.9	2.7	SSE	0	896.9	58
3/29/00	12:45p	25.3	25.3	26.3	23.8	0.4	1.8	SSE	0	896.9	56
3/29/00	1:00p	22.8	22.8	23.7	21.4	0.9	1.8	S	0	896.7	49
3/29/00	1:15p	22.3	22.3	23.1	21.3	0.4	1.3	S	0	896.3	49
3/29/00	1:30p	21.4	21.4	22.1	20.8	0.9	2.2	SSE	0	896	48
3/29/00	1:45p	22.2	22.2	23.1	21.2	0.9	1.8	S	0	895.8	50
3/29/00	2:00p	20.8	20.8	21.3	20.4	0.4	1.3	NNW	0	895.6	51
3/29/00	2:15p	20.3	20.3	20.8	19.9	0.9	1.8	N	0	895.6	52
3/29/00	2:30p	20.4	20.4	20.8	20.2	0.9	2.2	N	0	895.5	53
3/29/00	2:45p	19.6	19.6	20.3	19.2	0.9	2.7	NNW	0	895.6	54
3/29/00	3:00p	19.6	19.6	20.1	18.8	0.9	2.2	N	0	895.6	55
3/29/00	3:15p	18.9	18.9	19.2	18.7	0.9	2.2	N	0	895.6	56
3/29/00	3:30p	18.6	18.6	18.8	18.2	0.9	2.2	N	0	895.5	56
3/29/00	3:45p	18.5	18.5	19.1	18.1	0.9	2.7	N	0	895.4	58
3/29/00	4:00p	19.1	19.1	19.5	18.2	0.9	2.7	N	0	895.5	58
3/29/00	4:15p	18.5	18.5	18.8	18.2	0.9	3.6	NNW	0	895.5	59
3/29/00	4:30p	17.9	17.9	18.5	17.5	0.9	2.7	N	0	895.6	59
3/29/00	4:45p	18	18	18.3	17.4	0.9	1.8	N	0	895.7	59
3/29/00	5:00p	17.6	17.6	18.3	17.1	0.9	2.2	N	0	895.8	60
3/29/00	5:15p	17.1	17.1	17.3	16.8	0.9	2.2	N	0	895.8	61
3/29/00	5:30p	16.8	16.8	16.9	16.6	0.9	2.2	N	0	895.8	61
3/29/00	5:45p	16.2	16.2	16.6	15.8	0.9	2.7	N	0	896	62
3/29/00	6:00p	15.8	15.8	15.9	15.7	0.9	2.7	N	0	896.1	62
3/29/00	6:15p	15.5	15.5	15.8	15.2	0.9	2.7	NNW	0	896.3	63
3/29/00	6:30p	15	15	15.2	14.8	0.9	2.2	N	0	896.6	64
3/29/00	6:45p	14.6	14.6	14.8	14.4	0.9	2.2	NNE	0	896.9	65
3/29/00	7:00p	14.3	14.3	14.4	14.2	0.4	1.8	N	0	896.9	65
3/29/00	7:15p	14.1	14.1	14.2	13.9	0.4	2.2	N	0	897.1	66
3/29/00	7:30p	13.7	13.7	13.9	13.6	0.9	2.2	ENE	0	897.2	67
3/29/00	7:45p	13.4	13.4	13.6	13.3	0.4	2.2	NE	0	897.4	67
3/29/00	8:00p	13.3	13.3	13.3	13.2	0.4	2.7	E	0	897.6	68
3/29/00	8:15p	13.2	13.2	13.3	13.2	0.4	1.3	NNW	0	897.7	69
3/29/00	8:30p	13.1	13.1	13.2	13.1	0.4	2.2	E	0	898	69
3/29/00	8:45p	13.1	13.1	13.1	12.9	0.4	1.8	N	0	898.1	70
3/29/00	9:00p	13	13	13	12.9	0.4	1.8	NNW	0	898.3	70
3/29/00	9:15p	13	13	13	12.9	0.4	1.3	N	0	898.3	70

Date	Time	Temp. Out	Wind Chill	Hi Temp	Low Temp	Wind Speed (m/s)			Rain	Bar	Hum In
		C°	C°	C°	C°	Avg	Hi	Dir	mm	mB	%
3/29/00	9:30p	12.9	12.9	12.9	12.8	0.4	2.2	N	0	898.3	71
3/29/00	9:45p	12.8	12.8	12.8	12.7	0.4	1.8	N	0	898.4	71
3/29/00	10:00p	12.6	12.6	12.7	12.6	0.4	2.7	N	0	898.4	72
3/29/00	10:15p	12.5	12.5	12.6	12.5	0.4	1.8	N	0	898.4	72
3/29/00	10:30p	12.5	12.5	12.6	12.4	0.4	2.7	NNW	0	898.3	72
3/29/00	10:45p	12.5	12.5	12.5	12.4	0.4	1.8	N	0	898.4	73
3/29/00	11:00p	12.4	12.4	12.5	12.4	0.4	1.8	N	0	898.4	73
3/29/00	11:15p	12.5	12.5	12.6	12.5	0.4	1.3	N	0	898.2	74
3/29/00	11:30p	12.5	12.5	12.6	12.4	0.4	1.8	N	0	898	74
3/29/00	11:45p	12.5	12.5	12.6	12.4	0.4	1.8	N	0	898.1	74
3/30/00	12:00a	12.5	12.5	12.6	12.5	0.4	2.2	N	0	897.9	75
3/30/00	12:15a	12.5	12.5	12.5	12.4	0.4	1.8	N	0	897.7	75
3/30/00	12:30a	12.5	12.5	12.5	12.4	0	0.9	NNW	0	897.5	75
3/30/00	12:45a	12.5	12.5	12.5	12.4	0.4	1.8	N	0	897.5	75
3/30/00	1:00a	12.4	12.4	12.5	12.4	0.4	1.8	N	0	897.4	75
3/30/00	1:15a	12.4	12.4	12.4	12.2	0.4	1.3	N	0	897.4	76
3/30/00	1:30a	11.9	11.9	12.2	11.8	0.4	1.8	N	0	897.4	76
3/30/00	1:45a	11.8	11.8	11.9	11.8	0.4	1.8	N	0	897.5	75
3/30/00	2:00a	11.8	11.8	11.9	11.8	0	0.9	NNW	0	897.4	75
3/30/00	2:15a	11.9	11.9	11.9	11.8	0.4	1.3	N	0	897.4	76
3/30/00	2:30a	11.9	11.9	11.9	11.9	0.4	1.3	N	0	897.1	76
3/30/00	2:45a	11.9	11.9	12	11.9	0	1.3	N	0	897	76
3/30/00	3:00a	11.9	11.9	12	11.9	0.4	1.8	N	0	896.9	77
3/30/00	3:15a	11.9	11.9	12	11.9	0.4	1.3	N	0	896.8	77
3/30/00	3:30a	11.9	11.9	11.9	11.9	0	0.9	N	0	896.8	77
3/30/00	3:45a	11.9	11.9	11.9	11.9	0.4	1.3	N	0	896.6	77
3/30/00	4:00a	11.9	11.9	11.9	11.8	0.4	2.2	N	0	896.4	77
3/30/00	4:15a	11.9	11.9	11.9	11.8	0.4	1.3	N	0	896.6	78
3/30/00	4:30a	11.8	11.8	11.9	11.8	0.4	1.8	N	0	896.4	78
3/30/00	4:45a	11.8	11.8	11.9	11.8	0.4	1.8	N	0	896.4	78
3/30/00	5:00a	11.9	11.9	11.9	11.8	0.4	1.3	N	0	896.6	78
3/30/00	5:15a	11.9	11.9	11.9	11.9	0.4	2.2	N	0	896.5	78
3/30/00	5:30a	11.9	11.9	11.9	11.9	0.4	1.3	N	0	896.6	79
3/30/00	5:45a	11.9	11.9	12	11.9	0.4	0.9	N	0	896.8	79
3/30/00	6:00a	11.9	11.9	12	11.9	0.4	1.3	N	0	896.9	79
3/30/00	6:15a	12	12	12	11.9	0.4	1.3	N	0	897	79
3/30/00	6:30a	12	12	12.1	12	0.4	1.3	N	0	897.2	79
3/30/00	6:45a	12.1	12.1	12.1	12	0.4	1.3	N	0	897.3	79
3/30/00	7:00a	12.1	12.1	12.1	12.1	0.4	1.3	N	0	897.1	79
3/30/00	7:15a	12.2	12.2	12.2	12.1	0.4	1.8	N	0	897.1	80
3/30/00	7:30a	12.2	12.2	12.2	12.2	0.4	2.2	N	0	897.3	80
3/30/00	7:45a	12.2	12.2	12.3	12.2	0.4	1.3	N	0	897.5	80
3/30/00	8:00a	12.2	12.2	12.2	12.2	0.4	2.2	N	0	897.6	80
3/30/00	8:15a	12.2	12.2	12.3	12.2	0	0.9	N	0	897.6	80
3/30/00	8:30a	12.3	12.3	12.3	12.3	0.4	1.3	N	0	897.6	80
3/30/00	8:45a	12.4	12.4	12.4	12.3	0.4	1.3	N	0	897.7	81
3/30/00	9:00a	12.6	12.6	12.6	12.4	0	1.3	N	0	897.6	81
3/30/00	9:15a	12.6	12.6	12.7	12.6	0.4	1.8	N	0	897.8	81
3/30/00	9:30a	12.7	12.7	12.7	12.7	0.9	2.2	NNE	0	897.7	82
3/30/00	9:45a	12.8	12.8	12.9	12.7	0.9	2.7	N	0	897.5	82
3/30/00	10:00a	12.9	12.9	13.1	12.9	0.9	2.2	N	0	897.6	82
3/30/00	10:15a	13.1	13.1	13.2	13	0.4	1.8	N	0	897.6	82
3/30/00	10:30a	13.2	13.2	13.2	13.1	0.9	2.7	N	0	897.5	83
3/30/00	10:45a	13.3	13.3	13.4	13.2	0.4	1.8	N	0	897.5	83
3/30/00	11:00a	13.4	13.4	13.6	13.3	0.4	1.8	N	0	897.4	83
3/30/00	11:15a	13.7	13.7	13.8	13.6	0.4	1.8	N	0	897.2	83
3/30/00	11:30a	13.9	13.9	14.1	13.7	0.4	1.8	N	0	897.1	83
3/30/00	11:45a	14.1	14.1	14.2	13.9	0.4	1.8	N	0	897.1	83

Date	Time	Temp. Out	Wind Chill	Hi Temp	Low Temp	Wind Speed (m/s)			Rain	Bar	Hum In
		C°	C°	C°	C°	Avg	Hi	Dir	mm	mB	%
3/30/00	12:00p	14.1	14.1	14.3	13.9	0.4	1.8	NNW	0	896.9	83
3/30/00	12:15p	14.1	14.1	14.2	14	0.4	1.3	N	0	896.7	83
3/30/00	12:30p	14.2	14.2	14.4	14.1	0	1.8	N	0	896.7	83
3/30/00	12:45p	14.8	14.8	15.7	14.4	0	1.3	N	0	896.4	83
3/30/00	1:00p	15.4	15.4	15.6	15.3	0	1.3	N	0	896.3	84
3/30/00	1:15p	15.7	15.7	16.2	15.3	0.4	1.3	N	0	896.1	84
3/30/00	1:30p	16.9	16.9	17.4	16.1	0	0	---	0	895.9	85
3/30/00	1:45p	17.4	17.4	17.9	17.1	0	0.9	N	0	895.7	85
3/30/00	2:00p	18.1	18.1	18.4	17.9	0.4	1.8	SSW	0	895.1	84
3/30/00	2:15p	18.4	18.4	18.6	18.3	0.4	1.3	SSW	0	895	84
3/30/00	2:30p	18.8	18.8	18.9	18.6	0.4	1.8	SW	0	894.8	84
3/30/00	2:45p	18.8	18.8	18.9	18.7	0	0.9	SW	0	894.4	83
3/30/00	3:00p	19	19	19.1	18.9	0	1.3	SW	0	894.4	83
3/30/00	3:15p	19.1	19.1	19.2	18.9	0	1.3	SSW	0	894.3	82
3/30/00	3:30p	19.3	19.3	19.6	19	0.4	1.8	SSW	0	894.3	82
3/30/00	3:45p	19.6	19.6	20	19.3	0	1.3	SSW	0	894.3	81
3/30/00	4:00p	19.6	19.6	20.1	18.9	0	0.4	SSW	0	894.2	80
3/30/00	4:15p	19.2	19.2	19.9	18.9	0	0	---	0	894.2	79
3/30/00	4:30p	19.8	19.8	20.2	19.3	0	0.9	SSW	0	894.2	80
3/30/00	4:45p	19.2	19.2	19.3	19.1	0	0	---	0	894.2	79
3/30/00	5:00p	19.4	19.4	20.5	19.1	0	0	---	0	894.2	78
3/30/00	5:15p	20.4	20.4	20.9	19.8	0	1.3	SSW	0	894	78
3/30/00	5:30p	19.1	19.1	19.8	18.5	0	0	---	0	894.2	77
3/30/00	5:45p	18.9	18.9	19.6	18.3	0	0	---	0	894.3	76
3/30/00	6:00p	18.4	18.4	18.7	18.2	0	0	---	0	894.4	76
3/30/00	6:15p	18	18	18.2	17.8	0	0	---	0	894.3	76
3/30/00	6:30p	17.4	17.4	17.8	17.1	0	0	---	0	894.5	76
3/30/00	6:45p	16.7	16.7	17.1	16.3	0	0	---	0	894.8	75
3/30/00	7:00p	15.9	15.9	16.2	15.6	0	0	---	0	894.8	75
3/30/00	7:15p	15.4	15.4	15.6	14.9	0	0	---	0	894.9	75
3/30/00	7:30p	14.8	14.8	15	14.6	0	0	---	0	895	75
3/30/00	7:45p	14.4	14.4	14.6	14.1	0	0	---	0	895.2	75
3/30/00	8:00p	14	14	14.1	13.8	0	0	---	0	895.2	76
3/30/00	8:15p	13.6	13.6	13.8	13.3	0	0	---	0	895.3	76
3/30/00	8:30p	13.1	13.1	13.3	13.1	0	0	---	0	895.5	76
3/30/00	8:45p	12.9	12.9	13.2	12.7	0	0	---	0	895.6	76
3/30/00	9:00p	13.5	13.5	14.3	12.6	0	0	---	0	895.5	77
3/30/00	9:15p	13.9	13.9	14.4	13.2	0	0	---	0	895.5	78
3/30/00	9:30p	13.8	13.8	14.3	13.4	0	0	---	0	895.4	78
3/30/00	9:45p	13.9	13.9	14.5	13.6	0	0	---	0	895.4	78
3/30/00	10:00p	13.8	13.8	13.9	13.8	0	0	---	0	895.5	79
3/30/00	10:15p	14.1	14.1	14.4	13.8	0	0	---	0	895.4	79
3/30/00	10:30p	14.4	14.4	14.6	14.4	0	0	---	0	895.4	79
3/30/00	10:45p	14.4	14.4	14.6	14.3	0	0.4	ESE	0	895.2	79
3/30/00	11:00p	14.4	14.4	14.6	14.3	0	0	---	0	895	79
3/30/00	11:15p	14.4	14.4	14.5	14.2	0	0.9	ESE	0	895	79
3/30/00	11:30p	14.4	14.4	14.5	14.3	0	0.9	E	0	894.9	79
3/30/00	11:45p	14.3	14.3	14.4	14.2	0	0	---	0	894.9	80
3/31/00	12:00a	14.1	14.1	14.2	14	0	0	---	0	894.8	79
3/31/00	12:15a	13.8	13.8	13.9	13.5	0	0	---	0	894.5	79
3/31/00	12:30a	13.3	13.3	13.5	13.2	0	0	---	0	894.5	79
3/31/00	12:45a	13.1	13.1	13.2	13.1	0	0	---	0	894.4	79
3/31/00	1:00a	12.9	12.9	13.1	12.7	0	0	---	0	894.4	79
3/31/00	1:15a	12.7	12.7	12.8	12.5	0	0	---	0	894.2	78
3/31/00	1:30a	12.4	12.4	12.5	12.3	0	0	---	0	894	79
3/31/00	1:45a	12.2	12.2	12.4	12.1	0	0	---	0	894	79
3/31/00	2:00a	11.9	11.9	12.1	11.8	0	0	---	0	893.9	79
3/31/00	2:15a	11.7	11.7	11.7	11.6	0	0	---	0	893.9	79

Date	Time	Temp. Out	Wind Chill	Hi Temp	Low Temp	Wind Speed (m/s)			Rain	Bar	Hum In
		C°	C°	C°	C°	Avg	Hi	Dir	mm	mB	%
3/31/00	2:30a	11.3	11.3	11.5	11.2	0	0	---	0	893.9	79
3/31/00	2:45a	11.3	11.3	11.3	11.2	0	0	---	0	893.9	79
3/31/00	3:00a	11.2	11.2	11.2	11.1	0	0	---	0	893.8	80
3/31/00	3:15a	11	11	11.1	10.8	0	0	---	0	893.8	80
3/31/00	3:30a	10.7	10.7	10.8	10.7	0	0	---	0	893.6	80
3/31/00	3:45a	10.7	10.7	10.7	10.7	0	0	---	0	893.7	80
3/31/00	4:00a	11	11	11.2	10.7	0	0	---	0	893.4	80
3/31/00	4:15a	11.2	11.2	11.2	11.1	0	0	---	0	893.4	81
3/31/00	4:30a	10.9	10.9	11.2	10.7	0	0	---	0	893.4	81
3/31/00	4:45a	10.8	10.8	10.9	10.7	0	0	---	0	893.4	81
3/31/00	5:00a	10.9	10.9	10.9	10.8	0	0	---	0	893.4	82
3/31/00	5:15a	10.7	10.7	10.7	10.7	0	0	---	0	893.5	82
3/31/00	5:30a	10.6	10.6	10.7	10.6	0	0	---	0	893.5	83
3/31/00	5:45a	10.5	10.5	10.6	10.4	0.9	1.3	SE	0	893.7	83
3/31/00	6:00a	10.5	10.5	10.6	10.4	0.9	1.3	SSE	0	893.7	84
3/31/00	6:15a	10.5	10.5	10.6	10.4	0.9	0.9	SSE	0	893.8	83
3/31/00	6:30a	10.4	10.4	10.4	10.3	0.4	0.9	SSE	0	893.9	83
3/31/00	6:45a	10.2	10.2	10.3	10.1	0.4	0.9	SSE	0	893.8	83
3/31/00	7:00a	9.9	9.9	10.1	9.9	0.9	1.3	SSE	0	893.9	83
3/31/00	7:15a	9.9	9.9	10.1	9.9	0.9	1.3	S	0	894	84
3/31/00	7:30a	10.2	10.2	10.3	10.1	0.9	1.3	S	0	894	84
3/31/00	7:45a	10.3	10.3	10.6	10.2	0.9	1.3	S	0	894.2	84
3/31/00	8:00a	11.3	11.3	12.3	10.6	0.9	1.3	S	0	894.2	85
3/31/00	8:15a	12.2	12.2	12.4	12.1	1.3	1.3	SSW	0	894.3	85
3/31/00	8:30a	12.7	12.7	13.1	12.3	1.3	1.8	SSW	0	894.5	87
3/31/00	8:45a	13.6	13.6	13.8	13.1	1.3	2.2	SSW	0	894.5	91
3/31/00	9:00a	14.1	14.1	14.2	13.8	1.8	2.7	SSW	0	894.3	88
3/31/00	9:15a	14.4	14.4	14.6	14.2	1.8	3.1	SSW	0	894.2	85
3/31/00	9:30a	14.8	13.8	15.1	14.6	2.2	3.1	SSW	0	894.3	83
3/31/00	9:45a	15.4	14.4	15.6	15.1	2.2	3.1	SW	0	894.3	81
3/31/00	10:00a	16.2	16.2	16.6	15.6	1.8	3.1	SSW	0	894.3	80
3/31/00	10:15a	17	16.1	17.5	16.5	2.2	4	SSW	0	894.3	79
3/31/00	10:30a	18.2	18.2	18.7	17.6	1.8	4	SW	0	894.2	78
3/31/00	10:45a	19.7	19	20.4	18.8	2.2	3.1	SSW	0	894.1	75
3/31/00	11:00a	20.6	19.9	20.9	20.2	2.2	4	SSW	0	894	69
3/31/00	11:15a	20.9	20.3	21.4	20.7	2.2	3.6	SSW	0	894.1	62
3/31/00	11:30a	21.8	21.8	23.1	20.9	1.8	4	SSW	0	894.1	59
3/31/00	11:45a	22.5	22.5	22.8	22.1	1.8	2.7	SSW	0	894.1	56
3/31/00	12:00p	22.6	22.6	23.3	22	1.8	3.6	SSW	0	894.2	53
3/31/00	12:15p	23.8	23.8	24.2	23.3	1.3	3.1	SW	0	894.2	50
3/31/00	12:30p	23.9	23.9	24.8	23.3	1.8	3.1	SSW	0	894.1	46
3/31/00	12:45p	23.3	23.3	24	21.6	1.8	3.6	SSW	0	894	41
3/31/00	1:00p	20.8	20.8	21.4	20.6	1.8	3.6	SSW	0	893.8	36
3/31/00	1:15p	20.6	20.6	20.9	20.4	1.8	3.1	SSW	0	893.4	36
3/31/00	1:45p	21.1	21.1	21.3	20.9	1.8	3.1	SW	0	893.2	36
3/31/00	2:00p	20.8	20.8	20.9	20.7	1.8	4	SSW	0	893.1	37
3/31/00	2:15p	21	21	21.2	20.8	1.8	3.1	SW	0	892.8	39
3/31/00	2:30p	21	21	21.1	20.9	1.8	3.1	SSW	0	892.8	40
3/31/00	2:45p	20.9	20.9	21.1	20.8	1.3	3.6	SSW	0	892.9	41
3/31/00	3:00p	21.1	21.1	21.3	20.9	1.8	4	SSW	0	892.8	41
3/31/00	3:15p	21	21	21.2	20.8	1.8	3.1	SSW	0	892.7	42
3/31/00	3:30p	21.1	21.1	21.2	20.9	1.3	2.7	SSW	0	892.8	43
3/31/00	3:45p	21.4	21.4	22.3	21	1.3	3.6	SSW	0	892.6	43
3/31/00	4:00p	21.9	21.9	22.3	21.4	1.8	3.6	SSW	0	892.8	43
3/31/00	4:15p	21.3	21.3	21.4	21.2	1.3	2.7	SSW	0	892.7	44
3/31/00	4:30p	21.4	21.4	21.6	21.2	1.3	2.7	SW	0	892.6	44
3/31/00	4:45p	21.3	21.3	21.6	21.2	0.9	2.2	SW	0	892.7	44
3/31/00	5:00p	21.1	21.1	21.4	20.9	1.3	2.7	SSW	0	892.7	44

Date	Time	Temp. Out	Wind Chill	Hi Temp	Low Temp	Wind Speed (m/s)			Rain	Bar	Hum In
		C°	C°	C°	C°	Avg	Hi	Dir	mm	mB	%
3/31/00	5:15p	21.4	21.4	21.7	21	0.9	2.2	SSW	0	892.7	44
3/31/00	5:30p	20.7	20.7	21	20.5	0.9	1.8	SW	0	892.9	44
3/31/00	5:45p	20.7	20.7	21.1	20.3	0.9	1.3	SW	0	892.9	45
3/31/00	6:00p	20.1	20.1	20.3	19.8	0.4	1.8	SW	0	893.1	45
3/31/00	6:15p	19.5	19.5	19.8	19.3	0.4	0.9	SW	0	893.2	45
3/31/00	6:30p	18.5	18.5	19.3	17.8	0	0.4	SW	0	893.3	45
3/31/00	6:45p	17.3	17.3	17.8	16.9	0	0	---	0	893.4	45
3/31/00	7:00p	16.8	16.8	17	16.3	0	0.9	SW	0	893.7	45
3/31/00	7:15p	15.9	15.9	16.3	15.6	0	0.4	SW	0	893.9	46
3/31/00	7:30p	15.4	15.4	15.6	15	0	0	---	0	893.9	46
3/31/00	7:45p	14.7	14.7	14.9	14.4	0	0	---	0	894.2	47
3/31/00	8:00p	14.3	14.3	14.4	14.2	0	0	---	0	894.4	47
3/31/00	8:15p	14.1	14.1	14.2	13.9	0	0	---	0	894.7	47
3/31/00	8:30p	13.9	13.9	14	13.9	0	0	---	0	894.8	48
3/31/00	8:45p	13.6	13.6	13.9	13.3	0	0	---	0	894.9	49
3/31/00	9:00p	13.2	13.2	13.3	13.1	0	0	---	0	894.9	49
3/31/00	9:15p	13.1	13.1	13.1	13	0	0	---	0	895.1	50
3/31/00	9:30p	13.1	13.1	13.2	13.1	0	0	---	0	895.2	51
3/31/00	9:45p	13.1	13.1	13.2	13	0	0	---	0	895.2	51
3/31/00	10:00p	12.9	12.9	13	12.9	0	0	---	0	895.2	51
3/31/00	10:15p	12.7	12.7	12.8	12.7	0	0.4	SW	0	895.2	52
3/31/00	10:30p	12.7	12.7	12.8	12.3	0.4	0.9	SW	0	895.2	53
3/31/00	10:45p	12.3	12.3	12.3	12.2	0	0.9	SW	0	895.2	52
3/31/00	11:00p	12.3	12.3	12.4	12.1	0	0	---	0	895.1	54
3/31/00	11:15p	12.1	12.1	12.3	12	0	0	---	0	895	54
3/31/00	11:30p	11.8	11.8	12.2	11.6	0.4	0.9	SW	0	895	54
3/31/00	11:45p	11.7	11.7	11.8	11.6	0	0	---	0	894.9	55
4/01/00	12:00a	12.2	12.2	12.5	11.8	0	0	---	0	894.9	56
4/01/00	12:15a	12.8	12.8	13	12.6	0	0	---	0	894.6	56
4/01/00	12:30a	13.2	13.2	13.4	13	0	0	---	0	894.7	57
4/01/00	12:45a	13.6	13.6	13.7	13.4	0.9	1.3	SW	0	894.4	57
4/01/00	1:00a	13.9	13.9	14	13.7	1.3	1.8	SW	0	894.1	58
4/01/00	1:15a	14.1	14.1	14.2	14	1.3	2.2	SW	0	894.2	58
4/01/00	1:30a	14.3	14.3	14.4	14.2	1.3	1.8	SSW	0	894.2	58
4/01/00	1:45a	14.4	14.4	14.5	14.4	1.8	2.2	SSW	0	894.1	58
4/01/00	2:00a	14.6	14.6	14.7	14.5	1.8	2.7	SSW	0	894.1	58
4/01/00	2:15a	14.8	14.8	14.8	14.7	1.8	2.7	SSW	0	894	58
4/01/00	2:30a	14.7	14.7	14.8	14.6	1.8	2.7	SSW	0	893.7	58
4/01/00	2:45a	14.6	14.6	14.6	14.6	1.8	2.7	SSW	0	893.8	58
4/01/00	3:00a	14.7	14.7	14.8	14.6	1.8	2.7	SSW	0	893.7	58
4/01/00	3:15a	14.7	13.7	14.8	14.7	2.2	2.7	SSW	0	893.6	58
4/01/00	3:30a	14.9	13.9	15.1	14.8	2.2	3.1	SSW	0	893.7	58
4/01/00	3:45a	15	14	15.1	14.9	2.2	2.7	SSW	0	893.5	58
4/01/00	4:00a	14.8	14.8	14.9	14.6	1.8	2.7	SSW	0	893.5	58
4/01/00	4:15a	14.5	14.5	14.6	14.4	1.8	2.2	SW	0	893.6	57
4/01/00	4:30a	14.3	14.3	14.4	14.2	1.8	2.2	SW	0	893.5	57
4/01/00	4:45a	14.2	14.2	14.2	14.1	1.8	2.2	SSW	0	893.7	58
4/01/00	5:00a	14.2	14.2	14.3	14.1	1.8	2.7	SSW	0	893.8	58
4/01/00	5:15a	14.2	14.2	14.3	14.2	1.8	2.7	SSW	0	894	58
4/01/00	5:30a	14.1	14.1	14.2	14	1.8	2.2	SSW	0	894.1	58
4/01/00	5:45a	13.9	13.9	14	13.8	1.8	2.2	SSW	0	894.3	58
4/01/00	6:00a	13.8	13.8	13.9	13.8	1.8	2.7	SSW	0	894.4	58
4/01/00	6:15a	13.7	13.7	13.8	13.6	1.8	2.2	SSW	0	894.7	58
4/01/00	6:30a	13.5	13.5	13.6	13.4	1.3	1.8	SSW	0	894.7	58
4/01/00	6:45a	13.3	13.3	13.4	13.3	1.3	1.8	SSW	0	895.1	58
4/01/00	7:00a	13.2	13.2	13.3	13.2	1.3	1.8	SSW	0	895.2	58
4/01/00	7:15a	13.2	13.2	13.2	13.1	1.3	1.8	SSW	0	895.2	58
4/01/00	7:30a	13.2	13.2	13.3	13.1	1.3	1.8	SSW	0	895.4	59

Date	Time	Temp. Out	Wind Chill	Hi Temp	Low Temp	Wind Speed (m/s)			Rain	Bar	Hum In
		C°	C°	C°	C°	Avg	Hi	Dir	mm	mB	%
4/01/00	7:45a	13.4	13.4	13.6	13.3	1.3	1.8	SSW	0	895.7	59
4/01/00	8:00a	13.7	13.7	14.1	13.6	1.3	1.8	SSW	0	895.9	59
4/01/00	8:15a	14.1	14.1	14.4	14.1	1.3	1.3	SSW	0	896	60
4/01/00	8:30a	15.1	15.1	15.9	14.4	1.3	1.3	SSW	0	896.1	61
4/01/00	8:45a	16.6	16.6	17.1	16.1	0.9	1.8	SSW	0	896.1	63
4/01/00	9:00a	16.7	16.7	16.8	16.6	1.3	2.2	SSW	0	896.2	63
4/01/00	9:15a	16.8	16.8	16.9	16.8	1.3	1.8	SSW	0	896.2	62
4/01/00	9:30a	16.7	16.7	16.8	16.7	0.9	1.8	SSW	0	896.4	60
4/01/00	9:45a	16.8	16.8	16.8	16.7	0.9	1.3	SSW	0	896.6	60
4/01/00	10:00a	17.1	17.1	17.4	16.8	0.9	1.8	SSW	0	896.5	60
4/01/00	10:15a	17.9	17.9	18.3	17.4	1.3	1.8	SSW	0	896.5	60
4/01/00	10:30a	17.9	17.9	18.1	17.8	1.3	2.2	SSW	0	896.4	59
4/01/00	10:45a	18.6	18.6	19	18.2	1.3	2.7	SSW	0	896.6	59
4/01/00	11:00a	18.7	18.7	18.9	18.6	0.9	1.8	SSW	0	896.3	59
4/01/00	11:15a	18.9	18.9	19.3	18.8	0.9	1.8	SSW	0	896.3	59
4/01/00	11:30a	19.7	19.7	19.9	19.4	0.4	1.8	SSW	0	896.3	58
4/01/00	11:45a	19.8	19.8	20.2	19.7	0.4	1.3	SSW	0	896.3	58
4/01/00	12:00p	21.2	21.2	22.6	20.2	0.4	1.8	SSW	0	896.3	59
4/01/00	12:15p	22	22	22.6	21.2	0.4	1.3	SSW	0	896.2	59
4/01/00	12:30p	20.1	20.1	21.2	19.3	0.9	1.3	SSE	0	896.2	56
4/01/00	12:45p	17.8	17.8	19.3	15.8	0.4	1.3	SSE	0.4	896.3	52
4/01/00	1:00p	14.9	14.9	15.8	14.4	0.4	1.3	SSE	0.8	896.4	51
4/01/00	1:15p	14.4	14.4	14.7	14.3	0.9	1.3	S	0.8	896.5	53
4/01/00	1:30p	14.7	14.7	14.8	14.6	0.4	1.3	S	0	896.8	56
4/01/00	1:45p	14.3	14.3	14.6	14	0.4	1.3	S	0.2	896.3	58
4/01/00	2:00p	13.9	13.9	14.1	13.8	0.4	0.9	S	0	896.3	59
4/01/00	2:15p	14.1	14.1	14.1	13.9	0	0.4	S	0.2	896	60
4/01/00	2:30p	14.1	14.1	14.2	14.1	0.4	1.3	S	0.4	896.5	61
4/01/00	2:45p	13.7	13.7	14	13.5	0	0.9	S	0.4	896.1	62
4/01/00	3:00p	13.9	13.9	14	13.7	0.4	0.9	S	0	896	63
4/01/00	3:15p	13.8	13.8	13.8	13.7	0	0	---	0	896.2	63
4/01/00	3:30p	13.7	13.7	13.7	13.6	0.4	0.9	SSW	0	896.1	64
4/01/00	3:45p	13.8	13.8	14	13.7	0	0.4	SSW	0	896.2	65
4/01/00	4:00p	14	14	14.1	13.9	0	0	---	0	896.1	66
4/01/00	4:15p	14.1	14.1	14.1	14	0	1.3	SSW	0	896.1	66
4/01/00	4:30p	14.3	14.3	14.4	14.1	0.9	1.3	SSW	0	895.9	67
4/01/00	4:45p	14.3	14.3	14.3	14.2	0.4	1.3	SSW	0	896	68
4/01/00	5:00p	13.9	13.9	14.2	13.7	0	0	---	0	896.5	68
4/01/00	5:15p	13.7	13.7	13.7	13.6	0	0	---	0	896.8	68
4/01/00	5:30p	13.6	13.6	13.7	13.6	0	0	---	0	896.7	68
4/01/00	5:45p	13.6	13.6	13.6	13.6	0	0	---	0	897.1	69
4/01/00	6:00p	13.4	13.4	13.6	13.3	0	1.3	ESE	0	897.1	69
4/01/00	6:15p	13.2	13.2	13.3	13.1	0	0	---	0	897.1	70
4/01/00	6:30p	12.9	12.9	13.1	12.7	0	0.9	N	0	897.1	70
4/01/00	6:45p	12.6	12.6	12.7	12.4	0	0	---	0	897.4	69
4/01/00	7:00p	12.3	12.3	12.4	12.3	0	0	---	0	897.5	70
4/01/00	7:15p	12.2	12.2	12.3	12.2	0	0	---	0	897.7	70
4/01/00	7:30p	12.2	12.2	12.3	12.2	0	0	---	0	898.1	70
4/01/00	7:45p	12.2	12.2	12.2	12.2	0	0	---	0	898.4	70
4/01/00	8:00p	12.2	12.2	12.2	12.2	0	0	---	0	898.3	70
4/01/00	8:15p	12.1	12.1	12.2	12.1	0	0	---	0	898.5	70
4/01/00	8:30p	12	12	12.1	11.9	0	0	---	0	898.6	71
4/01/00	8:45p	11.9	11.9	12	11.9	0	0	---	0	898.9	71
4/01/00	9:00p	11.9	11.9	12	11.9	0	0	---	0	899	71
4/01/00	9:15p	11.9	11.9	11.9	11.9	0	0	---	0	899.1	71
4/01/00	9:30p	11.9	11.9	11.9	11.8	0	0	---	0	899.2	71
4/01/00	9:45p	11.9	11.9	11.9	11.8	0	0	---	0	899.2	71
4/01/00	10:00p	12.1	12.1	12.2	11.9	0	0.4	N	0	899.2	72

Date	Time	Temp. Out	Wind Chill	Hi Temp	Low Temp	Wind Speed (m/s)			Rain	Bar	Hum In
		C°	C°	C°	C°	Avg	Hi	Dir	mm	mB	%
4/01/00	10:15p	12.3	12.3	12.3	12.2	0	0.4	---	0	899.3	72
4/01/00	10:30p	12.3	12.3	12.3	12.3	0	0	---	0	899.4	72
4/01/00	10:45p	12.3	12.3	12.4	12.3	0	0	---	0	899.5	72
4/01/00	11:00p	12.4	12.4	12.4	12.4	0	0	---	0	899.4	73
4/01/00	11:15p	12.4	12.4	12.4	12.3	0	0	---	0	899.3	73
4/01/00	11:30p	12.3	12.3	12.3	12.3	0	0	---	0	899.2	73
4/01/00	11:45p	12.4	12.4	12.4	12.3	0.4	1.3	NW	0	899.1	73
4/02/00	12:00a	12.4	12.4	12.5	12.4	0	1.3	N	0	899.2	73
4/02/00	12:15a	12.5	12.5	12.5	12.4	0	1.3	N	0	899.2	74
4/02/00	12:30a	12.4	12.4	12.5	12.4	0	1.3	N	0	899.1	74
4/02/00	12:45a	12.5	12.5	12.6	12.4	0.4	0.9	N	0	898.9	74
4/02/00	1:00a	12.6	12.6	12.6	12.6	0.4	2.2	N	0.2	898.9	75
4/02/00	1:15a	12.6	12.6	12.6	12.6	0.4	1.8	N	0	899	75
4/02/00	1:30a	12.6	12.6	12.7	12.6	0.9	2.2	N	0	898.8	75
4/02/00	1:45a	12.6	12.6	12.6	12.6	0.9	2.2	NNW	0	898.6	75
4/02/00	2:00a	12.6	12.6	12.6	12.6	0.9	2.2	N	0	898.5	76
4/02/00	2:15a	12.6	12.6	12.6	12.5	0.4	1.8	N	0	898.4	76
4/02/00	2:30a	12.4	12.4	12.5	12.4	0.4	1.3	NE	0	898.6	76
4/02/00	2:45a	12.4	12.4	12.4	12.4	0.4	1.8	E	0	898.6	76
4/02/00	3:00a	12.4	12.4	12.4	12.3	0.4	1.8	NNE	0	898.5	76
4/02/00	3:15a	12.4	12.4	12.4	12.4	0	1.3	N	0	898.7	76
4/02/00	3:30a	12.4	12.4	12.4	12.4	0	0.9	NE	0	898.4	76
4/02/00	3:45a	12.4	12.4	12.4	12.4	0	0.4	N	0	898.1	76
4/02/00	4:00a	12.5	12.5	12.5	12.4	0	0.9	N	0	898.2	77
4/02/00	4:15a	12.5	12.5	12.6	12.5	0	0.9	N	0	898.2	77
4/02/00	4:30a	12.6	12.6	12.6	12.6	0	0.9	N	0	898.2	77
4/02/00	4:45a	12.7	12.7	12.8	12.6	0.4	1.8	WNW	0	898.1	77
4/02/00	5:00a	12.8	12.8	12.9	12.8	0.4	1.8	N	0	898.4	78
4/02/00	5:15a	12.9	12.9	12.9	12.9	0.4	1.8	N	0.2	898.1	78
4/02/00	5:30a	12.9	12.9	12.9	12.8	0.9	3.1	N	0.2	898.2	78
4/02/00	5:45a	12.8	12.8	12.8	12.8	0.4	1.8	N	0.2	898.1	79
4/02/00	6:00a	12.8	12.8	12.8	12.8	0	1.3	NNW	0	898.6	78
4/02/00	6:15a	12.8	12.8	12.8	12.8	0	0.9	N	0	899	78
4/02/00	6:30a	12.8	12.8	12.8	12.8	0.4	2.2	N	0	899.1	79
4/02/00	6:45a	12.8	12.8	12.8	12.8	0	0.4	---	0.6	899.6	79
4/02/00	7:00a	12.8	12.8	12.8	12.8	0.4	1.3	N	0.8	899.4	79
4/02/00	7:15a	12.8	12.8	12.8	12.8	0	0.9	NNW	0.2	899.3	79
4/02/00	7:30a	12.7	12.7	12.8	12.7	0.4	1.3	NNW	0.2	899.5	79
4/02/00	7:45a	12.7	12.7	12.8	12.7	0.4	1.8	N	0	899.5	79
4/02/00	8:00a	12.7	12.7	12.8	12.7	0.4	1.3	N	0.2	899.5	79
4/02/00	8:15a	12.8	12.8	12.8	12.8	0	1.3	N	0.8	899.9	79
4/02/00	8:30a	12.8	12.8	12.8	12.8	0	0.4	N	0.2	900.2	79
4/02/00	8:45a	12.8	12.8	12.9	12.8	0.4	0.9	N	0.2	900.2	79
4/02/00	9:00a	12.9	12.9	12.9	12.9	0.4	1.3	N	0	900.5	80
4/02/00	9:15a	12.9	12.9	13	12.9	0.4	1.8	N	0	900.4	80
4/02/00	9:30a	13.1	13.1	13.1	13	0.4	1.3	NNW	0	900.3	80
4/02/00	9:45a	13.1	13.1	13.1	13.1	0.4	1.3	NNW	0	900.5	80
4/02/00	10:00a	13.1	13.1	13.1	12.9	0.4	1.3	N	0	900.4	81
4/02/00	10:15a	13	13	13.1	13	0.4	2.2	N	0	900.6	81
4/02/00	10:30a	13.1	13.1	13.1	13	0	0.9	N	0	900.6	81
4/02/00	10:45a	13.1	13.1	13.1	13	0.4	1.3	NNW	0.2	900.5	81
4/02/00	11:00a	13.1	13.1	13.1	13.1	0.4	1.8	NNW	0	900	81
4/02/00	11:15a	13.1	13.1	13.1	13.1	0.4	1.3	N	0	900.2	81
4/02/00	11:30a	13.1	13.1	13.2	13.1	0	0.9	N	0	900.3	81
4/02/00	11:45a	13.2	13.2	13.3	13.1	0.4	1.3	NNW	0	900	81
4/02/00	12:00p	13.2	13.2	13.3	13.2	0.4	2.2	NNW	0	899.6	82
4/02/00	12:15p	13.3	13.3	13.3	13.3	0.4	1.8	NNW	0	899.4	82
4/02/00	12:30p	13.4	13.4	13.4	13.3	0.9	1.8	N	0	899.1	82

Date	Time	Temp. Out	Wind Chill	Hi Temp	Low Temp	Wind Speed (m/s)			Rain	Bar	Hum In
		C°	C°	C°	C°	Avg	Hi	Dir	mm	mB	%
4/02/00	12:45p	13.6	13.6	13.7	13.4	0	1.3	N	0.2	899.6	82
4/02/00	1:00p	13.4	13.4	13.4	13.4	0.4	1.3	N	0	899.5	82
4/02/00	1:15p	13.5	13.5	13.6	13.4	0.4	1.8	NNW	0	899.1	82
4/02/00	1:30p	13.6	13.6	13.7	13.5	0.4	1.8	NNE	0	898.7	82
4/02/00	1:45p	13.6	13.6	13.7	13.6	0	0.9	N	0	898.8	82
4/02/00	2:00p	13.8	13.8	14	13.6	0	1.3	N	0	898.6	82
4/02/00	2:15p	14.1	14.1	14.3	13.9	0	0.9	N	0	898.5	82
4/02/00	2:30p	14.4	14.4	14.6	14.2	0.4	1.3	N	0	898.3	83
4/02/00	2:45p	14.6	14.6	14.7	14.4	0.4	0.9	N	0	898.1	83
4/02/00	3:00p	14.8	14.8	14.9	14.7	0.4	1.8	N	0	898	83
4/02/00	3:15p	14.7	14.7	14.9	14.6	0.4	1.3	N	0	897.8	83
4/02/00	3:30p	15.2	15.2	15.4	14.9	0.4	1.3	N	0	897.7	83
4/02/00	3:45p	15.2	15.2	15.2	15.2	0	1.8	NNE	0	897.7	83
4/02/00	4:00p	15.4	15.4	15.4	15.2	0	1.3	N	0	897.7	83
4/02/00	4:15p	15.2	15.2	15.3	15.1	0.4	1.3	N	0	897.6	83
4/02/00	4:30p	15.2	15.2	15.3	15.1	0	0.9	NNE	0	897.4	83
4/02/00	4:45p	15.1	15.1	15.1	15	0	0	---	0	897.3	83
4/02/00	5:00p	14.9	14.9	15	14.9	0	0.9	NNE	0	897.4	82
4/02/00	5:15p	15.1	15.1	15.2	15.1	0	0	---	0	897.4	82
4/02/00	5:30p	15.1	15.1	15.2	15	0	0	---	0	897.3	82
4/02/00	5:45p	14.8	14.8	15	14.6	0	0.4	NNW	0	897.3	83
4/02/00	6:00p	14.5	14.5	14.6	14.4	0	0	---	0	897.2	82
4/02/00	6:15p	14.3	14.3	14.4	14.2	0	0	---	0	897.4	82
4/02/00	6:30p	14.1	14.1	14.2	14	0	0	---	0	897	82
4/02/00	6:45p	13.9	13.9	14	13.8	0	0	---	0	897.4	82
4/02/00	7:00p	13.7	13.7	13.8	13.6	0	0	---	0	897.5	82
4/02/00	7:15p	13.5	13.5	13.6	13.4	0	0	---	0	897.8	82
4/02/00	7:30p	13.3	13.3	13.4	13.2	0	0	---	0	897.8	82
4/02/00	7:45p	13.2	13.2	13.2	13.1	0	0.4	NNW	0	898	82
4/02/00	8:00p	13	13	13.1	12.9	0	0	---	0	898.1	82
4/02/00	8:15p	12.8	12.8	12.9	12.6	0	0	---	0	898.1	82
4/02/00	8:30p	12.6	12.6	12.6	12.6	0	0	---	0	898.2	82
4/02/00	8:45p	12.4	12.4	12.6	12.3	0	0	---	0	898.2	82
4/02/00	9:00p	12.2	12.2	12.3	12.2	0	0	---	0	898.2	82
4/02/00	9:15p	12.2	12.2	12.2	12.1	0	0	---	0	898.3	82
4/02/00	9:30p	12.1	12.1	12.2	12.1	0	0	---	0	898.2	82
4/02/00	9:45p	12.1	12.1	12.1	12.1	0	0	---	0	898.4	82
4/02/00	10:00p	12.2	12.2	12.2	12.1	0	0	---	0	898.3	82
4/02/00	10:15p	12.6	12.6	12.8	12.2	0	0.4	---	0	898.4	83
4/02/00	10:30p	12.6	12.6	12.7	12.4	0	0	---	0	898.4	83
4/02/00	10:45p	12.4	12.4	12.6	12.4	0	0.9	N	0	898.3	83
4/02/00	11:00p	12.5	12.5	12.7	12.3	0	0.4	N	0	898.5	83
4/02/00	11:15p	12.5	12.5	12.8	12.4	0	1.3	N	0	898.3	83
4/02/00	11:30p	12.7	12.7	12.8	12.6	0	0.9	N	0	898.3	83
4/02/00	11:45p	12.6	12.6	12.9	12.5	0	2.2	NE	0	897.9	83
4/03/00	12:00a	12.8	12.8	12.9	12.8	0	1.3	N	0	897.8	83
4/03/00	12:15a	12.7	12.7	12.9	12.5	0	2.2	N	0	897.9	84
4/03/00	12:30a	12.7	12.7	12.8	12.6	0.4	1.8	NNE	0	897.8	84
4/03/00	12:45a	12.6	12.6	12.7	12.5	0.4	1.8	NNE	0	897.7	84
4/03/00	1:00a	12.7	12.7	12.8	12.6	0.4	1.3	N	0	897.6	84
4/03/00	1:15a	12.8	12.8	12.8	12.7	0.4	1.3	N	0	897.5	84
4/03/00	1:30a	12.6	12.6	12.8	12.5	0.4	1.8	N	0	897.5	84
4/03/00	1:45a	12.4	12.4	12.6	12.3	0.4	1.8	N	0	897.2	84
4/03/00	2:00a	12.3	12.3	12.4	12.2	0.4	1.8	N	0	897.2	84
4/03/00	2:15a	12.2	12.2	12.3	12.1	0	0.4	N	0	897	84
4/03/00	2:30a	12.2	12.2	12.3	12.2	0	0	---	0	897	84
4/03/00	2:45a	12.2	12.2	12.3	12.2	0	0.4	---	0	896.8	84
4/03/00	3:00a	12.4	12.4	12.6	12.3	0	0.4	---	0	896.6	84

Date	Time	Temp. Out	Wind Chill	Hi Temp	Low Temp	Wind Speed (m/s)			Rain	Bar	Hum In
		C°	C°	C°	C°	Avg	Hi	Dir	mm	mB	%
4/03/00	3:15a	12.6	12.6	12.7	12.6	0	0.4	N	0	896.5	84
4/03/00	3:30a	12.7	12.7	12.8	12.7	0	0.9	N	0	896.3	84
4/03/00	3:45a	12.4	12.4	12.7	12.1	0.4	0.9	N	0	896.2	84
4/03/00	4:00a	12	12	12.1	11.9	0.4	1.3	W	0	896.3	84
4/03/00	4:15a	11.9	11.9	12	11.9	0.4	0.9	W	0	896	84
4/03/00	4:30a	12	12	12	11.9	0.4	0.9	W	0	896	84
4/03/00	4:45a	12	12	12.1	11.9	0.9	0.9	W	0	896	85
4/03/00	5:00a	12.2	12.2	12.3	12.1	0.9	0.9	W	0	896.1	85
4/03/00	5:15a	12.4	12.4	12.4	12.3	0.9	0.9	W	0	896.2	85
4/03/00	5:30a	12.4	12.4	12.4	12.3	0.9	1.3	W	0	896.2	86
4/03/00	5:45a	12.4	12.4	12.4	12.4	0.9	1.3	W	0	896.2	86
4/03/00	6:00a	12.4	12.4	12.5	12.3	0.9	1.3	WSW	0	896.3	86
4/03/00	6:15a	12.6	12.6	12.7	12.5	0.9	1.3	WSW	0	896.3	86
4/03/00	6:30a	12.9	12.9	13.1	12.7	0.9	1.3	WSW	0	896.4	86
4/03/00	6:45a	13.2	13.2	13.3	13.1	0.9	1.3	WSW	0	896.5	86
4/03/00	7:00a	13.3	13.3	13.4	13.3	0.9	1.3	WSW	0	896.6	86
4/03/00	7:15a	13.3	13.3	13.4	13.2	0.9	1.3	WSW	0	896.7	86
4/03/00	7:30a	13.5	13.5	13.6	13.3	0.9	1.3	WSW	0	896.7	86
4/03/00	7:45a	13.4	13.4	13.6	13.3	0.9	1.3	WSW	0	896.8	86
4/03/00	8:00a	13.7	13.7	14	13.5	0.9	1.3	WSW	0	896.8	87
4/03/00	8:15a	14.2	14.2	14.7	13.9	0.9	1.3	SW	0	896.9	87
4/03/00	8:30a	17.1	17.1	18	14.7	0.9	1.3	SW	0	897	92
4/03/00	8:45a	17.7	17.7	18	17	0.9	1.3	SW	0	897	96
4/03/00	9:00a	16.7	16.7	17	16.6	0.4	1.3	SW	0	897	93
4/03/00	9:15a	16.6	16.6	16.7	16.5	0.9	1.8	SW	0	897	90
4/03/00	9:30a	17	17	17.2	16.7	0.9	1.8	SSW	0	897.1	88
4/03/00	9:45a	17.5	17.5	17.8	17.2	0.9	1.8	SW	0	897.3	88
4/03/00	10:00a	18.2	18.2	18.7	17.8	0.9	1.8	SSW	0	897.1	87
4/03/00	10:15a	19.3	19.3	19.8	18.8	0.9	1.8	SSW	0	897.2	88
4/03/00	10:30a	20.2	20.2	20.7	19.9	0.9	2.2	SSW	0	897.1	89
4/03/00	10:45a	21.6	21.6	22.2	20.7	1.3	2.2	SSW	0	896.7	90
4/03/00	11:00a	22.4	22.4	23.1	21.2	0.9	2.7	SW	0	896.7	87
4/03/00	11:15a	22.6	22.6	22.9	22.2	1.8	3.1	SW	0	896.5	81
4/03/00	11:30a	22.5	22.5	23.4	21.8	1.3	2.2	SW	0	896.5	77
4/03/00	11:45a	22.8	22.8	23.7	20.6	1.3	3.1	SSW	0	896.7	73
4/03/00	12:00p	21.3	21.3	21.9	20.2	1.8	2.7	SW	0	896.5	68
4/03/00	12:15p	22.3	22.3	22.9	21.3	1.8	3.1	SSW	0	896.4	66
4/03/00	12:30p	21.2	21.2	22.2	20.2	1.8	3.6	SW	0	896.3	62
4/03/00	12:45p	20.4	20.4	20.7	20	1.8	3.6	SW	0	896.1	60
4/03/00	1:00p	19.9	19.9	20.3	19.8	1.3	3.1	SSW	0	895.7	60
4/03/00	1:15p	20.2	20.2	20.4	19.8	1.8	2.7	SW	0	895.6	61
4/03/00	1:30p	20	20	20.2	19.8	1.8	3.1	SW	0	895.4	62
4/03/00	1:45p	20.3	20.3	20.7	19.9	1.8	3.1	SW	0	895.2	64
4/03/00	2:00p	20.7	20.7	20.9	20.6	1.8	4	SW	0	894.9	64
4/03/00	2:15p	21	21	21.2	20.7	1.8	3.1	SSW	0	894.8	65
4/03/00	2:30p	20.8	20.8	21.2	20.6	1.3	3.1	SW	0	894.8	65
4/03/00	2:45p	20.6	20.6	20.8	20.4	1.3	2.7	SW	0	894.8	65
4/03/00	3:00p	20.4	20.4	20.6	20.2	1.3	2.7	SW	0	894.8	65
4/03/00	3:15p	20.2	20.2	20.3	20.2	1.3	2.2	SSW	0	894.9	65
4/03/00	3:30p	20.6	20.6	20.8	20.3	1.3	2.2	SSW	0	894.7	66
4/03/00	3:45p	20.9	20.9	21.4	20.6	1.3	2.2	SW	0	894.6	66
4/03/00	4:00p	21.4	21.4	21.7	21.1	1.3	2.2	SW	0	894.6	66
4/03/00	4:15p	20.7	20.7	21	20.6	1.3	2.7	SW	0	894.4	66
4/03/00	4:30p	20.8	20.8	21	20.7	0.9	2.2	SW	0	894.2	66
4/03/00	4:45p	20.7	20.7	20.9	20.5	1.3	2.2	SSW	0	894.4	66
4/03/00	5:00p	20.1	20.1	20.5	20	0.9	1.8	SW	0	894.4	66
4/03/00	5:15p	20.2	20.2	20.3	19.9	0.9	2.2	SW	0	894.3	66
4/03/00	5:30p	19.6	19.6	19.9	19.4	0.9	1.8	SW	0	894.4	66

Date	Time	Temp. Out	Wind Chill	Hi Temp	Low Temp	Wind Speed (m/s)			Rain	Bar	Hum In
		C°	C°	C°	C°	Avg	Hi	Dir	mm	mB	%
4/03/00	5:45p	19.3	19.3	19.5	19	0.9	1.3	SW	0	894.4	66
4/03/00	6:00p	19.1	19.1	19.2	18.9	0.9	1.8	SW	0	894.6	66
4/03/00	6:15p	19.1	19.1	19.2	18.9	0.9	1.3	SW	0	894.6	67
4/03/00	6:30p	18.6	18.6	18.9	18.3	0.4	1.8	SW	0	894.8	67
4/03/00	6:45p	18	18	18.3	17.8	0	1.3	SW	0	895.1	67
4/03/00	7:00p	17.5	17.5	17.7	17.3	0	0	---	0	895.1	67
4/03/00	7:15p	17.2	17.2	17.3	16.9	0	0	---	0	895.4	67
4/03/00	7:30p	16.8	16.8	16.9	16.7	0	0	---	0	895.6	67
4/03/00	7:45p	16.6	16.6	16.7	16.5	0	0	---	0	895.7	68
4/03/00	8:00p	16.4	16.4	16.5	16.2	0	0	---	0	895.8	68
4/03/00	8:15p	16.1	16.1	16.2	15.9	0	0	---	0	896	68
4/03/00	8:30p	15.9	15.9	15.9	15.8	0	0	---	0	896	69
4/03/00	8:45p	16	16	16.1	15.9	0	0	---	0	896.2	69
4/03/00	9:00p	16.1	16.1	16.1	16	0	0	---	0	896.4	70
4/03/00	9:15p	15.9	15.9	16	15.8	0	0	---	0	896.3	70
4/03/00	9:30p	15.8	15.8	15.9	15.8	0	0	---	0	896.3	70
4/03/00	9:45p	15.9	15.9	15.9	15.8	0	0	---	0	896.3	70
4/03/00	10:00p	15.7	15.7	15.8	15.6	0	0	---	0	896.3	71
4/03/00	10:15p	15.8	15.8	15.9	15.7	0	0	---	0	896.4	72
4/03/00	10:30p	16.1	16.1	16.2	15.9	0.4	1.8	SW	0	896.4	73
4/03/00	10:45p	16.2	16.2	16.3	16.2	0.9	1.8	SW	0	896.3	74
4/03/00	11:00p	16.2	16.2	16.3	16.1	0.9	1.3	SW	0	896.1	74
4/03/00	11:15p	16.2	16.2	16.2	16.1	0.9	1.3	SW	0	895.8	75
4/03/00	11:30p	16.3	16.3	16.3	16.2	0.9	1.8	SW	0	896.2	76
4/03/00	11:45p	16.1	16.1	16.2	16	0.9	1.3	SW	0	896.2	76
4/04/00	12:00a	16	16	16.1	16	0.9	1.3	SW	0	896	77
4/04/00	12:15a	16.2	16.2	16.2	16.1	0.9	1.3	SW	0	896.2	78
4/04/00	12:30a	16.1	16.1	16.1	16.1	1.3	1.8	SW	0	896.1	78
4/04/00	12:45a	16.2	16.2	16.2	16.1	0.9	1.3	SW	0	896	79
4/04/00	1:00a	16.2	16.2	16.3	16.2	0.9	1.3	SW	0	896	79
4/04/00	1:15a	16.2	16.2	16.2	16.1	0.9	1.3	SW	0	895.9	79
4/04/00	1:30a	16.1	16.1	16.1	16	0.9	1.8	SW	0	895.9	79
4/04/00	1:45a	15.9	15.9	16	15.8	1.3	1.8	SW	0	895.8	80
4/04/00	2:00a	15.7	15.7	15.8	15.6	1.3	1.8	SW	0	895.7	80
4/04/00	2:15a	15.7	15.7	15.7	15.7	1.8	2.2	SW	0	895.6	80
4/04/00	2:30a	15.7	15.7	15.7	15.6	1.3	2.2	SSW	0	895.3	80
4/04/00	2:45a	15.7	15.7	15.7	15.6	1.8	2.7	SSW	0	895.1	80
4/04/00	3:00a	15.6	15.6	15.7	15.4	1.8	2.2	SSW	0	894.9	80
4/04/00	3:15a	15.3	15.3	15.4	15.3	1.8	2.2	SSW	0	895	80
4/04/00	3:30a	15.2	15.2	15.3	15.2	1.8	2.2	SW	0	894.7	80
4/04/00	3:45a	15.2	15.2	15.2	15.2	1.3	2.2	SSW	0	894.7	80
4/04/00	4:00a	14.9	14.9	15.2	14.7	1.3	1.8	SSW	0	894.6	80
4/04/00	4:15a	14.7	14.7	14.7	14.6	1.3	1.8	SSW	0	894.6	80
4/04/00	4:30a	14.6	14.6	14.7	14.5	1.3	1.8	SSW	0	894.6	81
4/04/00	4:45a	14.6	14.6	14.7	14.3	0.9	1.3	SSW	0	894.5	81
4/04/00	5:00a	14.2	14.2	14.3	14.1	0.4	0.9	SSW	0	894.7	80
4/04/00	5:15a	14.2	14.2	14.2	14.1	0.4	0.9	SSW	0	894.6	80
4/04/00	5:30a	13.8	13.8	14.2	13.6	0.4	0.9	SSW	0	894.6	80
4/04/00	5:45a	13.4	13.4	13.6	13.2	0	0.9	SSW	0	894.8	80
4/04/00	6:00a	13	13	13.2	12.9	0.4	0.9	SSW	0	894.8	80
4/04/00	6:15a	13	13	13.1	13	0.4	0.9	SSW	0	895	80
4/04/00	6:30a	13.2	13.2	13.4	13.1	0.4	0.9	SSW	0	895.2	81
4/04/00	6:45a	13.5	13.5	13.6	13.3	0.4	0.9	SSW	0	895.4	81
4/04/00	7:00a	13.4	13.4	13.4	13.3	0	0	---	0	895.4	81
4/04/00	7:15a	13.6	13.6	13.9	13.3	0	0.4	SSW	0	895.6	81
4/04/00	7:30a	13.9	13.9	14.1	13.6	0	0.4	SSW	0	895.7	81
4/04/00	7:45a	13.9	13.9	14.2	13.6	0	0	---	0	895.7	82
4/04/00	8:00a	14	14	14.4	13.8	0	0.9	NW	0	896	82

Date	Time	Temp. Out	Wind Chill	Hi Temp	Low Temp	Wind Speed (m/s)			Rain	Bar	Hum In
		C°	C°	C°	C°	Avg	Hi	Dir	mm	mB	%
4/04/00	8:15a	14.5	14.5	15	14.2	0.4	1.3	NNW	0	896.2	82
4/04/00	8:30a	16.6	16.6	17.2	15.1	0.9	1.8	NNW	0	896.1	88
4/04/00	8:45a	16.6	16.6	16.9	16	0.4	1.3	N	0	896.2	91
4/04/00	9:00a	15.1	15.1	15.9	14.6	0.9	1.8	N	0	896.4	86
4/04/00	9:15a	14.4	14.4	14.6	14.3	0.4	1.3	N	0	896.4	83
4/04/00	9:30a	14.3	14.3	14.4	14.2	0.4	1.3	NNW	0	896.7	81
4/04/00	9:45a	14.3	14.3	14.3	14.2	0.4	1.8	NNW	0	896.5	81
4/04/00	10:00a	14.3	14.3	14.3	14.2	0.4	1.8	N	0	897	81
4/04/00	10:15a	14.3	14.3	14.4	14.2	0	1.3	NNW	0	897	82
4/04/00	10:30a	14.4	14.4	14.4	14.4	0.4	1.3	NNW	0	896.9	82
4/04/00	10:45a	14.4	14.4	14.5	14.4	0.4	1.3	NNW	0	897.2	82
4/04/00	11:00a	14.4	14.4	14.5	14.3	0.4	1.3	NNE	0	897.1	82
4/04/00	11:15a	14.4	14.4	14.5	14.3	0.4	1.3	N	0	896.9	83
4/04/00	11:30a	14.5	14.5	14.6	14.4	0.4	1.3	NNW	0.4	897.1	83
4/04/00	11:45a	14.6	14.6	14.7	14.3	0.4	0.9	NNW	0	897.2	83
4/04/00	12:00p	14.4	14.4	14.6	14.3	0.4	2.2	NNW	0.2	897	83
4/04/00	12:15p	14.6	14.6	14.8	14.5	0.4	1.8	NNE	0	896.6	83
4/04/00	12:30p	14.6	14.6	14.7	14.4	0.4	1.3	N	0	896.3	83
4/04/00	12:45p	14.5	14.5	14.6	14.4	0.4	1.8	N	0.2	896.5	83
4/04/00	1:00p	14.3	14.3	14.4	14.2	0.9	1.3	N	0	896.3	83
4/04/00	1:15p	14.4	14.4	14.6	14.3	0.4	1.8	N	0	896.2	83
4/04/00	1:30p	14.7	14.7	14.9	14.5	0.4	1.8	N	0	895.9	83
4/04/00	1:45p	14.9	14.9	15.1	14.7	0.4	1.3	N	0	895.6	84
4/04/00	2:00p	15.1	15.1	15.3	14.9	0.4	1.8	N	0	895.2	84
4/04/00	2:15p	15.4	15.4	15.7	15.2	0.4	1.3	N	0	895.2	84
4/04/00	2:30p	15.8	15.8	16.1	15.6	0.4	1.8	NNW	0	895.2	85
4/04/00	2:45p	16.4	16.4	16.6	15.9	0	1.3	N	0	894.9	85
4/04/00	3:00p	16.3	16.3	16.6	16.1	0	2.2	NNE	0	894.6	85
4/04/00	3:15p	16.4	16.4	16.6	16.2	0	1.3	NNE	0	894.7	85
4/04/00	3:30p	16.1	16.1	16.4	15.9	0.4	1.3	NNE	0	894.4	84
4/04/00	3:45p	16.1	16.1	16.3	15.8	0.4	1.8	NE	0	894	84
4/04/00	4:00p	16.1	16.1	16.3	15.9	0.4	2.2	NNW	0	894.1	84
4/04/00	4:15p	16.2	16.2	16.2	16.1	0.4	2.7	NE	0	894	84
4/04/00	4:30p	16	16	16.1	15.9	0.4	1.3	NNE	0	894	83
4/04/00	4:45p	16.2	16.2	16.3	16.1	0.4	2.2	NNE	0	893.5	83
4/04/00	5:00p	16.3	16.3	16.3	16.2	0	1.3	N	0	893.4	84
4/04/00	5:15p	16.1	16.1	16.3	15.8	0.4	1.3	N	0	893.3	83
4/04/00	5:30p	15.7	15.7	15.8	15.6	0.4	1.3	NNE	0	893.5	83
4/04/00	5:45p	15.5	15.5	15.6	15.4	0.4	0.9	N	0	893.3	83
4/04/00	6:00p	15.3	15.3	15.4	15.2	0.4	1.3	N	0	893.4	83
4/04/00	6:15p	15.1	15.1	15.2	15.1	0	0.4	N	0	893.6	83
4/04/00	6:30p	14.9	14.9	15.1	14.7	0.4	1.3	N	0	893.6	83
4/04/00	6:45p	14.6	14.6	14.7	14.6	0	1.3	N	0	893.9	83
4/04/00	7:00p	14.6	14.6	14.6	14.5	0.4	1.8	N	0	893.6	83
4/04/00	7:15p	14.4	14.4	14.5	14.4	0.4	1.3	N	0	893.4	83
4/04/00	7:30p	14.3	14.3	14.4	14.3	0.4	1.3	N	0	893.8	83
4/04/00	7:45p	14.2	14.2	14.3	14.2	0	1.3	N	0	893.8	83
4/04/00	8:00p	14.1	14.1	14.2	14.1	0.4	1.3	N	0	893.8	83
4/04/00	8:15p	14.1	14.1	14.1	14.1	0.4	1.3	N	0	893.7	83
4/04/00	8:30p	14.1	14.1	14.1	14	0.4	1.3	N	0	893.7	84
4/04/00	8:45p	13.9	13.9	14	13.9	0	0.9	N	0	893.4	84
4/04/00	9:00p	13.9	13.9	13.9	13.9	0	1.8	N	0	893.5	84
4/04/00	9:15p	14	14	14.1	13.9	0	1.3	N	0	893.5	84
4/04/00	9:30p	14.1	14.1	14.1	14.1	0	0.9	NNE	0	893.6	84
4/04/00	9:45p	14.1	14.1	14.1	14.1	0	0.4	---	0	893.8	84
4/04/00	10:00p	14.1	14.1	14.2	14.1	0	0.4	---	0	893.8	84
4/04/00	10:15p	14.1	14.1	14.2	14.1	0	0.9	NNE	0	893.9	84
4/04/00	10:30p	14.2	14.2	14.2	14.1	0	0.9	N	0	893.8	85

Date	Time	Temp. Out	Wind Chill	Hi Temp	Low Temp	Wind Speed (m/s)			Rain	Bar	Hum In
		C°	C°	C°	C°	Avg	Hi	Dir	mm	mB	%
4/04/00	10:45p	14.2	14.2	14.2	14.2	0	0.9	N	0	893.7	85
4/04/00	11:00p	14.2	14.2	14.2	14.2	0	0.4	N	0	893.6	85
4/04/00	11:15p	14.2	14.2	14.2	14.2	0	0.9	N	0	893.5	85
4/04/00	11:30p	14.2	14.2	14.2	14.2	0	0.9	N	0	893.3	85
4/04/00	11:45p	14.2	14.2	14.2	14.2	0	0.9	N	0.2	893.3	85
4/05/00	12:00a	14.2	14.2	14.2	14.2	0	1.3	N	0	892.9	85
4/05/00	12:15a	14.2	14.2	14.2	14.2	0	0.4	N	0	892.7	85
4/05/00	12:30a	14.2	14.2	14.3	14.2	0	1.3	N	0	892.5	85
4/05/00	12:45a	14.2	14.2	14.3	14.2	0	1.3	NNE	0	892.2	85
4/05/00	1:00a	14.3	14.3	14.3	14.2	0	0.4	N	0	892.2	85
4/05/00	1:15a	14.3	14.3	14.4	14.3	0	1.3	NNE	0	891.8	86
4/05/00	1:30a	14.4	14.4	14.4	14.4	0	1.8	NNE	0	891.5	86
4/05/00	1:45a	14.5	14.5	14.6	14.4	0	1.3	NE	0	891.6	86
4/05/00	2:00a	14.6	14.6	14.6	14.5	0	0	---	0	891.3	86
4/05/00	2:15a	14.6	14.6	14.6	14.6	0	0	---	0	891	86
4/05/00	2:30a	14.6	14.6	14.6	14.6	0	0	---	0	890.8	86
4/05/00	2:45a	14.6	14.6	14.6	14.6	0	0	---	0	890.4	86
4/05/00	3:00a	14.6	14.6	14.6	14.6	0	1.3	SE	0	890.3	86
4/05/00	3:15a	14.6	14.6	14.6	14.6	0	0.9	S	0	889.8	86
4/05/00	3:30a	14.6	14.6	14.6	14.6	0	0	---	0	889.2	86
4/05/00	3:45a	14.6	14.6	14.6	14.6	0	0	---	0	889	86
4/05/00	4:00a	14.6	14.6	14.6	14.6	0	0	---	0	889	86
4/05/00	4:15a	14.6	14.6	14.6	14.6	0	0	---	0.2	888.6	87
4/05/00	4:30a	14.6	14.6	14.6	14.6	0.9	1.8	SSW	0	888.9	87
4/05/00	4:45a	14.6	14.6	14.6	14.6	0.4	1.3	SSW	1.4	888.6	87
4/05/00	5:00a	14.5	14.5	14.6	14.5	0.9	1.3	SSW	0.6	888.8	87
4/05/00	5:15a	14.5	14.5	14.6	14.5	0.4	1.3	SSW	0.2	888.3	87
4/05/00	5:30a	14.5	14.5	14.5	14.4	0	0.9	SSW	0	888.2	87
4/05/00	5:45a	14.6	14.6	14.6	14.5	0.4	1.3	SSW	0	888.3	87
4/05/00	6:00a	14.6	14.6	14.6	14.6	0.4	1.8	SSW	0	888	88
4/05/00	6:15a	14.6	14.6	14.6	14.6	0.9	1.8	SW	0	888.2	88
4/05/00	6:30a	14.6	14.6	14.6	14.6	0.4	1.3	SW	0	888.4	88
4/05/00	6:45a	14.6	14.6	14.6	14.6	0.4	1.3	SW	0	888.3	88
4/05/00	7:00a	14.7	14.7	14.7	14.6	0.4	1.3	SW	0	888.2	88
4/05/00	7:15a	14.7	14.7	14.7	14.7	0.4	1.3	SW	0	888.1	88
4/05/00	7:30a	14.7	14.7	14.7	14.6	0	0.9	SW	0	887.7	88
4/05/00	7:45a	14.7	14.7	14.7	14.6	0	0.9	SSW	0	887.9	88
4/05/00	8:00a	14.7	14.7	14.8	14.7	0.9	2.2	SW	0	887.8	89
4/05/00	8:15a	14.9	14.9	14.9	14.8	0.9	2.2	SW	0	887.8	89
4/05/00	8:30a	14.9	14.9	15	14.9	0.9	1.8	SSW	0	887.8	89
4/05/00	8:45a	15.1	15.1	15.2	15	0.9	2.2	SW	0	887.6	90
4/05/00	9:00a	15.3	15.3	15.4	15.2	0.9	1.8	SSW	0	887.7	90
4/05/00	9:15a	15.4	15.4	15.4	15.4	0.9	1.8	SSW	0	887.8	90
4/05/00	9:30a	15.6	15.6	15.7	15.4	1.3	2.2	SSW	0	887.7	90
4/05/00	9:45a	15.9	15.9	16.1	15.7	0.9	2.2	SSW	0	887.1	90
4/05/00	10:00a	16.3	16.3	16.7	16.1	1.3	2.7	SW	0	887.4	91
4/05/00	10:15a	16.7	16.7	16.7	16.6	1.8	3.6	SW	0	887.3	92
4/05/00	10:30a	16.9	16.9	17.2	16.7	1.8	3.1	SW	0	887.3	92
4/05/00	10:45a	17.2	17.2	17.7	16.8	1.8	3.6	SW	0	887.2	92
4/05/00	11:00a	17.7	17.7	18.3	17.3	1.8	3.1	SW	0	886.9	93
4/05/00	11:15a	17.7	17.7	18	17.1	1.8	2.7	SW	0	886.9	92
4/05/00	11:30a	17.4	17.4	17.8	17	1.8	3.6	SW	0	886.8	91
4/05/00	11:45a	17	17	17.3	16.8	1.8	3.6	SW	0	887	88
4/05/00	12:00p	17.4	16.6	17.9	16.7	2.2	4.5	SW	0	887	88
4/05/00	12:15p	16.7	15.8	17.8	15.8	2.2	4.5	SSW	0	886.9	87
4/05/00	12:30p	17.1	15.7	18.2	16.3	2.7	4.9	SSW	0	886.6	86
4/05/00	12:45p	15.9	14.4	16.3	15.7	2.7	4.5	SSW	0	886.5	83
4/05/00	1:00p	15.4	13.8	15.7	15.1	2.7	4.5	SSW	0	886.5	81

Date	Time	Temp. Out	Wind Chill	Hi Temp	Low Temp	Wind Speed (m/s)			Rain	Bar	Hum In
		C°	C°	C°	C°	Avg	Hi	Dir	mm	mB	%
4/05/00	1:15p	15.4	13.8	15.6	15.2	2.7	4.5	SSW	0	886.6	81
4/05/00	1:30p	15.4	14.4	15.5	15.1	2.2	4.9	SSW	0	886.4	81
4/05/00	1:45p	15.4	14.4	15.6	15.1	2.2	3.6	SSW	0	886.2	81
4/05/00	2:00p	15.2	14.2	15.4	15.1	2.2	4	SW	0	886.2	80
4/05/00	2:15p	15	13.3	15.4	14.3	2.7	5.4	SSW	0	886.4	79
4/05/00	2:30p	14.3	12.6	14.5	14	2.7	5.8	SSW	0	886.5	77
4/05/00	2:45p	13.7	12.7	13.9	13.4	2.2	4	SSW	0	886.5	77
4/05/00	3:00p	13.7	11.9	13.9	13.4	2.7	5.8	SSW	0	886.4	77
4/05/00	3:15p	14.3	12.6	14.7	13.8	2.7	4.5	SSW	0	886.3	78
4/05/00	3:30p	14.3	11.9	14.8	14.1	3.1	5.8	SSW	0	886.4	77
4/05/00	3:45p	14.4	12	14.7	14.1	3.1	4.9	SSW	0	886.6	76
4/05/00	4:00p	14.2	11.7	14.6	13.5	3.1	5.4	SSW	0	886.8	75
4/05/00	4:15p	13.6	11.1	13.8	13.3	3.1	5.4	SSW	0	887	74
4/05/00	4:30p	13.7	11.2	14.1	13.2	3.1	4.9	S	0	887.2	73
4/05/00	4:45p	12.9	11.1	13.2	12.8	2.7	4	SSW	0	887.4	72
4/05/00	5:00p	12.9	11.8	13	12.8	2.2	4.9	S	0	887.7	72
4/05/00	5:15p	12.7	11.6	12.8	12.7	2.2	4	S	0	887.8	72
4/05/00	5:30p	12.7	10.8	12.9	12.5	2.7	4.5	SSW	0	888	71
4/05/00	5:45p	12.3	10.4	12.5	12.3	2.7	4.9	SSW	0	888.2	71
4/05/00	6:00p	12.1	10.1	12.3	11.9	2.7	4.5	SSW	0	888.3	71
4/05/00	6:15p	11.7	9	11.9	11.6	3.1	4.9	SSW	0	888.5	70
4/05/00	6:30p	11.4	10.2	11.6	11.2	2.2	3.6	SSW	0	888.9	70
4/05/00	6:45p	11.1	9.9	11.3	10.9	2.2	4	S	0	889.3	70
4/05/00	7:00p	10.8	10.8	10.9	10.7	1.8	3.6	SSW	0	889.6	71
4/05/00	7:15p	10.7	10.7	10.8	10.6	1.8	3.6	SSW	0	889.8	71
4/05/00	7:30p	10.5	10.5	10.6	10.3	1.8	2.7	S	0	890.1	72
4/05/00	7:45p	10.3	10.3	10.4	10.2	1.8	3.1	S	0	890.4	72
4/05/00	8:00p	10.2	10.2	10.3	10	1.8	3.1	S	0	890.7	72
4/05/00	8:15p	10	10	10.1	9.9	1.8	3.1	S	0	891	73
4/05/00	8:30p	10.1	8.8	10.2	10	2.2	3.1	S	0	891.1	73
4/05/00	8:45p	10.1	10.1	10.2	10.1	1.8	4	S	0	891.5	74
4/05/00	9:00p	10.3	10.3	10.3	10.2	1.8	4	SSE	0	891.8	74
4/05/00	9:15p	10.3	9.1	10.3	10.2	2.2	4.9	SSE	0	891.9	74
4/05/00	9:30p	10.2	8.9	10.3	10.1	2.2	4.9	SSE	0	892.4	75
4/05/00	9:45p	10	8.7	10.1	9.9	2.2	4.5	SSE	0	892.6	75
4/05/00	10:00p	9.9	8.6	9.9	9.8	2.2	4.5	SSE	0	892.9	75
4/05/00	10:15p	9.8	8.6	9.9	9.8	2.2	5.4	SE	0	893.1	76
4/05/00	10:30p	9.7	9.7	9.8	9.7	1.8	4	SE	0	893	76
4/05/00	10:45p	9.7	8.4	9.7	9.7	2.2	5.4	SE	0	893.1	77
4/05/00	11:00p	9.7	7.6	9.8	9.7	2.7	5.4	SSE	0	893.2	78
4/05/00	11:15p	9.7	8.4	9.8	9.7	2.2	5.4	SSE	0	893.4	78
4/05/00	11:30p	9.8	8.5	9.8	9.8	2.2	4.5	SE	0	893.4	78
4/05/00	11:45p	9.8	8.6	9.9	9.8	2.2	4.5	SE	0	893.5	79
4/06/00	12:00a	9.9	9.9	9.9	9.8	1.8	4	SE	0	893.3	79
4/06/00	12:15a	9.9	8.6	9.9	9.9	2.2	4	SE	0	893.5	79
4/06/00	12:30a	9.9	9.9	9.9	9.9	1.8	4.5	SE	0	893.6	80
4/06/00	12:45a	9.9	9.9	9.9	9.8	1.8	3.6	SSE	0	893.6	80
4/06/00	1:00a	9.9	8.6	9.9	9.8	2.2	4	SE	0	893.4	80
4/06/00	1:15a	9.9	9.9	9.9	9.9	1.8	4.5	SE	0	893.7	81
4/06/00	1:30a	9.9	9.9	10	9.9	1.8	3.6	SE	0	893.7	81
4/06/00	1:45a	9.9	9.9	9.9	9.9	1.8	3.1	SE	0	893.6	81
4/06/00	2:00a	9.8	9.8	9.9	9.6	1.8	4	SE	0	893.7	82
4/06/00	2:15a	9.4	9.4	9.5	9.3	1.8	4.5	SE	0	893.9	82
4/06/00	2:30a	9.3	8	9.3	9.2	2.2	4	SE	0	894.1	83
4/06/00	2:45a	9.1	7.8	9.2	9.1	2.2	4.9	SE	0	894.2	83
4/06/00	3:00a	8.9	6.7	9.1	8.8	2.7	5.4	SE	0	894.2	84
4/06/00	3:15a	8.8	7.5	8.8	8.8	2.2	5.8	SE	0	894.2	84
4/06/00	3:30a	8.8	6.6	8.8	8.7	2.7	4.9	SE	0	894.3	85

Date	Time	Temp. Out	Wind Chill	Hi Temp	Low Temp	Wind Speed (m/s)			Rain	Bar	Hum In
		C°	C°	C°	C°	Avg	Hi	Dir	mm	mB	%
4/06/00	3:45a	8.8	6.6	8.8	8.7	2.7	4.9	SE	0	894.3	85
4/06/00	4:00a	8.7	7.4	8.8	8.7	2.2	5.4	SE	0	894.5	86
4/06/00	4:15a	8.8	6.6	8.8	8.7	2.7	4.9	ESE	0	894.5	86
4/06/00	4:30a	8.8	6.6	8.8	8.7	2.7	5.4	ESE	0.2	894.7	87
4/06/00	4:45a	8.8	6.6	8.8	8.7	2.7	5.4	ESE	0	895	87
4/06/00	5:00a	8.8	7.5	8.9	8.8	2.2	4.9	ESE	0	895.1	87
4/06/00	5:15a	8.8	7.5	8.9	8.8	2.2	5.4	ESE	0	895.2	88
4/06/00	5:30a	8.8	7.5	8.8	8.8	2.2	4.5	ESE	0	895.5	88
4/06/00	5:45a	8.7	6.5	8.8	8.7	2.7	4.5	ESE	0	895.8	88
4/06/00	6:00a	8.6	7.3	8.7	8.5	2.2	3.6	ESE	0	896.1	88
4/06/00	6:15a	8.4	8.4	8.5	8.4	1.8	3.6	ESE	0.2	896.4	88
4/06/00	6:30a	8.3	7	8.4	8.3	2.2	4	ESE	0	896.4	88
4/06/00	6:45a	8.3	6.1	8.3	8.3	2.7	4.9	ESE	0	896.7	89
4/06/00	7:00a	8.3	6	8.3	8.2	2.7	4.9	ESE	0	897.1	89
4/06/00	7:15a	8.1	5.8	8.2	8.1	2.7	4.9	ESE	0	897.4	89
4/06/00	7:30a	8	5.7	8.1	7.9	2.7	5.8	ESE	0	897.5	89
4/06/00	7:45a	7.9	6.6	8	7.9	2.2	5.4	ESE	0	897.9	89
4/06/00	8:00a	7.9	6.6	7.9	7.9	2.2	4.9	ESE	0	898.2	89
4/06/00	8:15a	8	6.6	8.1	7.9	2.2	3.6	ESE	0	898.3	89
4/06/00	8:30a	8.2	6.8	8.3	8	2.2	4	ESE	0	898.7	89
4/06/00	8:45a	8.3	7	8.4	8.2	2.2	5.4	SE	0	898.7	89
4/06/00	9:00a	8.7	7.4	8.8	8.4	2.2	4.9	ESE	0	899	90
4/06/00	9:15a	8.6	7.3	8.7	8.4	2.2	4.9	ESE	0	899.2	90
4/06/00	9:30a	8.9	6.7	9	8.7	2.7	4.9	ESE	0	899.2	90
4/06/00	9:45a	9.2	7	9.3	8.8	2.7	4.5	ESE	0	899.4	89
4/06/00	10:00a	9.2	7.9	9.3	9.1	2.2	4	ESE	0	899.5	90
4/06/00	10:15a	8.9	7.6	9.3	8.7	2.2	3.6	SE	0	899.8	89
4/06/00	10:30a	8.6	7.2	8.7	8.5	2.2	4.5	ESE	0	899.8	88
4/06/00	10:45a	8.6	7.2	8.7	8.4	2.2	4.9	SE	0	900.1	88
4/06/00	11:00a	8.5	7.2	8.6	8.4	2.2	4.9	ESE	0	900.3	88
4/06/00	11:15a	9.1	7.8	10.4	8.6	2.2	3.6	ESE	0	900.1	89
4/06/00	11:30a	10.3	10.3	10.9	9.9	1.8	3.6	ESE	0	900.1	92
4/06/00	11:45a	10.1	10.1	10.6	9.9	1.8	3.6	ESE	0	899.9	91
4/06/00	12:00p	10.5	10.5	10.7	10.4	1.3	3.1	ESE	0	899.9	90
4/06/00	12:15p	10.7	10.7	10.9	10.2	1.3	3.1	E	0	899.9	89
4/06/00	12:30p	9.6	9.6	10.2	9.3	1.8	3.6	E	0	900.2	87
4/06/00	12:45p	9.4	9.4	9.6	9.2	1.8	3.6	E	0	900.2	86
4/06/00	1:00p	9.5	9.5	9.6	9.4	1.8	2.7	ESE	0	900.1	86
4/06/00	1:15p	9.8	9.8	9.9	9.4	1.8	3.6	E	0	900.1	87
4/06/00	1:30p	9.9	9.9	10.1	9.7	1.3	2.7	E	0	900	87
4/06/00	1:45p	9.4	9.4	9.6	9.3	1.3	3.6	E	0	900.2	87
4/06/00	2:00p	8.9	8.9	9.2	8.8	1.8	3.1	ESE	0	900.1	86
4/06/00	2:15p	9.6	9.6	10.2	9.1	1.3	2.7	ESE	0	899.8	86
4/06/00	2:30p	10.6	10.6	11.1	10.2	1.3	2.7	E	0	899.6	87
4/06/00	2:45p	10.9	10.9	11.2	10.7	1.3	3.1	E	0	899.4	88
4/06/00	3:00p	11.2	11.2	11.4	11.1	1.3	3.1	ESE	0	899.4	88
4/06/00	3:15p	11.2	11.2	11.5	10.7	0.9	3.1	E	0	899.6	88
4/06/00	3:30p	10.4	10.4	10.7	10.3	1.3	2.2	E	0	899.5	87
4/06/00	3:45p	10.7	10.7	10.9	10.4	1.3	2.7	E	0	899.7	86
4/06/00	4:00p	10.7	10.7	11.1	10.4	0.9	2.7	E	0	899.5	86
4/06/00	4:15p	11.1	11.1	11.2	10.9	0.9	3.1	E	0	899.5	86
4/06/00	4:30p	11	11	11.3	10.6	1.3	3.1	E	0	899.6	86
4/06/00	4:45p	10.3	10.3	10.6	10.1	1.3	4.5	E	0	900	85
4/06/00	5:00p	9.9	9.9	10.1	9.8	0.9	3.1	ENE	0	900.1	84
4/06/00	5:15p	10.1	10.1	10.3	9.9	0.9	2.7	E	0	900.2	84
4/06/00	5:30p	10.1	10.1	10.2	9.9	0.9	2.7	ENE	0	900.2	84
4/06/00	5:45p	9.9	9.9	10	9.8	0.9	2.2	ENE	0	900.4	84
4/06/00	6:00p	9.9	9.9	10.1	9.6	0.9	2.2	ENE	0	900.5	85

Date	Time	Temp. Out	Wind Chill	Hi Temp	Low Temp	Wind Speed (m/s)			Rain	Bar	Hum In
		C°	C°	C°	C°	Avg	Hi	Dir	mm	mB	%
4/06/00	6:15p	9.6	9.6	9.6	9.5	0.9	2.7	ENE	0	900.5	84
4/06/00	6:30p	9.3	9.3	9.5	9.2	1.3	2.7	E	0	900.8	85
4/06/00	6:45p	9.1	9.1	9.2	8.9	0.9	2.2	E	0	901	85
4/06/00	7:00p	8.8	8.8	8.9	8.7	0.9	3.1	E	0	901.3	85
4/06/00	7:15p	8.7	8.7	8.7	8.7	0.9	2.7	E	0	901.3	85
4/06/00	7:30p	8.7	8.7	8.7	8.7	0.9	2.2	E	0	901.6	85
4/06/00	7:45p	8.7	8.7	8.7	8.6	0.9	2.2	E	0	901.6	85
4/06/00	8:00p	8.6	8.6	8.7	8.6	0.9	1.8	E	0	901.8	85
4/06/00	8:15p	8.7	8.7	8.7	8.7	0.9	2.2	E	0	902	86
4/06/00	8:30p	8.7	8.7	8.7	8.7	0.9	1.8	ENE	0	902.1	86
4/06/00	8:45p	8.7	8.7	8.7	8.7	0.9	1.3	E	0	902.2	86
4/06/00	9:00p	8.7	8.7	8.7	8.6	0.9	1.8	E	0	902.2	86
4/06/00	9:15p	8.6	8.6	8.6	8.6	0.9	1.8	ENE	0	902.3	86
4/06/00	9:30p	8.6	8.6	8.6	8.6	0.9	2.2	ENE	0	902.3	86
4/06/00	9:45p	8.7	8.7	8.7	8.6	0.4	1.8	ENE	0	902.4	87
4/06/00	10:00p	8.6	8.6	8.7	8.6	0.4	2.2	ENE	0	902.4	86
4/06/00	10:15p	8.5	8.5	8.6	8.4	0.9	2.2	E	0	902.5	87
4/06/00	10:30p	8.4	8.4	8.5	8.4	0.9	1.8	ENE	0	902.4	87
4/06/00	10:45p	8.5	8.5	8.5	8.4	0.9	1.8	E	0	902.3	87
4/06/00	11:00p	8.4	8.4	8.5	8.4	0.9	1.8	E	0	902.3	87
4/06/00	11:15p	8.4	8.4	8.4	8.3	0.9	2.7	E	0	902.4	87
4/06/00	11:30p	8.3	8.3	8.3	8.2	0.9	2.7	E	0	902.4	87
4/06/00	11:45p	8.3	8.3	8.3	8.2	0.9	2.2	E	0	902.4	87
4/07/00	12:00a	8.3	8.3	8.4	8.3	0.9	3.1	E	0	902.4	87
4/07/00	12:15a	8.4	8.4	8.4	8.3	0.9	2.7	E	0.2	902.2	88
4/07/00	12:30a	8.3	8.3	8.4	8.3	0.4	1.8	NE	0	902.4	88
4/07/00	12:45a	8.3	8.3	8.3	8.3	0.4	2.2	ENE	0	902.4	88
4/07/00	1:00a	8.3	8.3	8.3	8.3	0.9	2.2	ENE	0	902.3	88
4/07/00	1:15a	8.3	8.3	8.3	8.2	0.9	2.2	ENE	0	902.5	88
4/07/00	1:30a	8.2	8.2	8.2	8.1	0.9	1.8	ENE	0	902.2	88
4/07/00	1:45a	8.1	8.1	8.1	8.1	0.9	2.2	ENE	0	902.3	88
4/07/00	2:00a	7.9	7.9	8.1	7.9	0.9	3.1	ENE	0	902.3	88
4/07/00	2:15a	7.8	7.8	7.9	7.8	0.4	2.7	E	0	902.3	88
4/07/00	2:30a	7.8	7.8	7.9	7.8	0.4	1.8	E	0	902.4	88
4/07/00	2:45a	7.8	7.8	7.8	7.8	0.4	1.3	E	0	902.4	88
4/07/00	3:00a	7.8	7.8	7.9	7.8	0.4	1.3	ENE	0	902.2	88
4/07/00	3:15a	7.9	7.9	7.9	7.9	0.4	1.3	ENE	0	902.1	88
4/07/00	3:30a	7.9	7.9	7.9	7.9	0.4	1.3	E	0	902.1	88
4/07/00	3:45a	7.8	7.8	7.9	7.8	0.4	1.8	ENE	0	902	88
4/07/00	4:00a	7.8	7.8	7.8	7.8	0.4	1.8	E	0	901.9	88
4/07/00	4:15a	7.7	7.7	7.8	7.7	0.9	1.8	E	0	901.9	88
4/07/00	4:30a	7.6	7.6	7.7	7.6	0.4	1.8	E	0	901.9	88
4/07/00	4:45a	7.7	7.7	7.8	7.7	0.4	0.9	NNE	0	902	88
4/07/00	5:00a	7.9	7.9	7.9	7.8	0.4	2.2	E	0	901.8	89
4/07/00	5:15a	7.8	7.8	7.9	7.8	0.4	1.3	E	0	901.9	89
4/07/00	5:30a	7.8	7.8	7.8	7.7	0.4	1.3	N	0	901.9	89
4/07/00	5:45a	7.7	7.7	7.8	7.7	0	0.9	N	0	902.1	89
4/07/00	6:00a	7.9	7.9	8	7.8	0.4	1.3	NNW	0	902.1	89
4/07/00	6:15a	8.1	8.1	8.1	7.9	0.4	1.8	N	0	902.2	89
4/07/00	6:30a	8.1	8.1	8.2	8.1	0.4	1.8	E	0	902.3	89
4/07/00	6:45a	8.2	8.2	8.2	8.1	0.4	2.2	E	0	902.4	89
4/07/00	7:00a	8.2	8.2	8.2	8.1	0.4	1.8	E	0	902.5	89
4/07/00	7:15a	8.1	8.1	8.2	8.1	0.4	1.3	NW	0	902.6	89
4/07/00	7:30a	8	8	8.1	7.9	0.4	2.2	E	0	902.9	89
4/07/00	7:45a	7.9	7.9	7.9	7.9	0.4	1.8	E	0	903	89
4/07/00	8:00a	8.1	8.1	8.3	7.9	0	1.3	NNW	0	903	89
4/07/00	8:15a	8.7	8.7	8.8	8.3	0.4	2.7	NNW	0	903.1	89
4/07/00	8:30a	8.9	8.9	9	8.8	0.4	2.2	E	0	903.5	90

Date	Time	Temp. Out	Wind Chill	Hi Temp	Low Temp	Wind Speed (m/s)			Rain	Bar	Hum In
		C°	C°	C°	C°	Avg	Hi	Dir	mm	mB	%
4/07/00	8:45a	9.1	9.1	9.3	9	0.4	2.7	E	0	903.5	90
4/07/00	9:00a	9.2	9.2	9.4	9.1	0.9	1.8	ENE	0	903.7	91
4/07/00	9:15a	9.3	9.3	9.4	9.2	0.9	1.8	E	0	903.9	91
4/07/00	9:30a	9.4	9.4	9.6	9.3	0.9	1.8	E	0	903.9	90
4/07/00	9:45a	9.7	9.7	9.9	9.6	0.9	2.2	E	0	904.1	90
4/07/00	10:00a	9.9	9.9	10.1	9.8	0.9	2.7	E	0	904	90
4/07/00	10:15a	10.3	10.3	10.8	10.1	0.9	2.2	N	0	903.8	91
4/07/00	10:30a	10.9	10.9	11.1	10.7	0.9	2.2	E	0	903.9	91
4/07/00	10:45a	10.9	10.9	11.1	10.7	0.9	2.2	NNW	0	904	91
4/07/00	11:00a	11.2	11.2	11.3	11	0.4	2.2	N	0	903.8	91
4/07/00	11:15a	11	11	11.2	10.9	0.9	2.2	E	0	903.9	90
4/07/00	11:30a	11	11	11.1	10.8	0.4	1.8	N	0	904	90
4/07/00	11:45a	10.7	10.7	10.8	10.6	0.9	3.1	N	0	903.9	89
4/07/00	12:00p	10.7	10.7	10.8	10.4	0.9	2.7	N	0	904	87
4/07/00	12:15p	10.6	10.6	10.7	10.4	0.9	2.2	N	0	904	87
4/07/00	12:30p	10.3	10.3	10.6	10.1	0.9	2.2	N	0	904	87
4/07/00	12:45p	10.3	10.3	10.7	10.2	0.4	1.8	N	0	904.1	87
4/07/00	1:00p	10.7	10.7	10.8	10.5	0.4	1.8	N	0	903.9	88
4/07/00	1:15p	10.9	10.9	11.3	10.5	0.9	2.2	E	0	903.8	88
4/07/00	1:30p	11.5	11.5	11.7	11.2	0.4	3.1	NNW	0	903.5	89
4/07/00	1:45p	11.1	11.1	11.2	11	0.9	2.2	E	0	903.2	88
4/07/00	2:00p	11.6	11.6	12.3	11.1	0.9	1.8	N	0	902.9	88
4/07/00	2:15p	12	12	12.2	11.7	0.9	3.1	N	0	902.7	89
4/07/00	2:30p	11.6	11.6	11.8	11.2	0.4	1.8	E	0	902.6	88
4/07/00	2:45p	11.3	11.3	11.7	11.2	0.4	1.8	NNE	0	902.5	87
4/07/00	3:00p	11.8	11.8	12.1	11.6	0.9	2.7	E	0	902.4	87
4/07/00	3:15p	12.2	12.2	12.7	12	0.4	2.2	NE	0	902.2	88
4/07/00	3:30p	11.9	11.9	12.5	11.4	0.4	2.2	E	0	902.3	87
4/07/00	3:45p	11.3	11.3	11.4	11.1	0.4	2.7	E	0	902.3	86
4/07/00	4:00p	11.1	11.1	11.2	11.1	0.4	1.8	E	0	902.4	86
4/07/00	4:15p	11.1	11.1	11.1	11	0.4	1.8	ENE	0	902.5	86
4/07/00	4:30p	11.1	11.1	11.1	11	0.4	1.8	NNW	0	902.6	86
4/07/00	4:45p	10.9	10.9	11	10.8	0.4	1.8	E	0	902.6	86
4/07/00	5:00p	10.8	10.8	10.9	10.7	0.4	1.8	N	0	902.5	86
4/07/00	5:15p	10.7	10.7	10.9	10.7	0.4	2.7	N	0	902.6	86
4/07/00	5:30p	10.6	10.6	10.7	10.4	0.4	1.8	N	0	902.6	86
4/07/00	5:45p	10.3	10.3	10.4	10.2	0.4	1.3	N	0	902.5	86
4/07/00	6:00p	10.2	10.2	10.3	10.2	0.4	2.7	NW	0	902.7	86
4/07/00	6:15p	10.1	10.1	10.2	10.1	0	2.2	N	0	902.7	86
4/07/00	6:30p	10	10	10.1	9.9	0	0.9	NNW	0	902.9	86
4/07/00	6:45p	9.9	9.9	9.9	9.8	0	0.9	NNW	0	903	86
4/07/00	7:00p	9.9	9.9	9.9	9.8	0	1.3	NNW	0	903.1	86
4/07/00	7:15p	9.9	9.9	9.9	9.8	0	0.9	N	0	903.2	86
4/07/00	7:30p	9.8	9.8	9.9	9.8	0.4	1.3	N	0	903.2	86
4/07/00	7:45p	9.8	9.8	9.8	9.7	0	1.3	NNW	0	903.2	86
4/07/00	8:00p	9.8	9.8	9.8	9.8	0.4	1.3	N	0	903.4	86
4/07/00	8:15p	9.8	9.8	9.8	9.8	0	0.9	ENE	0	903.4	87
4/07/00	8:30p	9.8	9.8	9.8	9.8	0	1.3	ENE	0	903.8	87
4/07/00	8:45p	9.8	9.8	9.8	9.7	0.4	1.3	E	0	903.9	87
4/07/00	9:00p	9.7	9.7	9.8	9.7	0.4	1.8	N	0	904	87
4/07/00	9:15p	9.7	9.7	9.7	9.7	0	1.8	NW	0	903.9	87
4/07/00	9:30p	9.7	9.7	9.7	9.6	0.9	3.1	NNW	0	903.8	87
4/07/00	9:45p	9.6	9.6	9.6	9.6	0.4	2.2	N	0	904.1	87
4/07/00	10:00p	9.6	9.6	9.6	9.5	0.9	2.2	N	0	904.1	87
4/07/00	10:15p	9.5	9.5	9.6	9.4	0.9	2.2	N	0	904.2	87
4/07/00	10:30p	9.4	9.4	9.4	9.3	0.9	1.8	N	0	904.4	87
4/07/00	10:45p	9.3	9.3	9.4	9.3	0.9	2.2	NNW	0	904.3	87
4/07/00	11:00p	9.3	9.3	9.3	9.2	0.4	2.2	N	0	904.2	87

Date	Time	Temp. Out	Wind Chill	Hi Temp	Low Temp	Wind Speed (m/s)			Rain	Bar	Hum In
		C°	C°	C°	C°	Avg	Hi	Dir	mm	mB	%
4/07/00	11:15p	9.2	9.2	9.2	9.2	0.4	2.7	N	0	904.3	87
4/07/00	11:30p	9.2	9.2	9.2	9.1	0.4	1.8	N	0	904.2	87
4/07/00	11:45p	9.1	9.1	9.1	9.1	0.4	1.3	NNW	0	904.3	87
4/08/00	12:00a	9.1	9.1	9.1	9	0.4	0.9	N	0	904.1	87
4/08/00	12:15a	9.1	9.1	9.1	9	0	1.3	N	0	904	87
4/08/00	12:30a	9	9	9.1	8.9	0.4	1.3	N	0	903.7	87
4/08/00	12:45a	8.8	8.8	8.9	8.7	0	0.9	NNW	0	903.7	87
4/08/00	1:00a	8.6	8.6	8.7	8.5	0	0.9	NNW	0	903.6	87
4/08/00	1:15a	8.3	8.3	8.4	8.2	0	0	---	0	903.6	87
4/08/00	1:30a	8.1	8.1	8.2	8	0	0	---	0	903.3	87
4/08/00	1:45a	7.9	7.9	8.1	7.8	0	0	---	0	903.2	86
4/08/00	2:00a	7.8	7.8	7.8	7.7	0	0	---	0	903.2	86
4/08/00	2:15a	7.8	7.8	7.9	7.7	0.4	1.3	NNW	0	903	86
4/08/00	2:30a	8	8	8.1	7.9	0	0.9	E	0	903	87
4/08/00	2:45a	8.2	8.2	8.2	8.1	0.4	2.2	NNW	0	902.8	87
4/08/00	3:00a	8.2	8.2	8.3	8.1	0.4	1.8	E	0	902.7	87
4/08/00	3:15a	8.3	8.3	8.3	8.3	0.4	1.8	E	0	902.6	88
4/08/00	3:30a	8.2	8.2	8.3	8.2	0.4	1.8	E	0	902.5	88
4/08/00	3:45a	8.3	8.3	8.3	8.3	0.4	1.3	NW	0	902.4	88
4/08/00	4:00a	8.3	8.3	8.4	8.3	0	1.3	NNW	0	902.2	88
4/08/00	4:15a	8.4	8.4	8.4	8.3	0.4	1.3	NNW	0	902.3	88
4/08/00	4:30a	8.4	8.4	8.5	8.4	0	1.3	NNW	0	902.2	88
4/08/00	4:45a	8.5	8.5	8.6	8.5	0	1.3	NNW	0	902.2	88
4/08/00	5:00a	8.6	8.6	8.7	8.5	0	0	---	0	902.2	88
4/08/00	5:15a	8.7	8.7	8.7	8.7	0	1.3	NNW	0	902.1	88
4/08/00	5:30a	8.7	8.7	8.7	8.7	0.4	1.3	NW	0	902.3	88
4/08/00	5:45a	8.7	8.7	8.7	8.7	0	0.9	N	0	902.3	88
4/08/00	6:00a	8.7	8.7	8.7	8.7	0	0.4	N	0.2	902.4	88
4/08/00	6:15a	8.7	8.7	8.7	8.7	0	1.3	ENE	0	902.3	88
4/08/00	6:30a	8.7	8.7	8.7	8.7	0.4	1.3	N	0	902.4	88
4/08/00	6:45a	8.7	8.7	8.7	8.6	0.4	0.9	N	0	902.4	88
4/08/00	7:00a	8.8	8.8	8.8	8.7	0.4	0.9	N	0	902.4	88
4/08/00	7:15a	8.9	8.9	8.9	8.8	0.4	1.8	N	0	902.4	88
4/08/00	7:30a	8.9	8.9	9	8.9	0.4	1.3	N	0	902.5	89
4/08/00	7:45a	9	9	9.1	8.9	0.4	0.9	N	0	902.5	89
4/08/00	8:00a	9.1	9.1	9.1	9	0.4	1.8	ENE	0	902.6	89
4/08/00	8:15a	9.1	9.1	9.2	9.1	0.4	1.3	ENE	0	902.7	89
4/08/00	8:30a	9.2	9.2	9.2	9.1	0.4	1.8	NW	0	902.9	89
4/08/00	8:45a	9.3	9.3	9.3	9.2	0.4	1.3	N	0	903.1	89
4/08/00	9:00a	9.2	9.2	9.3	9.2	0.9	2.2	N	0	903.1	89
4/08/00	9:15a	9.4	9.4	9.4	9.3	0.9	3.1	NNE	0	903.3	89
4/08/00	9:30a	9.4	9.4	9.5	9.4	0.9	2.7	NNE	0	903.3	89
4/08/00	9:45a	9.7	9.7	9.9	9.4	0.4	2.7	NNE	0	903.3	89
4/08/00	10:00a	10.1	10.1	10.2	9.9	0.9	2.7	N	0	903.3	90
4/08/00	10:15a	9.9	9.9	10.2	9.8	0.9	2.7	NNE	0	903.4	90
4/08/00	10:30a	9.9	9.9	9.9	9.8	0.9	2.2	N	0	903.5	90
4/08/00	10:45a	10.1	10.1	10.3	9.9	0.9	1.8	N	0	903.5	90
4/08/00	11:00a	10.3	10.3	10.4	10.2	0.9	2.2	N	0	903.5	90
4/08/00	11:15a	10.2	10.2	10.4	10.1	0.9	2.2	NNW	0	903.4	90
4/08/00	11:30a	10.4	10.4	10.6	10.2	0.9	2.7	N	0	903.3	90
4/08/00	11:45a	10.6	10.6	10.8	10.2	0.9	2.2	ENE	0	903.1	90
4/08/00	12:00p	10.7	10.7	10.8	10.4	0.4	1.8	N	0	903.1	90
4/08/00	12:15p	10.4	10.4	10.7	10.3	0.9	2.2	N	0	902.8	90
4/08/00	12:30p	10.9	10.9	11.3	10.7	0.4	2.7	E	0	902.7	90
4/08/00	12:45p	11.2	11.2	11.4	10.9	0.4	1.3	ENE	0	902.5	90
4/08/00	1:00p	10.7	10.7	10.9	10.6	0.4	1.8	ENE	0	902.4	90
4/08/00	1:15p	10.7	10.7	10.8	10.6	0.4	1.8	N	0	902.3	89
4/08/00	1:30p	10.7	10.7	11.1	10.6	0.4	2.2	E	0	902	89

Date	Time	Temp. Out	Wind Chill	Hi Temp	Low Temp	Wind Speed (m/s)			Rain	Bar	Hum In
		C°	C°	C°	C°	Avg	Hi	Dir	mm	mB	%
4/08/00	1:45p	11.3	11.3	11.7	11.1	0	1.3	E	0	901.9	89
4/08/00	2:00p	11.6	11.6	11.7	11.4	0.4	2.2	E	0	901.7	90
4/08/00	2:15p	11.3	11.3	11.3	11.2	0.4	1.3	E	0	901.6	89
4/08/00	2:30p	10.9	10.9	11.2	10.8	0	1.8	N	0	901.5	89
4/08/00	2:45p	10.9	10.9	10.9	10.8	0	1.3	E	0	901.4	88
4/08/00	3:00p	10.7	10.7	10.9	10.5	0	1.3	E	0	901.6	88
4/08/00	3:15p	10.3	10.3	10.5	10.3	0.4	1.3	ENE	0	901.4	88
4/08/00	3:30p	10.2	10.2	10.2	10.1	0.4	1.8	ENE	0	901.6	87
4/08/00	3:45p	10.2	10.2	10.2	10.1	0	2.2	NNW	0	901.4	88
4/08/00	4:00p	10.2	10.2	10.2	10.1	0.4	1.8	ENE	0	901.5	88
4/08/00	4:15p	10.1	10.1	10.2	10.1	0.4	2.2	N	0	901.6	88
4/08/00	4:30p	10	10	10.1	9.9	0.4	1.8	E	0	901.6	88
4/08/00	4:45p	9.9	9.9	10	9.9	0.4	1.8	N	0	901.6	88
4/08/00	5:00p	9.9	9.9	9.9	9.9	0.4	1.8	E	0	901.5	88
4/08/00	5:15p	10	10	10	9.9	0.4	1.3	ENE	0	901.6	88
4/08/00	5:30p	10	10	10	9.9	0.4	1.3	NE	0	901.6	88
4/08/00	5:45p	10	10	10.1	9.9	0.4	0.9	NNE	0	901.5	88
4/08/00	6:00p	9.9	9.9	9.9	9.8	0.4	2.2	E	0	901.6	88
4/08/00	6:15p	9.8	9.8	9.8	9.8	0.4	1.3	E	0	901.7	88
4/08/00	6:30p	9.8	9.8	9.8	9.7	0.4	1.8	N	0	901.8	89
4/08/00	6:45p	9.7	9.7	9.8	9.7	0.4	1.8	ENE	0	902	88
4/08/00	7:00p	9.7	9.7	9.8	9.7	0.4	1.8	NNW	0	901.9	89
4/08/00	7:15p	9.7	9.7	9.7	9.7	0.9	2.7	NNW	0	902.1	89
4/08/00	7:30p	9.7	9.7	9.7	9.7	0.4	2.2	N	0	902.1	89
4/08/00	7:45p	9.7	9.7	9.7	9.6	0.9	2.7	N	0	902.2	89
4/08/00	8:00p	9.7	9.7	9.7	9.7	0.4	1.8	N	0	902.3	89
4/08/00	8:15p	9.7	9.7	9.7	9.6	0.4	1.8	NNW	0	902.2	89
4/08/00	8:30p	9.7	9.7	9.7	9.7	0.4	1.3	N	0	902.4	89
4/08/00	8:45p	9.7	9.7	9.7	9.7	0.4	1.8	N	0	902.4	89
4/08/00	9:00p	9.7	9.7	9.7	9.6	0.9	2.2	N	0	902.7	90
4/08/00	9:15p	9.6	9.6	9.6	9.6	0.9	1.8	NNW	0	902.6	90
4/08/00	9:30p	9.6	9.6	9.6	9.6	0.9	1.8	NNW	0	902.5	90
4/08/00	9:45p	9.6	9.6	9.7	9.6	0.4	1.8	N	0	902.6	90
4/08/00	10:00p	9.7	9.7	9.7	9.7	0.4	2.2	N	0	902.5	90
4/08/00	10:15p	9.7	9.7	9.8	9.7	0.4	1.8	N	0	902.5	90
4/08/00	10:30p	9.8	9.8	9.8	9.7	0.4	1.8	N	0.2	902.6	90
4/08/00	10:45p	9.8	9.8	9.8	9.8	0.4	1.8	N	0	902.6	90
4/08/00	11:00p	9.8	9.8	9.8	9.8	0.4	2.7	N	0	902.4	90
4/08/00	11:15p	9.8	9.8	9.8	9.8	0.4	1.8	N	0	902.3	90
4/08/00	11:30p	9.8	9.8	9.8	9.8	0.9	2.7	N	0	902.2	90
4/08/00	11:45p	9.8	9.8	9.9	9.8	0.9	2.7	N	0	902.2	90
4/09/00	12:00a	9.9	9.9	9.9	9.8	0.4	2.2	NNW	0.2	902.1	90
4/09/00	12:15a	9.9	9.9	9.9	9.9	0.9	2.7	N	0	902.1	90
4/09/00	12:30a	9.8	9.8	9.8	9.8	0.4	1.8	N	0	902	90
4/09/00	12:45a	9.8	9.8	9.8	9.8	0	1.8	N	0	901.9	90
4/09/00	1:00a	9.8	9.8	9.8	9.8	0.4	1.3	N	0.2	901.8	90
4/09/00	1:15a	9.8	9.8	9.8	9.8	0.4	1.8	N	0	901.8	90
4/09/00	1:30a	9.8	9.8	9.9	9.8	0.4	2.2	N	0.2	901.8	90
4/09/00	1:45a	9.9	9.9	9.9	9.8	0.4	1.3	NNE	0	901.6	90
4/09/00	2:00a	9.9	9.9	9.9	9.9	0.4	2.2	N	0	901.5	90
4/09/00	2:15a	9.9	9.9	10	9.9	0.4	1.3	N	0	901.3	91
4/09/00	2:30a	10	10	10.1	10	0.4	1.8	N	0	901.3	91
4/09/00	2:45a	10.1	10.1	10.1	10	0.4	1.3	N	0	901.1	91
4/09/00	3:00a	10	10	10	9.9	0.4	2.7	N	0	901	91
4/09/00	3:15a	9.9	9.9	10	9.9	0.4	1.3	N	0	901	91
4/09/00	3:30a	9.8	9.8	9.9	9.8	0.4	1.8	NNE	0	900.7	91
4/09/00	3:45a	9.7	9.7	9.8	9.7	0.4	1.8	N	0	900.7	91
4/09/00	4:00a	9.7	9.7	9.7	9.7	0.4	1.3	N	0	900.9	91

Date	Time	Temp. Out	Wind Chill	Hi Temp	Low Temp	Wind Speed (m/s)			Rain	Bar	Hum In
		C°	C°	C°	C°	Avg	Hi	Dir	mm	mB	%
4/09/00	4:15a	9.8	9.8	9.8	9.7	0.4	1.8	NNE	0	900.8	91
4/09/00	4:30a	9.8	9.8	9.8	9.7	0	1.3	NNE	0	900.7	91
4/09/00	4:45a	9.7	9.7	9.7	9.7	0.4	1.3	NNE	0	900.8	91
4/09/00	5:00a	9.6	9.6	9.7	9.6	0.4	1.3	N	0	900.6	91
4/09/00	5:15a	9.6	9.6	9.6	9.5	0.4	1.8	N	0	900.9	91
4/09/00	5:30a	9.6	9.6	9.7	9.6	0.4	1.3	N	0	901	91
4/09/00	5:45a	9.6	9.6	9.7	9.6	0.4	1.3	N	0	901.1	91
4/09/00	6:00a	9.6	9.6	9.7	9.6	0	1.3	N	0	901.1	91
4/09/00	6:15a	9.5	9.5	9.6	9.4	0.4	1.8	NNE	0	901.2	91
4/09/00	6:30a	9.5	9.5	9.6	9.5	0.4	2.2	N	0	901.3	91
4/09/00	6:45a	9.4	9.4	9.5	9.3	0.4	1.3	NNE	0	901.4	91
4/09/00	7:00a	9.2	9.2	9.3	9.1	0	1.3	NNW	0	901.4	91
4/09/00	7:15a	9.2	9.2	9.2	9.1	0	0	---	0	901.3	91
4/09/00	7:30a	9.2	9.2	9.3	9.2	0.4	1.3	N	0	901.4	91
4/09/00	7:45a	9.4	9.4	9.5	9.3	0.4	1.3	NNE	0	901.6	91
4/09/00	8:00a	9.4	9.4	9.6	9.4	0	0.9	N	0	901.6	91
4/09/00	8:15a	9.6	9.6	9.8	9.4	0.4	1.3	N	0	901.9	91
4/09/00	8:30a	9.9	9.9	10.1	9.8	0.4	1.3	N	0	902	92
4/09/00	8:45a	10.2	10.2	10.4	10.1	0.4	1.3	N	0	902	92
4/09/00	9:00a	10.7	10.7	11.2	10.4	0.4	1.3	NNE	0	902	92
4/09/00	9:15a	11.6	11.6	11.9	11.2	0.4	1.8	NNE	0	902	93
4/09/00	9:30a	12.1	12.1	12.4	11.8	0.4	2.2	N	0	902.1	94
4/09/00	9:45a	12.6	12.6	13	12.3	0.9	2.2	N	0	902.1	94
4/09/00	10:00a	13.4	13.4	13.8	13.1	0.9	1.8	N	0	902.2	95
4/09/00	10:15a	13.3	13.3	13.7	12.9	0.4	1.3	N	0	902.2	95
4/09/00	10:30a	13.1	13.1	14.4	12.7	0.4	2.7	N	0	902.2	94
4/09/00	10:45a	14.3	14.3	16	13.3	0.9	2.7	N	0	902	96
4/09/00	11:00a	15.8	15.8	17.2	14.8	0.9	2.7	N	0	901.7	100
4/09/00	11:15a	17.2	17.2	18.2	16	0.4	2.2	N	0	901.8	100
4/09/00	11:30a	17.4	17.4	18.3	16.4	0.9	2.2	N	0	901.7	98
4/09/00	11:45a	16.7	16.7	17.4	15.8	0.4	2.2	N	0	901.7	92
4/09/00	12:00p	15.9	15.9	16.6	15.4	0.4	2.2	N	0	901.6	85
4/09/00	12:15p	17.9	17.9	19.7	16.3	0.4	2.7	N	0	901.3	86
4/09/00	12:30p	18.9	18.9	19.6	18.1	0.4	2.2	N	0	901.1	87
4/09/00	12:45p	18.2	18.2	20.2	16.6	0.4	1.8	N	0	901	80
4/09/00	1:00p	15.7	15.7	16.6	15.3	0.4	2.2	NNE	0	900.7	73
4/09/00	1:15p	15.8	15.8	16.1	15.6	0.4	1.8	N	0	900.5	74
4/09/00	1:30p	16.1	16.1	16.4	15.6	0.9	1.8	N	0	900.3	76
4/09/00	1:45p	15.6	15.6	15.7	15.5	0.4	1.8	N	0	900.3	78
4/09/00	2:00p	15.4	15.4	15.7	15.3	0.4	1.8	N	0	900.4	79
4/09/00	2:15p	15.3	15.3	15.4	15.3	0.4	1.3	NNW	0	900.1	80
4/09/00	2:30p	15.3	15.3	15.6	15.2	0.4	1.3	N	0	900.1	81
4/09/00	2:45p	15.5	15.5	15.6	15.3	0.9	1.8	N	0	899.9	82
4/09/00	3:00p	15.6	15.6	15.8	15.4	0.4	2.7	N	0	900.1	82
4/09/00	3:15p	15.6	15.6	15.7	15.2	0.4	1.3	N	0	900.1	82
4/09/00	3:30p	15.5	15.5	15.8	15.2	0.9	1.8	N	0	900	82
4/09/00	3:45p	15.7	15.7	15.9	15.5	0.4	2.2	NNE	0	900	83
4/09/00	4:00p	15.5	15.5	15.6	15.4	0.4	1.3	N	0	900	83
4/09/00	4:15p	15.6	15.6	15.6	15.4	0.4	1.3	N	0	899.9	83
4/09/00	4:30p	15.2	15.2	15.5	15	0.9	2.2	N	0	900.1	83
4/09/00	4:45p	14.8	14.8	15.1	14.7	0.4	1.8	N	0	900.1	83
4/09/00	5:00p	14.5	14.5	14.7	14.4	0.4	0.9	NNW	0	900.2	82
4/09/00	5:15p	14.2	14.2	14.4	14.1	0.4	1.3	N	0	900	82
4/09/00	5:30p	14.1	14.1	14.2	14.1	0.4	1.8	N	0	900.1	82
4/09/00	5:45p	14.2	14.2	14.2	14.1	0.9	2.2	N	0	900.2	82
4/09/00	6:00p	13.9	13.9	14.1	13.7	0.4	1.3	NW	0	900.3	82
4/09/00	6:15p	13.7	13.7	13.7	13.6	0	0.9	NW	0	900.5	82
4/09/00	6:30p	13.6	13.6	13.7	13.3	0.4	1.3	N	0	900.7	82

Date	Time	Temp. Out	Wind Chill	Hi Temp	Low Temp	Wind Speed (m/s)			Rain	Bar	Hum In
		C°	C°	C°	C°	Avg	Hi	Dir	mm	mB	%
4/09/00	6:45p	13.2	13.2	13.3	13.1	0	0.4	N	0	901	82
4/09/00	7:00p	12.9	12.9	13.1	12.8	0	0.4	N	0	901.1	82
4/09/00	7:15p	12.7	12.7	12.8	12.7	0	0.9	N	0	901.2	82
4/09/00	7:30p	12.5	12.5	12.6	12.3	0	0.4	N	0	901.5	82
4/09/00	7:45p	12.2	12.2	12.3	12.1	0	0	---	0	901.4	82
4/09/00	8:00p	12	12	12.1	11.9	0	0	---	0	901.6	82
4/09/00	8:15p	11.9	11.9	11.9	11.8	0	0	---	0	901.7	83
4/09/00	8:30p	11.8	11.8	11.9	11.8	0	0	---	0	901.8	83
4/09/00	8:45p	11.8	11.8	11.8	11.7	0	0	---	0	901.8	83
4/09/00	9:00p	11.9	11.9	12	11.7	0	0	---	0	902	83
4/09/00	9:15p	11.8	11.8	11.9	11.6	0	0	---	0	902.1	84
4/09/00	9:30p	11.6	11.6	11.6	11.5	0	0	---	0	902.3	84
4/09/00	9:45p	11.8	11.8	11.8	11.6	0	0	---	0	902.4	84
4/09/00	10:00p	11.9	11.9	11.9	11.8	0	0	---	0	902.3	84
4/09/00	10:15p	11.9	11.9	11.9	11.9	0	0	---	0	902.4	85
4/09/00	10:30p	11.8	11.8	11.9	11.8	0	0	---	0	902.5	85
4/09/00	10:45p	11.8	11.8	11.9	11.8	0	0	---	0	902.5	85
4/09/00	11:00p	11.9	11.9	11.9	11.9	0	0	---	0	902.5	85
4/09/00	11:15p	11.9	11.9	11.9	11.9	0	0	---	0	902.6	85
4/09/00	11:30p	11.9	11.9	11.9	11.8	0	0	---	0	902.4	85
4/09/00	11:45p	11.8	11.8	11.9	11.8	0	0	---	0	902.5	85
4/10/00	12:00a	11.8	11.8	11.9	11.8	0	0	---	0	902.4	85
4/10/00	12:15a	11.7	11.7	11.8	11.7	0	0	---	0	902.5	85
4/10/00	12:30a	11.7	11.7	11.7	11.6	0	0	---	0	902.5	85
4/10/00	12:45a	11.4	11.4	11.6	11.3	0	0	---	0	902.5	85
4/10/00	1:00a	11.1	11.1	11.3	10.9	0	0	---	0	902.5	85
4/10/00	1:15a	10.9	10.9	10.9	10.7	0	0	---	0	902.5	84
4/10/00	1:30a	10.6	10.6	10.7	10.4	0	0	---	0	902.6	84
4/10/00	1:45a	10.3	10.3	10.4	10.3	0	0	---	0	902.6	84
4/10/00	2:00a	10.2	10.2	10.3	10	0	0	---	0	902.4	84
4/10/00	2:15a	10	10	10	10	0	0	---	0	902.3	84
4/10/00	2:30a	10	10	10	9.9	0	0	---	0	902.4	84
4/10/00	2:45a	9.9	9.9	10	9.8	0	0	---	0	902.4	84
4/10/00	3:00a	9.7	9.7	9.8	9.5	0	0	---	0	902.4	84
4/10/00	3:15a	9.4	9.4	9.4	9.3	0	0	---	0	902.5	84
4/10/00	3:30a	9.2	9.2	9.3	9.2	0	0	---	0	902.5	84
4/10/00	3:45a	9.3	9.3	9.3	9.2	0	0	---	0	902.6	84
4/10/00	4:00a	9.2	9.2	9.3	9.2	0	0	---	0	902.4	85
4/10/00	4:15a	9.1	9.1	9.2	8.9	0	0	---	0	902.6	85
4/10/00	4:30a	8.9	8.9	9	8.8	0	0	---	0	902.6	85
4/10/00	4:45a	8.9	8.9	8.9	8.8	0	0	---	0	902.9	85
4/10/00	5:00a	8.9	8.9	8.9	8.8	0	0	---	0	903	85
4/10/00	5:15a	8.9	8.9	8.9	8.8	0	0	---	0	903.2	85
4/10/00	5:30a	8.9	8.9	9	8.9	0	0	---	0	903.2	85
4/10/00	5:45a	9	9	9.1	8.9	0	0	---	0	903.3	86
4/10/00	6:00a	9	9	9.1	8.9	0	0	---	0	903.3	86
4/10/00	6:15a	8.9	8.9	9	8.9	0	0	---	0	903.5	86
4/10/00	6:30a	8.9	8.9	9	8.8	0	0	---	0	903.7	86
4/10/00	6:45a	8.8	8.8	8.8	8.8	0	0	---	0	903.7	86
4/10/00	7:00a	9	9	9.1	8.8	0	0	---	0	903.9	86
4/10/00	7:15a	9.2	9.2	9.3	9.1	0	0	---	0	903.9	86
4/10/00	7:30a	9.2	9.2	9.2	9.1	0	0	---	0	903.9	86
4/10/00	7:45a	9.4	9.4	9.5	9.3	0	0	---	0	904.3	86
4/10/00	8:00a	9.4	9.4	9.5	9.3	0	0	---	0	904.5	87
4/10/00	8:15a	9.8	9.8	10.2	9.5	0	0	---	0	904.6	87
4/10/00	8:30a	11.3	11.3	12.1	10.2	0	0	---	0	904.7	91
4/10/00	8:45a	11.8	11.8	11.9	11.8	0	0	---	0	904.8	94
4/10/00	9:00a	12.1	12.1	12.4	11.8	0	0	---	0	904.9	92

Date	Time	Temp. Out	Wind Chill	Hi Temp	Low Temp	Wind Speed (m/s)			Rain	Bar	Hum In
		C°	C°	C°	C°	Avg	Hi	Dir	mm	mB	%
4/10/00	9:15a	12.7	12.7	13.2	12.4	0	0	---	0	904.9	91
4/10/00	9:30a	13.4	13.4	13.6	13.2	0	0	---	0	905	91
4/10/00	9:45a	13.9	13.9	14.3	13.6	0	0	---	0	904.9	91
4/10/00	10:00a	14.4	14.4	14.9	14.3	0	0	---	0	904.9	91
4/10/00	10:15a	15.4	15.4	15.9	14.9	0	0	---	0	904.8	92
4/10/00	10:30a	17	17	17.7	16	0	0	---	0	904.8	95
4/10/00	10:45a	18.2	18.2	18.6	17.7	0	0	---	0	904.7	96
4/10/00	11:00a	18.7	18.7	19.9	18.1	0	0	---	0	904.6	92
4/10/00	11:15a	19.3	19.3	20.6	17.7	0.4	1.3	SSE	0	904.5	88
4/10/00	11:30a	17.4	17.4	19.4	16.2	0	1.3	SSE	0	904.6	81
4/10/00	11:45a	17.1	17.1	19.2	16.2	0.4	1.3	ESE	0	904.6	77
4/10/00	12:00p	17.9	17.9	19.3	16.1	0	0	---	0	904.5	77
4/10/00	12:15p	18.4	18.4	19.5	17.1	0.4	1.8	SE	0	904.3	76
4/10/00	12:30p	19.4	19.4	20.6	18.3	0.4	2.2	SE	0	904.3	75
4/10/00	12:45p	18.5	18.5	19.9	17.4	0.4	2.2	E	0	904.1	70
4/10/00	1:00p	17.1	17.1	17.4	16.9	0.9	2.7	E	0	904	67
4/10/00	1:15p	17.2	17.2	17.5	16.8	0.4	1.8	ENE	0	903.9	67
4/10/00	1:30p	16.9	16.9	17.3	16.6	0.4	1.8	E	0	903.6	68
4/10/00	1:45p	16.4	16.4	16.9	16.2	0.4	1.8	ESE	0	903.5	68
4/10/00	2:00p	16.2	16.2	16.6	15.8	0.9	1.8	SE	0	903.4	68
4/10/00	2:15p	16.4	16.4	16.8	16.3	0.9	1.8	E	0	903.3	69
4/10/00	2:30p	16.7	16.7	16.9	16.4	0.9	2.2	SE	0	903.3	70
4/10/00	2:45p	16.1	16.1	16.3	15.8	0.4	1.3	ENE	0	903.3	70
4/10/00	3:00p	16.2	16.2	16.3	15.8	0.4	1.8	ENE	0	903.3	70
4/10/00	3:15p	15.7	15.7	16.1	15.4	0.4	1.3	ENE	0	903.2	70
4/10/00	3:30p	16.1	16.1	16.7	15.5	0.4	1.8	SE	0	903.1	70
4/10/00	3:45p	15.7	15.7	16.7	15	0.4	1.3	ENE	0	903.2	71
4/10/00	4:00p	15.7	15.7	16.4	15	0.9	2.2	ESE	0	903.2	70
4/10/00	4:15p	15.7	15.7	16.3	15.1	0.9	2.2	E	0	903.3	71
4/10/00	4:30p	15	15	15.2	14.9	0.4	1.8	E	0	903.3	71
4/10/00	4:45p	15.7	15.7	16	15.2	0.4	2.2	NW	0	903.3	71
4/10/00	5:00p	15.1	15.1	15.8	14.5	0.4	1.8	E	0	903.3	72
4/10/00	5:15p	14.7	14.7	14.9	14.4	0.4	3.6	NNE	0	903.3	71
4/10/00	5:30p	14.4	14.4	14.8	13.9	0.9	2.2	N	0	903.5	71
4/10/00	5:45p	13.6	13.6	13.9	13.4	0.4	1.8	ENE	0	903.5	71
4/10/00	6:00p	13.4	13.4	13.4	13.3	0.4	1.8	NNW	0	903.8	71
4/10/00	6:15p	13.3	13.3	13.4	13.3	0	1.3	N	0	903.9	72
4/10/00	6:30p	13.2	13.2	13.3	13.2	0.4	1.8	NW	0	904	72
4/10/00	6:45p	13.2	13.2	13.2	13.2	0.4	1.8	N	0	904.2	73
4/10/00	7:00p	13.1	13.1	13.2	13	0.9	3.1	N	0	904.4	73
4/10/00	7:15p	12.8	12.8	13	12.7	0.9	1.8	E	0	904.5	73
4/10/00	7:30p	12.4	12.4	12.7	12.3	0.4	3.1	N	0	904.8	73
4/10/00	7:45p	12.2	12.2	12.3	12.1	0.4	1.8	E	0	904.9	74
4/10/00	8:00p	12	12	12.1	11.9	0.4	1.8	ENE	0	905.3	74
4/10/00	8:15p	11.9	11.9	11.9	11.8	0.4	1.8	E	0	905.4	74
4/10/00	8:30p	11.7	11.7	11.8	11.7	0	0.9	E	0	905.5	74
4/10/00	8:45p	11.6	11.6	11.7	11.6	0.4	1.3	E	0	905.6	75
4/10/00	9:00p	11.4	11.4	11.6	11.4	0	0.9	E	0	905.6	75
4/10/00	9:15p	11.3	11.3	11.4	11.2	0	0.9	E	0	905.6	75
4/10/00	9:30p	11.2	11.2	11.3	11.2	0	0	---	0	905.9	75
4/10/00	9:45p	11.3	11.3	11.3	11.2	0	0.9	NW	0	906	75
4/10/00	10:00p	11	11	11.2	10.8	0	0.4	NNE	0	906	76
4/10/00	10:15p	10.8	10.8	10.8	10.7	0	0.9	NE	0	906.1	75
4/10/00	10:30p	10.7	10.7	10.7	10.6	0	0	---	0	906.1	75
4/10/00	10:45p	10.6	10.6	10.7	10.6	0	0	---	0	906.2	76
4/10/00	11:00p	10.6	10.6	10.7	10.6	0	0	---	0	906.3	76
4/10/00	11:15p	10.6	10.6	10.6	10.6	0	0	---	0	906.1	76
4/10/00	11:30p	10.6	10.6	10.6	10.6	0	0	---	0	906	76

Date	Time	Temp. Out	Wind Chill	Hi Temp	Low Temp	Wind Speed (m/s)			Rain	Bar	Hum In
		C°	C°	C°	C°	Avg	Hi	Dir	mm	mB	%
4/10/00	11:45p	10.5	10.5	10.6	10.4	0	0	---	0	905.9	76
4/11/00	12:00a	10.3	10.3	10.4	10.3	0	0.9	NE	0	905.7	76
4/11/00	12:15a	10.2	10.2	10.3	10.2	0	0.9	NE	0	905.6	76
4/11/00	12:30a	10.2	10.2	10.2	10.1	0.4	0.9	NE	0	905.5	77
4/11/00	12:45a	10.1	10.1	10.1	9.9	0	0.9	ENE	0	905.4	77
4/11/00	1:00a	9.9	9.9	9.9	9.9	0	0	---	0	905.5	77
4/11/00	1:15a	9.8	9.8	9.9	9.8	0	0.9	ENE	0	905.2	77
4/11/00	1:30a	9.9	9.9	9.9	9.9	0.4	0.9	ENE	0	905.3	78
4/11/00	1:45a	9.9	9.9	10	9.8	0.9	1.3	ESE	0	905.4	78
4/11/00	2:00a	9.7	9.7	9.8	9.7	0.4	0.9	ESE	0	905.2	78
4/11/00	2:15a	9.7	9.7	9.7	9.7	0.4	0.9	ESE	0	905.2	78
4/11/00	2:30a	9.7	9.7	9.7	9.7	0.4	0.9	ESE	0	905.2	78
4/11/00	2:45a	9.6	9.6	9.7	9.2	0	0.9	ESE	0	905.3	78
4/11/00	3:00a	8.9	8.9	9.2	8.7	0	0	---	0	905.1	78
4/11/00	3:15a	8.8	8.8	9.1	8.6	0	0	---	0	905	78
4/11/00	3:30a	8.8	8.8	9.2	8.6	0	0	---	0	905	78
4/11/00	3:45a	8.5	8.5	8.6	8.4	0	0	---	0	905	78
4/11/00	4:00a	8.6	8.6	8.8	8.4	0	0.4	---	0	904.9	78
4/11/00	4:15a	8.6	8.6	8.8	8.3	0	0.4	ESE	0	905	78
4/11/00	4:30a	8.7	8.7	9	8.3	0	1.3	ESE	0	905	79
4/11/00	4:45a	9.1	9.1	9.2	9.1	0.4	0.9	ESE	0	905	79
4/11/00	5:00a	9.2	9.2	9.3	9.1	0	0.9	ESE	0	905.1	80
4/11/00	5:15a	9.3	9.3	9.4	9	0	0	---	0	905.2	80
4/11/00	5:30a	9.3	9.3	9.4	9.3	0.4	0.9	ESE	0	905	80
4/11/00	5:45a	9.2	9.2	9.2	9.1	0.4	1.3	ESE	0	905.1	80
4/11/00	6:00a	9	9	9.1	8.9	0.9	1.3	ESE	0	905.3	81
4/11/00	6:15a	9	9	9.1	8.9	0.9	1.3	SE	0	905.4	80
4/11/00	6:30a	9.1	9.1	9.1	9	0.9	1.3	SE	0	905.3	80
4/11/00	6:45a	9.1	9.1	9.1	8.9	0.9	2.2	SE	0	905.5	81
4/11/00	7:00a	8.8	8.8	9.1	8.7	0.9	1.3	SE	0	905.5	81
4/11/00	7:15a	8.7	8.7	8.7	8.6	0.4	0.9	SE	0	905.6	81
4/11/00	7:30a	8.6	8.6	8.7	8.5	0	1.3	SE	0	905.7	81
4/11/00	7:45a	8.4	8.4	8.6	8.2	0	0	---	0	905.8	81
4/11/00	8:00a	8.8	8.8	9.7	8.2	0	0	---	0	906.2	81
4/11/00	8:15a	11.5	11.5	12.9	9.8	0	0.4	SE	0	906.4	84
4/11/00	8:30a	13	13	13.4	12.7	0	0.9	SE	0	906.3	94
4/11/00	8:45a	12.4	12.4	12.9	11.8	0.4	1.3	SE	0	906.3	94
4/11/00	9:00a	11.4	11.4	12	11	0.9	1.8	E	0	906.3	87
4/11/00	9:15a	11.1	11.1	11.6	10.9	0	0	---	0	906.4	83
4/11/00	9:30a	11.7	11.7	12.3	11.4	0.4	1.8	ESE	0	906.2	82
4/11/00	9:45a	12.6	12.6	13	12.1	0.9	2.2	ESE	0	906.2	83
4/11/00	10:00a	12.8	12.8	13.7	12.2	0.4	2.7	ENE	0	906.3	82
4/11/00	10:15a	14.7	14.7	15.4	13.7	0.9	1.8	ENE	0	906.3	87
4/11/00	10:30a	15.1	15.1	16.2	13.9	0.9	2.2	E	0	906	87
4/11/00	10:45a	15.4	15.4	16.6	13.8	0.9	1.8	E	0	905.9	83
4/11/00	11:00a	13.7	13.7	14.2	13.3	0.4	1.3	E	0	905.9	78
4/11/00	11:15a	14.9	14.9	16.2	13.7	0.9	2.2	E	0	905.8	77
4/11/00	11:30a	15.3	15.3	16.1	14.6	0.4	3.6	E	0	905.8	77
4/11/00	11:45a	16.1	16.1	16.9	15.2	0.9	2.2	E	0	905.7	76
4/11/00	12:00p	18.4	18.4	19.5	15.8	0.9	3.1	N	0	905.5	79
4/11/00	12:15p	17.8	17.8	19.3	15.8	0.9	2.7	N	0	905.3	75
4/11/00	12:30p	17.3	17.3	18.4	15.5	0.9	2.7	N	0	905.2	70
4/11/00	12:45p	16.4	16.4	18.1	15.3	0.9	3.6	N	0	905	63
4/11/00	1:00p	15.5	15.5	15.8	15.2	0.9	2.7	N	0	904.8	62
4/11/00	1:15p	15.4	15.4	15.6	15.1	0.9	3.1	N	0	904.7	63
4/11/00	1:30p	15.2	15.2	15.8	14.9	0.9	2.7	E	0	904.4	64
4/11/00	1:45p	15.1	15.1	15.8	14.5	0.4	1.3	N	0	904.4	66
4/11/00	2:00p	14.8	14.8	15.2	14.4	0.4	1.8	N	0	904.2	67

Date	Time	Temp. Out	Wind Chill	Hi Temp	Low Temp	Wind Speed (m/s)			Rain	Bar	Hum In
		C°	C°	C°	C°	Avg	Hi	Dir	mm	mB	%
4/11/00	2:15p	15.1	15.1	15.4	14.4	0.4	1.8	E	0	904	68
4/11/00	2:30p	14.5	14.5	14.9	14.2	0.9	2.2	E	0	904	68
4/11/00	2:45p	15.1	15.1	15.5	14.9	0.9	3.1	ENE	0	903.9	69
4/11/00	3:00p	15.7	15.7	16.1	15.3	0.9	3.1	N	0	903.8	70
4/11/00	3:15p	15.3	15.3	15.6	15.2	0.9	2.2	N	0	903.6	70
4/11/00	3:30p	15.6	15.6	15.8	15.2	0.9	2.7	N	0	903.4	70
4/11/00	3:45p	14.5	14.5	15.1	14.1	0.4	1.8	N	0	903.3	69
4/11/00	4:00p	14.8	14.8	15.2	14.7	0.9	2.2	N	0	903.3	70
4/11/00	4:15p	15.1	15.1	15.3	14.6	0.9	2.7	N	0	903.1	70
4/11/00	4:30p	13.9	13.9	14.6	13.6	0.4	1.3	E	0	903.2	69
4/11/00	4:45p	14.2	14.2	14.4	13.8	0.4	1.8	N	0	903.2	70
4/11/00	5:00p	13.9	13.9	14.2	13.6	0.9	2.2	E	0	903.2	70
4/11/00	5:15p	13.3	13.3	13.5	13.1	0.4	1.3	E	0	903.2	70
4/11/00	5:30p	13.2	13.2	13.2	13.1	0.4	1.3	NW	0	903.2	70
4/11/00	5:45p	13.2	13.2	13.2	13.1	0.4	1.3	N	0	903.4	70
4/11/00	6:00p	13.1	13.1	13.2	13	0	1.3	N	0	903.3	70
4/11/00	6:15p	13.1	13.1	13.2	12.8	0.4	1.8	N	0	903.5	71
4/11/00	6:30p	12.6	12.6	12.8	12.4	0.4	1.8	NNW	0	903.6	71
4/11/00	6:45p	12.4	12.4	12.4	12.4	0.4	1.3	NNW	0	903.7	71
4/11/00	7:00p	12.4	12.4	12.4	12.4	0.4	1.3	ENE	0	903.9	72
4/11/00	7:15p	12.4	12.4	12.4	12.4	0.4	1.3	N	0	904.1	72
4/11/00	7:30p	12.3	12.3	12.4	12.2	0.4	2.2	N	0	904.3	72
4/11/00	7:45p	12.1	12.1	12.2	12.1	0.4	1.3	NNW	0	904.6	73
4/11/00	8:00p	12.2	12.2	12.2	12.1	0.4	1.3	NNW	0	904.7	73
4/11/00	8:15p	12.1	12.1	12.2	12.1	0.4	2.7	N	0	904.8	74
4/11/00	8:30p	12.1	12.1	12.1	12	0	1.3	NNW	0	904.9	74
4/11/00	8:45p	11.9	11.9	12	11.8	0.4	2.2	NNW	0	904.8	74
4/11/00	9:00p	11.8	11.8	11.8	11.8	0.4	1.8	E	0	904.8	74
4/11/00	9:15p	11.7	11.7	11.7	11.7	0.4	2.2	ENE	0	904.7	75
4/11/00	9:30p	11.6	11.6	11.7	11.6	0.4	1.8	NE	0	904.8	75
4/11/00	9:45p	11.4	11.4	11.6	11.3	0.9	3.1	N	0	904.6	75
4/11/00	10:00p	11.3	11.3	11.3	11.2	0.9	2.7	NNE	0	904.7	75
4/11/00	10:15p	11.1	11.1	11.2	10.9	0.9	2.2	N	0	904.6	75
4/11/00	10:30p	10.9	10.9	10.9	10.9	0.9	2.2	N	0	904.6	75
4/11/00	10:45p	10.7	10.7	10.9	10.7	0.9	1.3	N	0	904.6	76
4/11/00	11:00p	10.5	10.5	10.7	10.3	0.4	1.8	NNW	0	904.7	76
4/11/00	11:15p	10.2	10.2	10.3	10.1	0.4	1.3	N	0	904.8	75
4/11/00	11:30p	10.1	10.1	10.1	10	0	0.9	N	0	904.7	75
4/11/00	11:45p	10.1	10.1	10.1	10	0	0.9	N	0	904.4	76
4/12/00	12:00a	9.9	9.9	10	9.7	0	0.9	N	0	904.3	76
4/12/00	12:15a	9.7	9.7	9.8	9.7	0	0.4	N	0	904.4	76
4/12/00	12:30a	9.7	9.7	9.8	9.7	0	0.4	N	0	904.4	76
4/12/00	12:45a	9.9	9.9	9.9	9.8	0	0.9	N	0	904.5	76
4/12/00	1:00a	9.9	9.9	10	9.9	0	0.4	N	0	904.3	77
4/12/00	1:15a	9.9	9.9	9.9	9.9	0	0.4	N	0	904.3	77
4/12/00	1:30a	9.8	9.8	9.9	9.8	0	0.4	N	0	904.4	77
4/12/00	1:45a	9.7	9.7	9.8	9.6	0	0.4	N	0	904.3	77
4/12/00	2:00a	9.5	9.5	9.6	9.5	0	0.4	---	0	904	77
4/12/00	2:15a	9.7	9.7	9.9	9.6	0	0	---	0	903.9	77
4/12/00	2:30a	9.8	9.8	9.9	9.8	0	0	---	0	903.8	77
4/12/00	2:45a	9.9	9.9	9.9	9.8	0	0	---	0	903.7	77
4/12/00	3:00a	9.8	9.8	9.8	9.7	0	0.4	N	0	903.5	77
4/12/00	3:15a	9.8	9.8	9.8	9.7	0	0.4	N	0	903.3	78
4/12/00	3:30a	9.7	9.7	9.8	9.7	0.4	1.3	NNW	0	903.1	78
4/12/00	3:45a	9.7	9.7	9.7	9.7	0.4	1.3	NNW	0	902.9	78
4/12/00	4:00a	9.7	9.7	9.7	9.7	0.4	1.8	NW	0	902.8	78
4/12/00	4:15a	9.7	9.7	9.8	9.7	0	0.4	NW	0	903	78
4/12/00	4:30a	9.7	9.7	9.7	9.7	0	0.9	NW	0	902.9	78

Date	Time	Temp. Out	Wind Chill	Hi Temp	Low Temp	Wind Speed (m/s)			Rain	Bar	Hum In
		C°	C°	C°	C°	Avg	Hi	Dir	mm	mB	%
4/12/00	4:45a	9.7	9.7	9.8	9.7	0	0.9	NW	0	903.1	78
4/12/00	5:00a	9.7	9.7	9.7	9.7	0.4	0.9	NW	0	903	78
4/12/00	5:15a	9.5	9.5	9.7	9.3	0	0.9	NW	0	903.1	78
4/12/00	5:30a	9.2	9.2	9.3	9.1	0.4	1.3	NW	0	903.1	78
4/12/00	5:45a	9.3	9.3	9.3	9.2	0.4	1.3	N	0	903.2	78
4/12/00	6:00a	9.2	9.2	9.3	9.2	0.4	0.9	N	0	903.4	78
4/12/00	6:15a	9.4	9.4	9.4	9.3	0.4	2.2	N	0	903.6	78
4/12/00	6:30a	9.4	9.4	9.4	9.4	0	0.9	NNW	0	903.8	79
4/12/00	6:45a	9.4	9.4	9.4	9.3	0	0.9	NNW	0	903.9	79
4/12/00	7:00a	9.3	9.3	9.4	9.2	0	0.4	NNW	0	903.9	79
4/12/00	7:15a	9.2	9.2	9.2	9.1	0	0.4	NNW	0	904	79
4/12/00	7:30a	9.1	9.1	9.2	9.1	0	0	---	0	904.3	79
4/12/00	7:45a	9.2	9.2	9.2	9.2	0	0	---	0	904.4	79
4/12/00	8:00a	9.2	9.2	9.3	9.2	0	0	---	0	904.4	79
4/12/00	8:15a	9.4	9.4	9.5	9.3	0	0	---	0	904.4	79
4/12/00	8:30a	9.7	9.7	9.9	9.5	0.4	0.9	NNW	0	904.5	79
4/12/00	8:45a	10.4	10.4	10.7	9.9	0	0.9	NNW	0	904.4	81
4/12/00	9:00a	10.7	10.7	10.8	10.6	0.4	0.9	N	0	904.6	82
4/12/00	9:15a	10.7	10.7	10.8	10.5	0.9	1.8	N	0	904.5	81
4/12/00	9:30a	10.6	10.6	10.7	10.4	0.9	2.2	N	0	904.4	81
4/12/00	9:45a	10.8	10.8	11.2	10.6	0.9	1.8	N	0	904.3	81
4/12/00	10:00a	11.5	11.5	11.9	11.2	0.9	3.1	N	0	904.2	81
4/12/00	10:15a	12.6	12.6	13.4	11.8	0.4	2.7	N	0	904.2	83
4/12/00	10:30a	12.7	12.7	13.1	12.4	0.9	2.2	N	0	904.1	84
4/12/00	10:45a	12.6	12.6	12.9	12.3	0.9	2.2	N	0	903.9	82
4/12/00	11:00a	12.8	12.8	13.3	12.5	0.9	2.7	N	0	903.8	82
4/12/00	11:15a	12.5	12.5	12.7	12.3	0.4	1.8	N	0	904	80
4/12/00	11:30a	12.3	12.3	12.4	12.2	0.4	1.8	NNW	0	903.9	79
4/12/00	11:45a	12.5	12.5	12.8	12.3	0.4	1.8	N	0	903.8	79
4/12/00	12:00p	12.9	12.9	13.2	12.6	0.4	1.3	N	0	903.8	79
4/12/00	12:15p	12.6	12.6	12.9	12.3	0.4	1.8	N	0	903.6	79
4/12/00	12:30p	12.8	12.8	13	12.4	0.4	1.3	N	0	903.3	79
4/12/00	12:45p	12.8	12.8	13	12.7	0.4	1.3	NW	0	903.3	79
4/12/00	1:00p	13.4	13.4	14.1	12.8	0.4	1.8	N	0	902.8	79
4/12/00	1:15p	13.4	13.4	13.8	13	0.4	1.8	NNE	0	902.8	80
4/12/00	1:30p	12.9	12.9	13.2	12.7	0.4	2.2	N	0	902.6	79
4/12/00	1:45p	13.2	13.2	13.9	12.8	0.4	1.8	N	0	902.5	79
4/12/00	2:00p	14.1	14.1	14.5	13.8	0.4	2.2	N	0	902.4	80
4/12/00	2:15p	13.8	13.8	14.2	13.4	0.9	2.2	N	0	902.1	80
4/12/00	2:30p	13.7	13.7	13.8	13.5	0.9	2.2	N	0	902	79
4/12/00	2:45p	13.7	13.7	13.9	13.5	0.4	2.2	N	0	901.8	79
4/12/00	3:00p	13.6	13.6	13.8	13.4	0	1.3	N	0	901.8	78
4/12/00	3:15p	13.7	13.7	13.8	13.6	0.4	1.3	N	0	901.7	78
4/12/00	3:30p	13.8	13.8	13.9	13.7	0	0.9	NNE	0	901.6	78
4/12/00	3:45p	13.8	13.8	14	13.6	0.4	1.8	N	0	901.5	78
4/12/00	4:00p	13.5	13.5	13.7	13.2	0.4	2.2	NW	0	901.4	78
4/12/00	4:15p	13.2	13.2	13.3	13.1	0	0.9	N	0	901.3	78
4/12/00	4:30p	12.9	12.9	13.1	12.9	0.4	1.3	N	0	901.2	78
4/12/00	4:45p	12.7	12.7	12.9	12.6	0.4	1.3	N	0	901.2	77
4/12/00	5:00p	12.5	12.5	12.6	12.3	0.4	1.3	N	0	901.1	77
4/12/00	5:15p	12.3	12.3	12.3	12.2	0.4	1.3	N	0	901.1	77
4/12/00	5:30p	12.2	12.2	12.2	12.2	0.4	1.3	N	0	901.2	77
4/12/00	5:45p	12.1	12.1	12.2	12.1	0.4	1.8	N	0	901.2	78
4/12/00	6:00p	12	12	12.1	11.9	0	1.3	NNW	0	901.3	78
4/12/00	6:15p	11.9	11.9	11.9	11.8	0	1.3	N	0	901.3	78
4/12/00	6:30p	11.8	11.8	11.8	11.8	0	0.9	NNW	0	901.3	78
4/12/00	6:45p	11.7	11.7	11.8	11.6	0	1.3	NNW	0	901.5	78
4/12/00	7:00p	11.6	11.6	11.6	11.6	0	0.4	NNW	0	901.4	79

Date	Time	Temp. Out	Wind Chill	Hi Temp	Low Temp	Wind Speed (m/s)			Rain	Bar	Hum In
		C°	C°	C°	C°	Avg	Hi	Dir	mm	mB	%
4/12/00	7:15p	11.5	11.5	11.6	11.4	0	1.3	N	0	901.4	79
4/12/00	7:30p	11.4	11.4	11.5	11.4	0	1.3	N	0	901.5	79
4/12/00	7:45p	11.5	11.5	11.5	11.4	0.4	1.8	N	0	901.4	79
4/12/00	8:00p	11.4	11.4	11.5	11.4	0.4	1.8	N	0	901.5	80
4/12/00	8:15p	11.3	11.3	11.4	11.3	0.4	1.8	N	0	901.6	80
4/12/00	8:30p	11.3	11.3	11.3	11.2	0.4	1.8	N	0	901.6	80
4/12/00	8:45p	11.2	11.2	11.3	11.2	0.9	1.8	N	0	901.6	80
4/12/00	9:00p	11.2	11.2	11.3	11.2	0.9	2.7	N	0	901.5	80
4/12/00	9:15p	11.3	11.3	11.4	11.3	0.9	2.7	N	0	901.5	80
4/12/00	9:30p	11.4	11.4	11.4	11.3	0.9	2.7	N	0	901.5	81
4/12/00	9:45p	11.2	11.2	11.3	11.2	0.9	2.7	NNE	0	901.5	81
4/12/00	10:00p	11.1	11.1	11.2	11	0.4	1.8	N	0	901.6	81
4/12/00	10:15p	11	11	11	10.9	0.4	2.2	N	0	901.6	81
4/12/00	10:30p	11	11	11	10.9	0.4	2.2	NW	0	901.6	81
4/12/00	10:45p	10.9	10.9	10.9	10.9	0.4	1.8	N	0	901.7	81
4/12/00	11:00p	10.9	10.9	10.9	10.8	0.4	2.2	N	0	901.7	81
4/12/00	11:15p	10.8	10.8	10.8	10.8	0.4	1.3	N	0	901.5	81
4/12/00	11:30p	10.8	10.8	10.8	10.7	0.4	1.3	N	0	901.4	82
4/12/00	11:45p	10.6	10.6	10.7	10.5	0.4	1.8	N	0	901.1	81
4/13/00	12:00a	10.4	10.4	10.5	10.4	0.4	1.3	NNE	0	901.2	81
4/13/00	12:15a	10.4	10.4	10.4	10.4	0	0.9	N	0	901.1	81
4/13/00	12:30a	10.4	10.4	10.4	10.4	0.4	2.2	N	0	901.1	82
4/13/00	12:45a	10.4	10.4	10.4	10.4	0.4	1.3	N	0	901.1	82
4/13/00	1:00a	10.4	10.4	10.4	10.3	0.4	1.8	N	0	900.9	82
4/13/00	1:15a	10.3	10.3	10.3	10.2	0.9	1.3	N	0	900.7	82
4/13/00	1:30a	10.1	10.1	10.2	10.1	0.9	1.8	N	0	900.6	82
4/13/00	1:45a	10.1	10.1	10.1	10	0.4	2.2	N	0	900.4	82
4/13/00	2:00a	9.9	9.9	10	9.8	0.4	1.3	NNW	0	900.4	82
4/13/00	2:15a	9.8	9.8	9.8	9.7	0	0.9	N	0	900.3	82
4/13/00	2:30a	9.8	9.8	9.8	9.7	0	0.9	N	0	900.2	82
4/13/00	2:45a	9.8	9.8	9.9	9.8	0	0.4	N	0	900.3	82
4/13/00	3:00a	9.8	9.8	9.8	9.7	0	0	---	0	900.1	82
4/13/00	3:15a	9.6	9.6	9.7	9.6	0	0	---	0	900	82
4/13/00	3:30a	9.6	9.6	9.6	9.6	0	0	---	0	899.9	82
4/13/00	3:45a	9.5	9.5	9.6	9.4	0	0	---	0	899.8	82
4/13/00	4:00a	9.5	9.5	9.5	9.4	0	0.4	N	0	899.8	82
4/13/00	4:15a	9.6	9.6	9.6	9.5	0	0	---	0	899.8	82
4/13/00	4:30a	9.7	9.7	9.7	9.6	0	0.4	N	0	899.7	82
4/13/00	4:45a	9.7	9.7	9.7	9.6	0	0.4	N	0	899.7	83
4/13/00	5:00a	9.5	9.5	9.6	9.4	0	0	---	0	899.7	83
4/13/00	5:15a	9.6	9.6	9.7	9.4	0	0	---	0	899.7	83
4/13/00	5:30a	9.7	9.7	9.7	9.6	0	0	---	0	899.7	83
4/13/00	5:45a	9.6	9.6	9.7	9.6	0	0	---	0	899.7	83
4/13/00	6:00a	9.6	9.6	9.7	9.6	0	0	---	0	899.7	83
4/13/00	6:15a	9.7	9.7	9.7	9.6	0	0	---	0	899.9	83
4/13/00	6:30a	9.6	9.6	9.8	9.5	0	0.4	N	0	899.9	83
4/13/00	6:45a	9.7	9.7	9.7	9.7	0	0.4	N	0	900	83
4/13/00	7:00a	9.6	9.6	9.7	9.5	0	0	---	0	900	83
4/13/00	7:15a	9.7	9.7	9.8	9.6	0	0	---	0	900	83
4/13/00	7:30a	9.6	9.6	9.8	9.6	0	0	---	0	900.1	83
4/13/00	7:45a	9.9	9.9	10.1	9.8	0	0.9	N	0	900.2	83
4/13/00	8:00a	10.1	10.1	10.2	10	0	0	---	0	900.3	83
4/13/00	8:15a	10.6	10.6	10.9	10.2	0	0	---	0	900.4	84
4/13/00	8:30a	11.2	11.2	11.3	11	0	1.3	N	0	900.5	85
4/13/00	8:45a	11.4	11.4	11.5	11.3	0.4	1.3	N	0	900.7	85
4/13/00	9:00a	11.6	11.6	11.7	11.5	0.4	1.3	N	0	900.7	85
4/13/00	9:15a	11.8	11.8	11.9	11.7	0.4	0.9	N	0	900.7	85
4/13/00	9:30a	12.1	12.1	12.3	11.9	0	0.9	N	0	900.7	85

Date	Time	Temp. Out	Wind Chill	Hi Temp	Low Temp	Wind Speed (m/s)			Rain	Bar	Hum In
		C°	C°	C°	C°	Avg	Hi	Dir	mm	mB	%
4/13/00	9:45a	12.6	12.6	12.9	12.3	0	1.3	N	0	900.7	85
4/13/00	10:00a	13.4	13.4	14.2	12.9	0	1.3	N	0	900.6	86
4/13/00	10:15a	14.2	14.2	14.4	14.1	0.4	2.2	NNE	0	900.5	87
4/13/00	10:30a	14.9	14.9	15.1	14.4	0	1.3	NNE	0	900.3	87
4/13/00	10:45a	15.1	15.1	16.2	14.8	0	1.3	NNE	0	900.1	86
4/13/00	11:00a	17.7	17.7	18.6	16.4	0.4	2.7	NNE	0	899.7	91
4/13/00	11:15a	19.2	19.2	19.8	18.2	0.4	1.8	N	0	899.5	92
4/13/00	11:30a	20.8	20.8	22.2	19.6	0.4	2.2	N	0	899.4	90
4/13/00	11:45a	21.3	21.3	21.9	20.6	0.4	2.2	N	0	899.3	84
4/13/00	12:00p	21.9	21.9	22.9	20.5	0.4	2.2	NNE	0	899.1	78
4/13/00	12:15p	22.8	22.8	23.6	21.1	0.4	3.1	NNE	0	899	73
4/13/00	12:30p	21.3	21.3	22.1	20.3	0.9	3.6	NNE	0	898.9	65
4/13/00	12:45p	19	19	20.3	18.6	0.4	2.2	N	0	898.5	58
4/13/00	1:00p	18.5	18.5	18.8	18.1	0.4	3.1	N	0	898.1	58
4/13/00	1:15p	18.4	18.4	18.8	18.1	0.4	2.7	N	0	897.7	61
4/13/00	1:30p	18.1	18.1	18.8	17.6	0.9	2.7	NNE	0	897.6	62
4/13/00	1:45p	17.9	17.9	18.2	17.6	0.9	2.7	NNE	0	897.2	64
4/13/00	2:00p	18.1	18.1	18.4	17.8	0.9	2.2	N	0	897.1	65
4/13/00	2:15p	18	18	18.3	17.4	0.4	1.8	NNE	0	896.8	66
4/13/00	2:30p	18.1	18.1	18.4	17.9	0.4	2.2	NNE	0	896.9	66
4/13/00	2:45p	17.7	17.7	17.9	17.4	0.9	2.7	N	0	896.8	66
4/13/00	3:00p	17.7	17.7	17.9	17.5	0.4	2.2	N	0	896.7	67
4/13/00	3:15p	17.8	17.8	18	17.6	0.4	2.2	N	0	896.7	67
4/13/00	3:30p	17.5	17.5	17.7	17.3	0.4	2.2	N	0	896.7	67
4/13/00	3:45p	17.6	17.6	17.7	17.4	0.4	1.3	NNE	0	896.6	67
4/13/00	4:00p	17.5	17.5	17.7	17.2	0.4	2.2	N	0	896.6	67
4/13/00	4:15p	17	17	17.2	16.9	0	1.8	NNE	0	896.5	67
4/13/00	4:30p	17.1	17.1	17.3	16.7	0.4	2.7	N	0	896.5	67
4/13/00	4:45p	16.3	16.3	16.7	16.1	0.4	1.3	N	0	896.6	67
4/13/00	5:00p	16.4	16.4	16.5	16.4	0.9	1.8	N	0	896.5	67
4/13/00	5:15p	16.3	16.3	16.4	16.2	0.4	1.8	N	0	896.4	67
4/13/00	5:30p	16	16	16.2	15.8	0.4	1.8	NNE	0	896.6	67
4/13/00	5:45p	15.7	15.7	15.9	15.5	0.4	1.3	N	0	896.8	67
4/13/00	6:00p	15.4	15.4	15.6	15.1	0.9	2.7	N	0	896.8	67
4/13/00	6:15p	14.8	14.8	15.1	14.6	0.4	2.2	N	0	896.9	67
4/13/00	6:30p	14.4	14.4	14.6	14.2	0	1.3	N	0	897.1	67
4/13/00	6:45p	14	14	14.2	13.7	0	0	---	0	897.1	67
4/13/00	7:00p	13.6	13.6	13.7	13.4	0	0	---	0	897.1	67
4/13/00	7:15p	13.3	13.3	13.4	13.2	0	0	---	0	897.2	67
4/13/00	7:30p	13.1	13.1	13.2	13	0	0	---	0	897.4	68
4/13/00	7:45p	13.3	13.3	13.5	13.1	0	0	---	0	897.5	68
4/13/00	8:00p	13.3	13.3	13.4	13.2	0	0	---	0	897.5	69
4/13/00	8:15p	12.9	12.9	13.2	12.7	0	0	---	0	897.5	69
4/13/00	8:30p	12.6	12.6	12.7	12.5	0	0	---	0	897.6	69
4/13/00	8:45p	12.7	12.7	12.8	12.4	0	0	---	0	897.7	69
4/13/00	9:00p	12.7	12.7	12.8	12.4	0	0	---	0	897.7	70
4/13/00	9:15p	12.2	12.2	12.4	12.1	0	0	---	0	897.8	70
4/13/00	9:30p	12.1	12.1	12.3	12	0	0	---	0	897.9	70
4/13/00	9:45p	12.1	12.1	12.2	11.9	0	0	---	0	897.9	70
4/13/00	10:00p	12.1	12.1	12.1	11.9	0	0	---	0	897.7	70
4/13/00	10:15p	12	12	12.1	11.9	0	0	---	0	898	71
4/13/00	10:30p	11.9	11.9	11.9	11.8	0	0	---	0	898	71
4/13/00	10:45p	11.7	11.7	11.8	11.7	0	0	---	0	897.9	71
4/13/00	11:00p	11.8	11.8	11.9	11.8	0	0	---	0	897.7	71
4/13/00	11:15p	11.8	11.8	11.8	11.7	0	0	---	0	897.5	72
4/13/00	11:30p	11.7	11.7	11.8	11.6	0	0	---	0	897.4	72
4/13/00	11:45p	11.7	11.7	11.7	11.6	0	0	---	0	897.2	72
4/14/00	12:00a	11.4	11.4	11.6	11.3	0	0	---	0	897.1	72

Date	Time	Temp. Out	Wind Chill	Hi Temp	Low Temp	Wind Speed (m/s)			Rain	Bar	Hum In
		C°	C°	C°	C°	Avg	Hi	Dir	mm	mB	%
4/14/00	12:15a	11.4	11.4	11.5	11.3	0	0	---	0	897	72
4/14/00	12:30a	11.5	11.5	11.6	11.4	0	0.4	NNE	0	897	72
4/14/00	12:45a	11.4	11.4	11.6	11.3	0	0	---	0	896.9	73
4/14/00	1:00a	11.4	11.4	11.4	11.3	0	0	---	0	896.9	73
4/14/00	1:15a	11.4	11.4	11.4	11.3	0	0	---	0	896.9	73
4/14/00	1:30a	11.4	11.4	11.4	11.4	0	0	---	0	896.7	73
4/14/00	1:45a	11.4	11.4	11.4	11.3	0	0	---	0	896.8	74
4/14/00	2:00a	11.2	11.2	11.3	11.2	0	0	---	0	896.7	74
4/14/00	2:15a	11.1	11.1	11.2	11	0	0	---	0	896.5	73
4/14/00	2:30a	10.9	10.9	11	10.9	0	0	---	0	896.7	73
4/14/00	2:45a	10.9	10.9	10.9	10.8	0	0	---	0	896.4	73
4/14/00	3:00a	10.8	10.8	10.8	10.8	0	0	---	0	896.1	73
4/14/00	3:15a	10.9	10.9	10.9	10.8	0	0	---	0	896.1	74
4/14/00	3:30a	10.9	10.9	10.9	10.8	0	0	---	0	896.1	74
4/14/00	3:45a	11	11	11.1	10.9	0	0	---	0	896	74
4/14/00	4:00a	11.1	11.1	11.3	11.1	0	0	---	0	896	74
4/14/00	4:15a	11.3	11.3	11.4	11.3	0	0	---	0	895.9	74
4/14/00	4:30a	11.4	11.4	11.4	11.4	0	0	---	0	895.8	75
4/14/00	4:45a	11.4	11.4	11.4	11.4	0	0	---	0	895.9	75
4/14/00	5:00a	11.6	11.6	11.7	11.4	0	0	---	0	895.8	75
4/14/00	5:15a	11.8	11.8	11.9	11.7	0	0	---	0	895.9	75
4/14/00	5:30a	12	12	12.2	11.9	0	0	---	0	895.9	75
4/14/00	5:45a	12.3	12.3	12.6	12.2	0	0	---	0	895.9	76
4/14/00	6:00a	12.5	12.5	12.6	12.4	0	0.9	SW	0	896	76
4/14/00	6:15a	12.4	12.4	12.4	12.3	0	0.9	SW	0	895.8	76
4/14/00	6:30a	12.3	12.3	12.3	12.2	0	0.9	SW	0	895.8	76
4/14/00	6:45a	12.4	12.4	12.4	12.3	0	0	---	0	895.8	76
4/14/00	7:00a	12.3	12.3	12.4	12.2	0.4	1.3	SW	0	895.7	77
4/14/00	7:15a	12.3	12.3	12.4	12.2	0.4	1.8	SW	0	895.9	77
4/14/00	7:30a	12.4	12.4	12.4	12.3	0.9	1.8	SW	0	896	77
4/14/00	7:45a	12.4	12.4	12.6	12.4	0.9	1.3	SSW	0	896	78
4/14/00	8:00a	12.7	12.7	13.2	12.6	0.9	1.8	SW	0	896.1	78
4/14/00	8:15a	14.7	14.7	16.1	13.3	0.9	1.8	SSW	0	896.1	79
4/14/00	8:30a	16.4	16.4	16.9	15.3	0.9	1.8	SW	0	896	86
4/14/00	8:45a	15.1	15.1	15.3	15.1	1.3	2.2	SW	0	896.1	86
4/14/00	9:00a	14.8	14.8	15.1	14.4	1.3	2.7	SW	0	896.1	82
4/14/00	9:15a	14.4	14.4	14.6	14.3	0.9	2.2	SW	0	896.2	79
4/14/00	9:30a	14.6	14.6	14.8	14.4	0.9	2.2	SW	0	896.3	78
4/14/00	9:45a	15	15	15.4	14.4	0.9	2.2	SW	0	896.2	78
4/14/00	10:00a	15.9	15.9	16.7	15.5	1.3	2.2	SW	0	896.2	80
4/14/00	10:15a	18.3	18.3	19.3	16.8	0.9	2.2	SW	0	895.9	85
4/14/00	10:30a	19.5	19.5	20	19	1.3	3.1	SSW	0	895.7	81
4/14/00	10:45a	18.7	18.7	19.6	17.7	1.3	2.7	SW	0	895.6	75
4/14/00	11:00a	19.9	19.9	21.1	18.8	0.9	2.7	SSW	0	895.4	73
4/14/00	11:15a	21.4	21.4	22.3	20.6	0.9	2.2	SW	0	895.4	70
4/14/00	11:30a	21.4	21.4	22.2	20.8	0.9	1.8	SW	0	895.1	67
4/14/00	11:45a	20.6	20.6	21.3	19.8	0.9	2.2	SSW	0	895	63
4/14/00	12:00p	20.9	20.9	22	19.3	0.9	2.7	SW	0	894.9	61
4/14/00	12:15p	20.1	20.1	20.7	19.4	0.4	1.8	SW	0	894.8	59
4/14/00	12:30p	18.2	18.2	19.6	17.4	0.4	1.8	SW	0	894.7	56
4/14/00	12:45p	17.3	17.3	17.6	17.1	0.4	1.8	SSW	0	894.4	55
4/14/00	1:00p	17.1	17.1	17.4	16.9	0.4	1.3	SSW	0	894.2	56
4/14/00	1:15p	17.7	17.7	17.9	17.3	0.9	2.7	SSW	0	894	59
4/14/00	1:30p	17.9	17.9	18.1	17.7	0.9	2.2	SW	0	893.8	60
4/14/00	1:45p	17.9	17.9	18.1	17.7	0.9	2.7	SW	0	893.7	61
4/14/00	2:00p	18.2	18.2	18.4	17.8	0.4	1.8	SSW	0	893.3	62
4/14/00	2:15p	18.4	18.4	18.7	18.1	0.4	1.3	SW	0	893	62
4/14/00	2:30p	18.4	18.4	18.8	17.8	0.4	1.3	SW	0	893	63

Date	Time	Temp. Out	Wind Chill	Hi Temp	Low Temp	Wind Speed (m/s)			Rain	Bar	Hum In
		C°	C°	C°	C°	Avg	Hi	Dir	mm	mB	%
4/14/00	2:45p	17.6	17.6	17.8	17.4	0.4	1.3	SSW	0	893.1	62
4/14/00	3:00p	17.3	17.3	17.4	17.1	0	0	---	0	893.1	62
4/14/00	3:15p	16.6	16.6	17.1	16.4	0	0	---	0	893.1	62
4/14/00	3:30p	16.2	16.2	16.4	16.1	0	0	---	0	892.9	62
4/14/00	3:45p	16.2	16.2	16.2	16.1	0	0	---	0	892.8	63
4/14/00	4:00p	16.1	16.1	16.1	16	0	0	---	0	892.8	63
4/14/00	4:15p	15.7	15.7	16	15.6	0	0	---	0	892.7	64
4/14/00	4:30p	15.6	15.6	15.6	15.5	0	0.9	NE	0	892.6	64
4/14/00	4:45p	15.5	15.5	15.6	15.4	0	0	---	0	892.6	64
4/14/00	5:00p	15.4	15.4	15.6	15.3	0	2.2	NNE	0	892.7	65
4/14/00	5:15p	15.2	15.2	15.3	15.1	0	0	---	0	892.6	65
4/14/00	5:30p	15.2	15.2	15.2	15.1	0	0.9	NNE	0	892.7	65
4/14/00	5:45p	15.2	15.2	15.3	15.1	0	0.9	NNE	0	892.7	66
4/14/00	6:00p	14.9	14.9	15.1	14.8	0	0	---	0	892.7	66
4/14/00	6:15p	14.7	14.7	14.8	14.5	0	2.2	NNE	0	892.7	66
4/14/00	6:30p	14.4	14.4	14.5	14.3	0	0	---	0	892.8	66
4/14/00	6:45p	14.2	14.2	14.3	14	0	0	---	0	893	66
4/14/00	7:00p	13.9	13.9	14	13.9	0	0	---	0	892.9	66
4/14/00	7:15p	13.9	13.9	13.9	13.9	0	0	---	0	892.9	67
4/14/00	7:30p	13.9	13.9	14	13.8	0	0	---	0	893	67
4/14/00	7:45p	13.8	13.8	13.9	13.8	0	0	---	0	893.1	68
4/14/00	8:00p	13.7	13.7	13.8	13.7	0	0	---	0	893.1	68
4/14/00	8:15p	13.7	13.7	13.7	13.6	0	0	---	0	893.1	68
4/14/00	8:30p	13.6	13.6	13.7	13.6	0	0	---	0	893.3	69
4/14/00	8:45p	13.6	13.6	13.6	13.5	0	0	---	0	893.4	69
4/14/00	9:00p	13.6	13.6	13.7	13.6	0	0	---	0	893.4	69
4/14/00	9:15p	13.6	13.6	13.7	13.6	0	0	---	0	893.6	70
4/14/00	9:30p	13.6	13.6	13.7	13.5	0	0	---	0	893.4	70
4/14/00	9:45p	13.3	13.3	13.4	13.2	0	0	---	0	893.4	70
4/14/00	10:00p	13.2	13.2	13.3	13.2	0	1.3	NE	0	893.2	70
4/14/00	10:15p	13.2	13.2	13.3	13.2	0	0.9	NE	0	893.2	70
4/14/00	10:30p	13.3	13.3	13.3	13.2	0	0.9	S	0	893.3	71
4/14/00	10:45p	13.3	13.3	13.4	13.3	0	0.4	---	0	893.4	71
4/14/00	11:00p	13.3	13.3	13.4	13.3	0	0	---	0	893.3	71
4/14/00	11:15p	13.4	13.4	13.5	13.3	0	0	---	0	893.2	72
4/14/00	11:30p	13.6	13.6	13.6	13.5	0	0	---	0	893.2	72
4/14/00	11:45p	13.6	13.6	13.7	13.6	0	0	---	0	893.2	72
4/15/00	12:00a	13.7	13.7	13.7	13.6	0.9	1.8	SW	0	893.2	74
4/15/00	12:15a	13.3	13.3	13.5	13	0.9	1.8	SW	0	892.9	74
4/15/00	12:30a	12.8	12.8	13	12.7	0.4	1.3	WSW	0.2	892.5	74
4/15/00	12:45a	12.6	12.6	12.7	12.4	0.4	1.3	SW	0	892.6	74
4/15/00	1:00a	12.4	12.4	12.4	12.4	0	0	---	0	892.5	75
4/15/00	1:15a	12.5	12.5	12.6	12.4	0	0	---	0	892.4	76
4/15/00	1:30a	12.6	12.6	12.6	12.6	0.4	1.8	SW	0	892.4	77
4/15/00	1:45a	12.5	12.5	12.6	12.5	0.4	1.3	SSW	0	892.1	77
4/15/00	2:00a	12.4	12.4	12.5	12.4	0.9	1.3	SSW	0	892.3	78
4/15/00	2:15a	12.6	12.6	12.7	12.6	0	0.9	SSW	0	892.3	79
4/15/00	2:30a	12.7	12.7	12.8	12.7	0.4	1.8	SSW	0	892.2	79
4/15/00	2:45a	12.8	12.8	12.9	12.8	0.4	1.3	SSW	0	892.2	80
4/15/00	3:00a	12.9	12.9	12.9	12.9	0	0.9	SW	0	892	80
4/15/00	3:15a	12.9	12.9	12.9	12.9	0	0.9	SW	0	891.8	80
4/15/00	3:30a	12.9	12.9	13	12.9	0.4	1.3	SW	0	891.7	80
4/15/00	3:45a	13	13	13	12.9	0.9	1.3	SW	0	891.5	81
4/15/00	4:00a	12.9	12.9	12.9	12.9	0.4	1.3	SW	0	891.7	81
4/15/00	4:15a	12.8	12.8	12.9	12.8	0	0	---	0	891.7	81
4/15/00	4:30a	12.8	12.8	12.8	12.7	0	1.3	SSW	0	891.7	81
4/15/00	4:45a	12.6	12.6	12.7	12.6	0.9	1.8	SSW	0	891.7	82
4/15/00	5:00a	12.6	12.6	12.7	12.6	1.3	2.7	SSW	0	891.7	82

Date	Time	Temp. Out	Wind Chill	Hi Temp	Low Temp	Wind Speed (m/s)			Rain	Bar	Hum In
		C°	C°	C°	C°	Avg	Hi	Dir	mm	mB	%
4/15/00	5:15a	12.6	12.6	12.6	12.6	1.3	1.8	SSW	0	891.6	83
4/15/00	5:30a	12.7	12.7	12.7	12.6	1.3	1.8	SSW	0	891.6	83
4/15/00	5:45a	12.7	12.7	12.7	12.7	1.3	2.2	SSW	0	891.8	84
4/15/00	6:00a	12.7	12.7	12.7	12.7	1.8	3.1	SSW	0	891.7	84
4/15/00	6:15a	12.6	12.6	12.7	12.5	1.8	3.1	SSW	0	891.5	85
4/15/00	6:30a	12.5	12.5	12.6	12.4	1.8	2.7	SW	0	891.6	85
4/15/00	6:45a	12.4	11.3	12.5	12.4	2.2	3.1	SW	0	891.5	86
4/15/00	7:00a	12.5	11.4	12.5	12.4	2.2	3.6	SW	0	891.7	86
4/15/00	7:15a	12.6	11.5	12.7	12.5	2.2	3.1	SW	0	892	87
4/15/00	7:30a	12.7	12.7	12.7	12.6	1.8	3.1	SW	0	892	87
4/15/00	7:45a	12.8	11.7	13	12.7	2.2	3.6	SW	0	892.2	87
4/15/00	8:00a	13.3	11.6	14.1	13	2.7	3.6	SW	0	892.4	88
4/15/00	8:15a	14.9	13.3	15.2	14.2	2.7	4	SW	0	892.7	88
4/15/00	8:30a	15.3	14.4	15.7	14.7	2.2	4	SW	0	893	93
4/15/00	8:45a	14.4	13.4	14.7	14.3	2.2	4	SSW	0	893	94
4/15/00	9:00a	13.9	12.1	14.3	13.7	2.7	4.5	SSW	0	893.2	90
4/15/00	9:15a	14.1	13.1	14.5	13.7	2.2	3.1	SSW	0	893.4	87
4/15/00	9:30a	14.8	14.8	15.3	14.5	1.8	3.6	SSW	0	893.5	87
4/15/00	9:45a	15.3	15.3	15.6	15.1	1.8	3.1	SSW	0	893.4	87
4/15/00	10:00a	15.6	15.6	16.3	15.1	1.8	3.6	SSW	0	893.5	88
4/15/00	10:15a	16.9	16.9	17.7	16.4	1.8	4	SSW	0	893.6	89
4/15/00	10:30a	17.3	16.5	17.7	16.7	2.2	4	SSW	0	893.5	84
4/15/00	10:45a	18.1	18.1	19.7	17.1	1.3	3.6	SSW	0	893.5	81
4/15/00	11:00a	19.1	19.1	19.8	18.3	1.8	3.1	SSW	0	893.5	77
4/15/00	11:15a	19.3	19.3	20.6	18.2	1.8	2.7	SW	0	893.3	72
4/15/00	11:30a	19.8	19.8	20.6	18.2	1.8	3.1	SSW	0	893.4	68
4/15/00	11:45a	17.6	17.6	18.7	16.4	1.8	3.1	SSW	0	893.6	62
4/15/00	12:00p	18.7	18.7	19.8	17.6	1.3	2.7	SSW	0	893.4	61
4/15/00	12:15p	19.7	19	20.5	19.2	2.2	4.5	SSW	0	893.4	60
4/15/00	12:30p	19.3	19.3	19.8	18	1.8	4	SW	0	893.3	55
4/15/00	12:45p	17.2	17.2	17.9	17	1.3	2.7	SW	0	893.2	50
4/15/00	1:00p	16.9	16.9	17.1	16.8	1.8	3.1	SSW	0	893.1	50
4/15/00	1:15p	17	17	17.3	16.8	1.8	3.6	SSW	0	892.9	52
4/15/00	1:30p	17	16.1	17.3	16.8	2.2	4.5	SSW	0	893	53
4/15/00	1:45p	17.3	17.3	17.5	17.1	1.3	4.5	SW	0	892.8	54
4/15/00	2:00p	17.7	17.7	17.8	17.4	1.3	2.7	SSW	0	892.8	55
4/15/00	2:15p	17.9	17.9	18	17.8	1.3	2.2	SSW	0	892.6	56
4/15/00	2:30p	17.7	17.7	18	17.4	1.8	3.1	SSW	0	892.6	56
4/15/00	2:45p	17.2	17.2	17.6	16.9	1.3	2.7	SSW	0	892.6	56
4/15/00	3:00p	16.9	16.9	17	16.8	1.3	2.2	SSW	0	892.7	57
4/15/00	3:15p	17.2	17.2	17.3	17	1.3	3.1	S	0	892.7	58
4/15/00	3:30p	17.1	17.1	17.2	17	1.3	2.2	SSW	0	892.7	58
4/15/00	3:45p	17	17	17.1	16.9	1.3	2.2	SSW	0	892.7	59
4/15/00	4:00p	17.1	17.1	17.2	16.9	0.9	1.8	SSW	0	892.6	59
4/15/00	4:15p	17.1	17.1	17.2	16.8	0.9	1.3	SSW	0	892.5	60
4/15/00	4:30p	17.1	17.1	17.2	17.1	0.9	2.2	SSW	0	892.4	60
4/15/00	4:45p	17.1	17.1	17.2	17.1	0.9	1.8	SSW	0	892.4	60
4/15/00	5:00p	17.1	17.1	17.1	17	0.9	1.8	SSW	0	892.4	61
4/15/00	5:15p	16.9	16.9	17	16.7	0	0.9	SSW	0	892.4	60
4/15/00	5:30p	16.6	16.6	16.6	16.4	0.4	0.9	SSW	0	892.7	61
4/15/00	5:45p	16.1	16.1	16.4	15.9	0	0	---	0	892.7	61
4/15/00	6:00p	15.7	15.7	15.8	15.6	0	0.4	SSW	0	892.8	60
4/15/00	6:15p	15.2	15.2	15.6	14.9	0	0	---	0	893.1	60
4/15/00	6:30p	14.5	14.5	14.9	14.1	0	0	---	0	893.3	60
4/15/00	6:45p	13.6	13.6	14.1	13.4	0	0	---	0	893.4	60
4/15/00	7:00p	13.3	13.3	13.4	13.1	0	0	---	0	893.4	60
4/15/00	7:15p	12.8	12.8	13.1	12.5	0	0	---	0	893.6	61
4/15/00	7:30p	12.4	12.4	12.5	12.3	0	0	---	0	893.8	61

Date	Time	Temp. Out	Wind Chill	Hi Temp	Low Temp	Wind Speed (m/s)			Rain	Bar	Hum In
		C°	C°	C°	C°	Avg	Hi	Dir	mm	mB	%
4/15/00	7:45p	12.1	12.1	12.3	11.9	0	0	---	0	894	62
4/15/00	8:00p	12	12	12.1	11.9	0	0	---	0	894.3	62
4/15/00	8:15p	12.1	12.1	12.2	12.1	0	0	---	0	894.6	63
4/15/00	8:30p	12.1	12.1	12.2	12.1	0	0	---	0	894.5	63
4/15/00	8:45p	12.6	12.6	12.9	12.2	0	0.9	NW	0	894.4	64
4/15/00	9:00p	12.8	12.8	12.9	12.7	0	0	---	0	894.5	64
4/15/00	9:15p	13.1	13.1	13.1	12.9	0	0.9	NNW	0	894.4	65
4/15/00	9:30p	13.1	13.1	13.1	13.1	0	1.3	NNW	0	894.5	65
4/15/00	9:45p	13.1	13.1	13.1	13.1	0	0.9	NW	0	894.5	66
4/15/00	10:00p	13.1	13.1	13.1	13	0	0.9	NW	0	894.4	66
4/15/00	10:15p	13	13	13.1	13	0	0	---	0	894.6	66
4/15/00	10:30p	13	13	13	12.9	0	0	---	0	894.8	66
4/15/00	10:45p	12.9	12.9	12.9	12.9	0	0	---	0	894.9	67
4/15/00	11:00p	13	13	13.1	12.9	0	0	---	0	894.8	67
4/15/00	11:15p	13.1	13.1	13.1	12.9	0	0	---	0	894.9	67
4/15/00	11:30p	12.8	12.8	12.9	12.8	0	0	---	0	894.8	67
4/15/00	11:45p	12.7	12.7	12.8	12.7	0	0	---	0	894.7	67
4/16/00	12:00a	12.7	12.7	12.7	12.7	0	0	---	0	894.5	67
4/16/00	12:15a	12.7	12.7	12.7	12.7	0	0	---	0	894.3	68
4/16/00	12:30a	12.7	12.7	12.7	12.7	0	0	---	0	894.2	68
4/16/00	12:45a	12.6	12.6	12.7	12.6	0	0	---	0	894	68
4/16/00	1:00a	12.6	12.6	12.6	12.6	0	0	---	0	893.8	68
4/16/00	1:15a	12.6	12.6	12.6	12.6	0	0	---	0	893.4	68
4/16/00	1:30a	12.5	12.5	12.6	12.4	0	0	---	0	893.5	69
4/16/00	1:45a	12.4	12.4	12.4	12.3	0	0	---	0	893.3	69
4/16/00	2:00a	12.3	12.3	12.4	12.3	0	0	---	0	893.2	69
4/16/00	2:15a	12.2	12.2	12.3	12.1	0	0	---	0	893	69
4/16/00	2:30a	11.9	11.9	12.1	11.9	0	0	---	0	893.1	69
4/16/00	2:45a	11.9	11.9	12	11.9	0	1.3	N	0	892.8	69
4/16/00	3:00a	11.8	11.8	11.9	11.7	0	0.4	N	0	892.7	69
4/16/00	3:15a	11.6	11.6	11.7	11.4	0	0.4	N	0	892.4	69
4/16/00	3:30a	11.5	11.5	11.6	11.4	0	0.4	N	0	892.2	70
4/16/00	3:45a	11.6	11.6	11.6	11.4	0	0	---	0	892.1	70
4/16/00	4:00a	11.6	11.6	11.7	11.5	0	0.4	N	0	892.1	70
4/16/00	4:15a	11.5	11.5	11.6	11.5	0	0	---	0	891.9	71
4/16/00	4:30a	11.5	11.5	11.6	11.4	0	0	---	0	891.6	71
4/16/00	4:45a	11.5	11.5	11.6	11.4	0	0	---	0	891.8	71
4/16/00	5:00a	11.6	11.6	11.7	11.6	0	0	---	0	891.8	71
4/16/00	5:15a	11.6	11.6	11.6	11.5	0	0	---	0	891.7	71
4/16/00	5:30a	11.6	11.6	11.8	11.6	0	0	---	0	891.9	72
4/16/00	5:45a	12	12	12.2	11.8	0	0	---	0	891.9	72
4/16/00	6:00a	12.4	12.4	12.6	12.2	0	0	---	0	892.1	72
4/16/00	6:15a	12.7	12.7	12.7	12.6	0	0	---	0	891.8	73
4/16/00	6:30a	12.9	12.9	13.1	12.7	0	0	---	0	891.8	73
4/16/00	6:45a	13.2	13.2	13.3	13.1	0	1.3	N	0	891.9	73
4/16/00	7:00a	13.4	13.4	13.4	13.3	0	0.9	N	0	891.8	74
4/16/00	7:15a	13.4	13.4	13.4	13.3	0	0.9	NNE	0	891.7	74
4/16/00	7:30a	13.4	13.4	13.4	13.4	0	0.4	NNE	0	891.6	74
4/16/00	7:45a	13.5	13.5	13.6	13.4	0	0	---	0	891.4	74
4/16/00	8:00a	13.7	13.7	13.8	13.6	0	1.3	NNE	0	891.7	74
4/16/00	8:15a	14.1	14.1	14.2	13.8	0	0.9	NNE	0	891.9	74
4/16/00	8:30a	14.4	14.4	14.5	14.3	0	0.4	NNE	0	891.9	75
4/16/00	8:45a	14.6	14.6	14.6	14.5	0	2.2	NNE	0	892.1	75
4/16/00	9:00a	14.6	14.6	14.7	14.4	0	0	---	0	892.3	75
4/16/00	9:15a	14.1	14.1	14.4	13.8	0	1.3	NE	1.6	892.1	75
4/16/00	9:30a	13.9	13.9	14	13.8	0	0.9	NNE	0.2	892	74
4/16/00	9:45a	14.1	14.1	14.1	14	0	0.9	NNE	0	892.3	75
4/16/00	10:00a	14.3	14.3	14.6	14.1	0.4	1.8	SSW	0	892.2	76

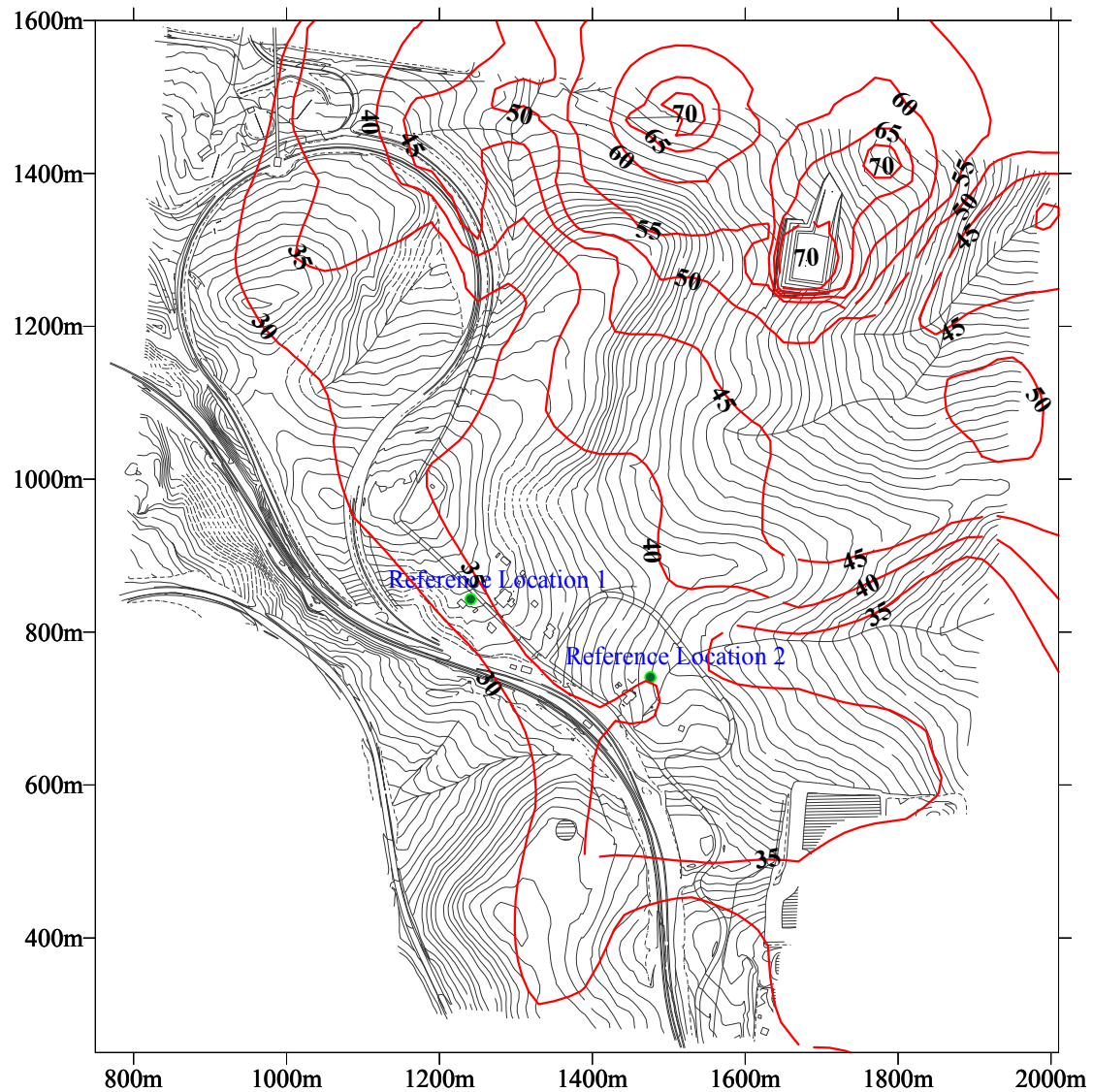
Date	Time	Temp. Out	Wind Chill	Hi Temp	Low Temp	Wind Speed (m/s)			Rain	Bar	Hum In
		C°	C°	C°	C°	Avg	Hi	Dir	mm	mB	%
4/16/00	10:15a	15.6	15.6	16.3	14.7	0.9	1.8	SSW	0	892	81
4/16/00	10:30a	16.8	16.8	17	16.3	0.9	1.8	SW	0	891.7	85
4/16/00	10:45a	17.1	17.1	17.2	16.8	0.9	1.8	SW	0	891.7	84
4/16/00	11:00a	16.9	16.9	17.4	16.6	0.9	1.8	SSW	0	891.7	81
4/16/00	11:15a	17.3	17.3	17.4	17.1	0.9	2.2	SW	0	891.5	79
4/16/00	11:30a	17.3	17.3	17.6	17.2	0.9	2.2	SW	0	891.1	78
4/16/00	11:45a	18.4	18.4	19.1	17.6	0.4	1.3	SW	0	890.8	79
4/16/00	12:00p	19.4	19.4	19.9	19	0.9	2.2	SW	0	890.7	79
4/16/00	12:15p	18.7	18.7	19.2	18.3	0.9	2.2	SSW	0	890.6	75
4/16/00	12:30p	18.3	18.3	18.5	18	0.9	2.2	SW	0	890.5	72
4/16/00	12:45p	17.9	17.9	18	17.8	0.9	1.8	SW	0	890.4	71
4/16/00	1:00p	17.9	17.9	17.9	17.8	0.9	2.2	SSW	0	890	70
4/16/00	1:15p	17.8	17.8	17.9	17.7	0.9	1.8	SW	0	890	70
4/16/00	1:30p	17.7	17.7	17.8	17.7	0.9	1.8	SW	0	889.8	71
4/16/00	1:45p	17.7	17.7	17.8	17.4	0.9	1.8	SW	0	889.8	71
4/16/00	2:00p	17.2	17.2	17.3	17.1	1.3	1.8	SW	0	889.6	70
4/16/00	2:15p	17.1	17.1	17.3	16.9	0.9	1.8	SW	0	889.6	71
4/16/00	2:30p	17	17	17.2	16.9	1.3	2.7	SSW	0	889.3	71
4/16/00	2:45p	16.8	16.8	16.9	16.8	1.3	2.7	SW	0	889.3	71
4/16/00	3:00p	16.7	16.7	16.8	16.6	1.3	3.1	SSW	0	889.3	71
4/16/00	3:15p	16.6	16.6	16.6	16.5	0.9	2.2	SSW	0	889.2	71
4/16/00	3:30p	16.5	16.5	16.5	16.4	0.9	2.2	SSW	0	889.1	71
4/16/00	3:45p	16.3	16.3	16.4	16.1	1.3	2.7	SSW	0	889	71
4/16/00	4:00p	16	16	16.1	15.9	0.9	1.8	SW	0	889	70
4/16/00	4:15p	15.8	15.8	15.9	15.7	0.9	2.2	SW	0	889	70
4/16/00	4:30p	15.6	15.6	15.7	15.6	0.9	1.8	SSW	0	889	70
4/16/00	4:45p	15.4	15.4	15.6	15.3	0.9	1.8	SW	0	889	70
4/16/00	5:00p	15.2	15.2	15.3	15.2	0.9	1.8	SW	0.2	889.1	70
4/16/00	5:15p	15.1	15.1	15.2	14.9	0.9	1.8	SW	0	889.4	70
4/16/00	5:30p	14.8	14.8	14.9	14.7	1.3	2.7	SSW	0	889.5	71
4/16/00	5:45p	14.3	14.3	14.7	13.9	1.3	3.1	SSW	0	889.7	71
4/16/00	6:00p	13.4	13.4	13.9	13	1.3	2.2	SSW	0	889.8	72
4/16/00	6:15p	12.8	12.8	13	12.7	0.9	1.3	SSW	0	889.8	73
4/16/00	6:30p	12.6	12.6	12.7	12.6	0.9	1.3	SSW	0	890.1	74
4/16/00	6:45p	12.6	12.6	12.7	12.5	0.4	1.3	SSW	0.2	890.3	75
4/16/00	7:00p	12.4	12.4	12.5	12.3	0.4	1.3	SSW	0	890.3	75
4/16/00	7:15p	12.2	12.2	12.3	12.1	0.9	1.3	SSW	0.2	890.3	76
4/16/00	7:30p	12.1	12.1	12.1	12.1	0.9	1.8	SSW	0.2	890.2	77
4/16/00	7:45p	12.1	12.1	12.1	12	0.9	1.8	SSW	0	890	78
4/16/00	8:00p	12	12	12	12	0.9	1.8	SSW	0	890.3	79
4/16/00	8:15p	12	12	12	12	0.9	1.8	SSW	0.2	890.3	80
4/16/00	8:30p	11.9	11.9	12	11.9	0.9	1.3	SSW	0	889.9	80
4/16/00	8:45p	11.9	11.9	11.9	11.9	0.9	1.3	SSW	0	890.1	81
4/16/00	9:00p	11.8	11.8	11.9	11.8	0.4	0.9	SSW	0.2	890.2	81
4/16/00	9:15p	11.8	11.8	11.8	11.8	0.4	0.9	SSW	0	889.9	81
4/16/00	9:30p	11.9	11.9	11.9	11.8	0.4	0.9	SSW	0	890.1	82
4/16/00	9:45p	11.9	11.9	11.9	11.9	0	0	---	0	890	82
4/16/00	10:00p	11.9	11.9	12	11.9	0.4	0.9	SSW	0	889.8	82
4/16/00	10:15p	11.9	11.9	11.9	11.9	0.4	0.9	SSW	0	889.9	82
4/16/00	10:30p	12	12	12	11.9	0.4	0.9	SSW	0	890	82
4/16/00	10:45p	12.1	12.1	12.1	12	0	0	---	0	890	82
4/16/00	11:00p	12.1	12.1	12.1	12.1	0	0	---	0	889.9	82
4/16/00	11:15p	12.1	12.1	12.1	12.1	0	0	---	1.2	890	82
4/16/00	11:30p	11.9	11.9	12.1	11.3	0.9	3.1	SSW	0.8	890.3	83
4/16/00	11:45p	10.6	9.4	11.2	10.4	2.2	4	S	0.2	890.3	83
4/17/00	12:00a	10.4	10.4	10.4	10.3	1.3	2.2	S	0	890.3	83
4/17/00	12:15a	10.2	10.2	10.3	10.1	1.3	1.8	SSW	0	890.1	84
4/17/00	12:30a	9.9	9.9	10.1	9.8	1.3	2.2	SSW	0	890.3	84

Date	Time	Temp. Out	Wind Chill	Hi Temp	Low Temp	Wind Speed (m/s)			Rain	Bar	Hum In
		C°	C°	C°	C°	Avg	Hi	Dir	mm	mB	%
4/17/00	12:45a	9.8	9.8	9.9	9.8	1.8	2.7	SSW	0	890.1	85
4/17/00	1:00a	9.8	8.6	9.9	9.8	2.2	3.1	SSW	0	890.2	85
4/17/00	1:15a	10	8.7	10.1	9.9	2.2	3.1	SSW	0	890.5	86
4/17/00	1:30a	10.1	10.1	10.1	10	1.8	2.7	SSW	0	890.5	87
4/17/00	1:45a	10	10	10.1	9.9	1.8	3.1	SSW	0	890.1	87
4/17/00	2:00a	9.7	9.7	9.9	9.6	1.8	2.7	SSW	0	889.8	87
4/17/00	2:15a	9.6	9.6	9.6	9.6	1.8	2.7	SSW	0	889.7	87
4/17/00	2:30a	9.6	8.3	9.6	9.5	2.2	2.7	SSW	0	889.4	88
4/17/00	2:45a	9.4	8.2	9.5	9.4	2.2	3.1	SSW	0	889.5	88
4/17/00	3:00a	9.4	6.4	9.4	9.4	3.1	4.5	SSW	0	889.6	89
4/17/00	3:15a	9.4	7.2	9.4	9.3	2.7	4.5	SSW	0	889.4	89
4/17/00	3:30a	9.3	7.2	9.4	9.3	2.7	4	SSW	0	889.7	89
4/17/00	3:45a	9.3	8.1	9.4	9.3	2.2	3.6	SSW	0	889.6	89
4/17/00	4:00a	9.2	7.9	9.3	9.2	2.2	3.1	SSW	0	889.6	90
4/17/00	4:15a	9.1	9.1	9.2	9	1.8	3.1	SSW	0	889.9	90
4/17/00	4:30a	9.2	7.9	9.3	9.1	2.2	3.1	SSW	0	890.1	90
4/17/00	4:45a	9.3	8	9.3	9.1	2.2	3.6	SSW	0	890.3	90
4/17/00	5:00a	8.9	7.6	9.1	8.8	2.2	3.1	SSW	0	890.5	90
4/17/00	5:15a	8.8	7.5	8.9	8.8	2.2	3.6	SSW	0	890.7	90
4/17/00	5:30a	8.8	7.4	8.9	8.7	2.2	3.1	SSW	0	890.9	90
4/17/00	5:45a	8.6	7.3	8.7	8.5	2.2	3.6	SSW	0	891.1	90
4/17/00	6:00a	8.6	7.3	8.7	8.5	2.2	4	SSW	0	891.4	90
4/17/00	6:15a	8.6	6.4	8.7	8.5	2.7	3.6	SSW	0	891.5	90
4/17/00	6:30a	8.4	6.2	8.6	8.4	2.7	3.6	SSW	0	891.4	90
4/17/00	6:45a	8.4	7.1	8.6	8.4	2.2	3.6	SSW	0	891.6	90
4/17/00	7:00a	8.4	7.1	8.5	8.4	2.2	3.1	SSW	0	891.8	90
4/17/00	7:15a	8.4	8.4	8.4	8.3	1.8	2.7	SSW	0	892.2	90
4/17/00	7:30a	8.4	7.1	8.4	8.3	2.2	3.1	SSW	0	892.2	90
4/17/00	7:45a	8.4	6.1	8.6	8.3	2.7	3.6	SSW	0	892.4	90
4/17/00	8:00a	9.2	6.1	10.5	8.6	3.1	4.9	SSW	0	892.6	91
4/17/00	8:15a	10.4	8.4	11.1	9.4	2.7	4	S	0	893.1	91
4/17/00	8:30a	10.9	9.7	11.8	9.4	2.2	4	S	0	893.2	92
4/17/00	8:45a	11.1	11.1	11.5	10.7	1.8	3.1	SSW	0	893.5	98
4/17/00	9:00a	10.6	10.6	11.2	10.3	1.8	3.6	SSW	0	893.8	96
4/17/00	9:15a	10.6	10.6	10.8	10.4	1.8	2.7	SSW	0	893.9	93
4/17/00	9:30a	10.7	9.4	10.8	10.6	2.2	4	S	0	893.9	91
4/17/00	9:45a	11.1	9.9	11.5	10.8	2.2	3.6	S	0	893.9	90
4/17/00	10:00a	12.2	11	13	11.6	2.2	3.6	SSW	0	893.8	92
4/17/00	10:15a	14	14	14.9	12.9	1.3	3.1	SSW	0	893.8	95
4/17/00	10:30a	14.8	14.8	15.2	14.4	1.3	2.7	SSW	0	893.7	93
4/17/00	10:45a	15.4	15.4	16.6	14.4	0.9	1.8	SE	0	893.7	89
4/17/00	11:00a	16.9	16.9	18.3	15.7	0.4	1.8	SW	0	893.8	86
4/17/00	11:15a	17.4	17.4	18.8	16.3	0.9	1.8	S	0	893.7	81
4/17/00	11:30a	17.5	17.5	17.9	16.8	0.9	1.8	SSE	0	893.8	77
4/17/00	11:45a	17.7	17.7	18.5	17.3	0.9	2.2	SSE	0	893.9	74
4/17/00	12:00p	18.8	18.8	19.6	18.2	0.4	1.8	S	0	893.8	70
4/17/00	12:15p	18.8	18.8	19.3	18.1	0.9	2.2	SSW	0	893.8	66
4/17/00	12:30p	17.4	17.4	18.6	15.6	1.3	2.7	SSE	0	893.7	58
4/17/00	12:45p	14.8	14.8	15.4	14.5	0.4	1.8	SSW	0	893.6	54
4/17/00	1:00p	14.7	14.7	14.9	14.3	0.4	1.8	SSW	0	893.3	55
4/17/00	1:15p	14.1	14.1	14.5	14	0.9	1.8	S	0	893.3	57
4/17/00	1:30p	14.1	14.1	14.3	13.9	0.4	0.9	S	0	893.2	59
4/17/00	1:45p	14.3	14.3	14.5	14.2	0.4	1.3	S	0	893.1	61
4/17/00	2:00p	14.7	14.7	15.1	14.3	0.4	1.3	S	0	893	62
4/17/00	2:15p	14.9	14.9	15.1	14.7	0.9	1.8	SSE	0	893	63
4/17/00	2:30p	14.7	14.7	14.9	14.6	0.9	1.8	S	0	892.9	63
4/17/00	2:45p	14.9	14.9	15.2	14.7	0.9	1.8	S	0	893	63
4/17/00	3:00p	15.3	15.3	15.7	15.1	0.9	1.8	S	0	893.1	64

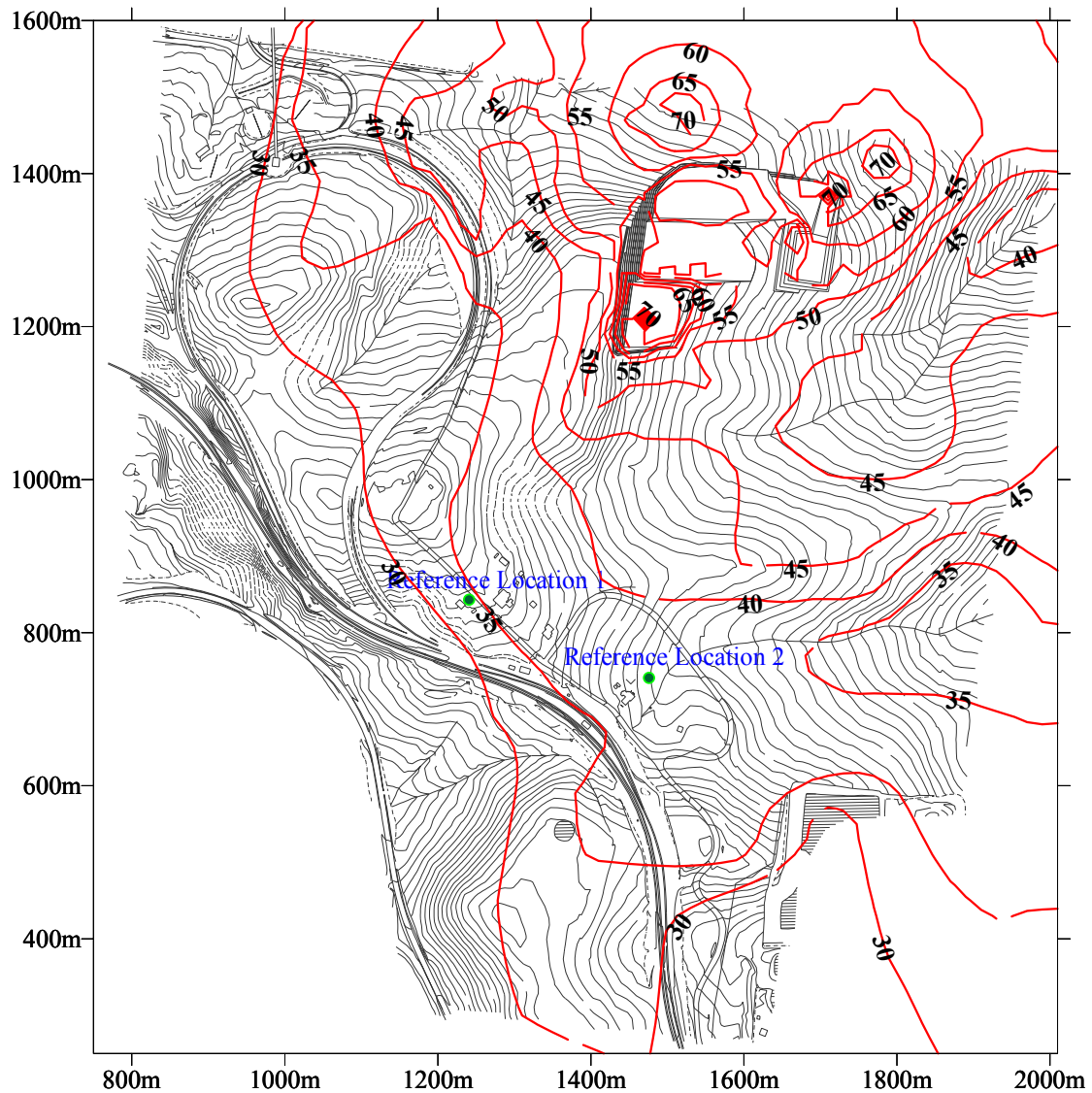
Date	Time	Temp. Out	Wind Chill	Hi Temp	Low Temp	Wind Speed (m/s)			Rain	Bar	Hum In
		C°	C°	C°	C°	Avg	Hi	Dir	mm	mB	%
4/17/00	3:15p	15.1	15.1	15.3	14.9	1.3	2.2	SSE	0	893.1	63
4/17/00	3:30p	15.2	15.2	15.5	15	0.9	2.2	SSE	0	893.1	63
4/17/00	3:45p	15.2	15.2	15.3	15.1	0.9	1.8	S	0	893.2	63
4/17/00	4:00p	14.8	14.8	15.1	14.6	0.9	2.2	S	0	893.3	63
4/17/00	4:15p	14.6	14.6	14.7	14.4	0.9	1.8	S	0	893.5	62
4/17/00	4:30p	14.3	14.3	14.4	14.2	0.9	1.3	S	0	893.6	62
4/17/00	4:45p	14.2	14.2	14.2	14.1	0.9	1.3	S	0	893.7	62
4/17/00	5:00p	14	14	14.1	13.9	0.9	1.8	SSW	0	893.8	62
4/17/00	5:15p	13.9	13.9	13.9	13.8	0.9	1.8	SSW	0	893.8	62
4/17/00	5:30p	13.7	13.7	13.9	13.6	0.9	1.8	SSW	0	893.9	62
4/17/00	5:45p	13.5	13.5	13.6	13.4	0.9	1.3	SSW	0	893.9	62
4/17/00	6:00p	13.1	13.1	13.4	12.9	0.9	1.3	SSW	0	894.1	62
4/17/00	6:15p	12.6	12.6	12.9	12.3	0.9	1.3	SSW	0	894.1	62
4/17/00	6:30p	11.7	11.7	12.2	11.2	0.9	1.3	SSW	0	894.3	62
4/17/00	6:45p	11	11	11.2	10.7	0.9	1.3	SSW	0	894.4	62
4/17/00	7:00p	10.4	10.4	10.7	10.2	0.4	1.3	SSW	0	894.7	62
4/17/00	7:15p	10.1	10.1	10.2	9.8	0	0.9	SSW	0	894.9	63
4/17/00	7:30p	9.6	9.6	9.8	9.4	0	0	---	0	895.1	63
4/17/00	7:45p	9.2	9.2	9.4	9	0	0	---	0	895.4	63
4/17/00	8:00p	8.8	8.8	9	8.4	0	0.9	SSW	0	895.4	64
4/17/00	8:15p	8.4	8.4	8.5	8.3	0	0	---	0	895.7	64
4/17/00	8:30p	8.6	8.6	8.7	8.5	0	0	---	0	895.9	65
4/17/00	8:45p	8.4	8.4	8.6	8.4	0	0	---	0	895.9	66
4/17/00	9:00p	8.3	8.3	8.4	8.2	0	0	---	0	896	67
4/17/00	9:15p	8.1	8.1	8.2	8	0	0	---	0	896	67
4/17/00	9:30p	8.1	8.1	8.2	8.1	0	0	---	0	896.1	67
4/17/00	9:45p	8.1	8.1	8.1	8	0	0	---	0	896.5	68
4/17/00	10:00p	8.3	8.3	8.4	8.1	0	0	---	0	896.5	68
4/17/00	10:15p	8.3	8.3	8.4	8.2	0	0	---	0	896.7	68
4/17/00	10:30p	8.2	8.2	8.2	8.1	0	0	---	0	896.8	68
4/17/00	10:45p	7.9	7.9	8.1	7.8	0	0	---	0	896.8	68
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4/18/00	12:30a	7.2	7.2	7.3	7.2	0	0	---	0	896.8	71
4/18/00	12:45a	7.1	7.1	7.2	6.9	0	0	---	0	896.8	71
4/18/00	1:00a	6.9	6.9	6.9	6.8	0	0	---	0	896.8	71
4/18/00	1:15a	6.7	6.7	6.8	6.7	0	0	---	0	896.8	72
4/18/00	1:30a	6.8	6.8	6.9	6.8	0	0	---	0	896.9	72
4/18/00	1:45a	6.9	6.9	7	6.9	0	0	---	0	896.8	72
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4/18/00	3:00a	6.8	6.8	6.8	6.8	0	0	---	0	896.3	73
4/18/00	3:15a	6.6	6.6	6.8	6.4	0	0	---	0	896.2	73
4/18/00	3:30a	6.2	6.2	6.4	6	0	0	---	0	896.4	73
4/18/00	3:45a	6	6	6.1	5.9	0	0	---	0	896.3	73
4/18/00	4:00a	6.1	6.1	6.2	6.1	0	0	---	0	896.3	73
4/18/00	4:15a	6.4	6.4	6.6	6.3	0	0	---	0	896.2	74
4/18/00	4:30a	6.7	6.7	6.9	6.6	0	0	---	0	896.2	75
4/18/00	4:45a	7.1	7.1	7.3	6.9	0	0	---	0	896.4	75
4/18/00	5:00a	7.3	7.3	7.5	7.3	0	0	---	0	896.3	75
4/18/00	5:15a	7.4	7.4	7.5	7.4	0.4	1.8	SSW	0	896.3	75
4/18/00	5:30a	7.3	7.3	7.3	7.2	1.3	1.3	SSW	0	896.1	75

Date	Time	Temp. Out	Wind Chill	Hi Temp	Low Temp	Wind Speed (m/s)			Rain	Bar	Hum In
		C°	C°	C°	C°	Avg	Hi	Dir	mm	mB	%
4/18/00	5:45a	7.3	7.3	7.3	7.2	1.3	1.8	SSW	0	896.3	75
4/18/00	6:00a	7.4	7.4	7.6	7.3	1.3	1.8	SSW	0	896.3	75
4/18/00	6:15a	7.6	7.6	7.6	7.5	1.3	1.8	SSW	0	896.3	75
4/18/00	6:30a	7.4	7.4	7.5	7.3	1.3	1.8	SSW	0	896.4	75
4/18/00	6:45a	7.6	7.6	7.6	7.4	1.3	1.8	SSW	0	896.4	75
4/18/00	7:00a	7.6	7.6	7.7	7.5	1.3	1.8	SSW	0	896.5	75
4/18/00	7:15a	7.7	7.7	7.7	7.6	1.3	1.3	SSW	0	896.5	75
4/18/00	7:30a	7.7	7.7	7.7	7.6	0.9	1.3	SSW	0	896.6	75
4/18/00	7:45a	7.7	7.7	7.7	7.7	0.4	0.9	SSW	0	896.6	75
4/18/00	8:00a	7.9	7.9	8.1	7.7	0.4	0.9	SSW	0	896.9	75
4/18/00	8:15a	8.2	8.2	8.3	8	0.4	0.9	SSW	0	897	76
4/18/00	8:30a	8.4	8.4	8.4	8.3	0.4	0.9	SSW	0	897.1	76
4/18/00	8:45a	8.5	8.5	8.7	8.4	0.9	1.3	SSW	0	897.3	76
4/18/00	9:00a	8.8	8.8	8.9	8.7	0.9	1.3	SSW	0	897.4	76
4/18/00	9:15a	8.9	8.9	9.7	8.7	0.9	1.8	SSW	0	897.5	76
4/18/00	9:30a	9.6	9.6	10.1	9.5	0.9	1.8	SSW	0	897.6	77
4/18/00	9:45a	10.6	10.6	11.1	10.1	0.9	1.3	SSW	0	897.4	78
4/18/00	10:00a	10.5	10.5	10.9	10.3	0.4	1.3	S	0	897.3	77
4/18/00	10:15a	11.5	11.5	12.1	10.9	0.4	1.8	S	0	897.2	77
4/18/00	10:30a	11	11	11.4	10.6	0.9	1.8	SSW	0	897.1	76
4/18/00	10:45a	10.9	10.9	11.1	10.6	0.4	1.8	SSW	0	897	74

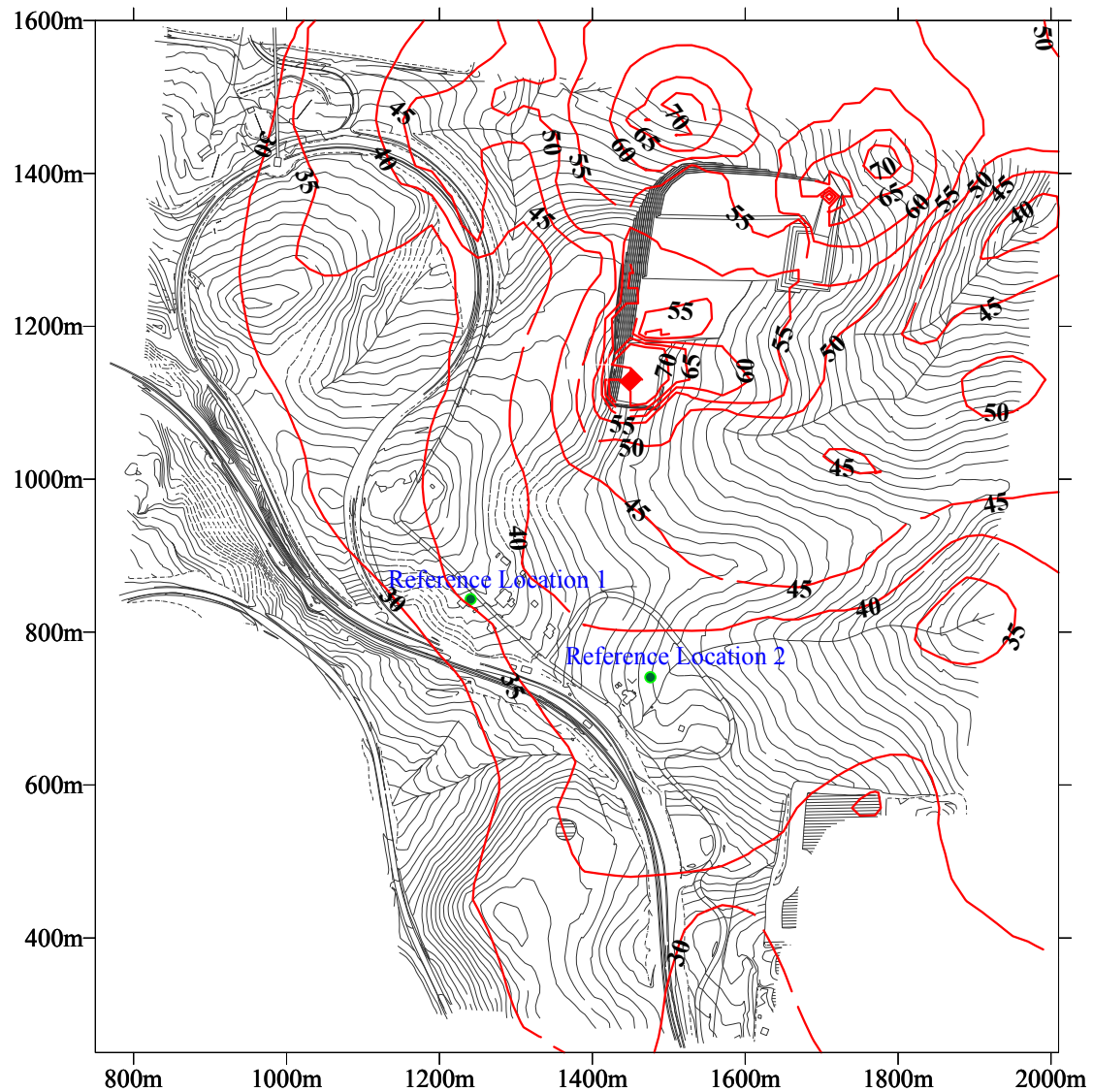
APPENDIX 3: STAGE 1 - NOISE CONTOUR PLOT - EXTRACTION (CALM)



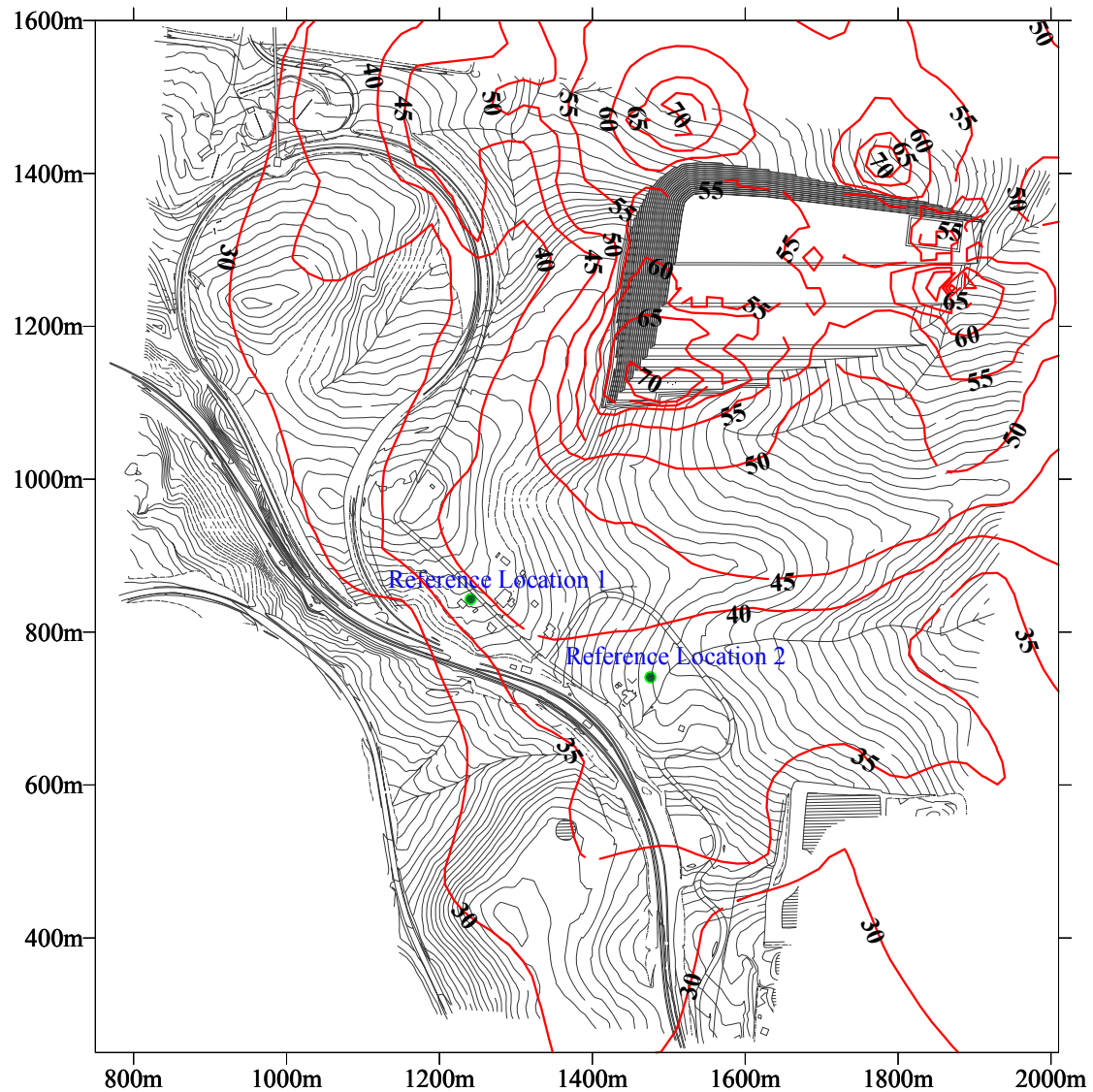
APPENDIX 4: STAGE 2 - NOISE CONTOUR PLOT - EXTRACTION (CALM)



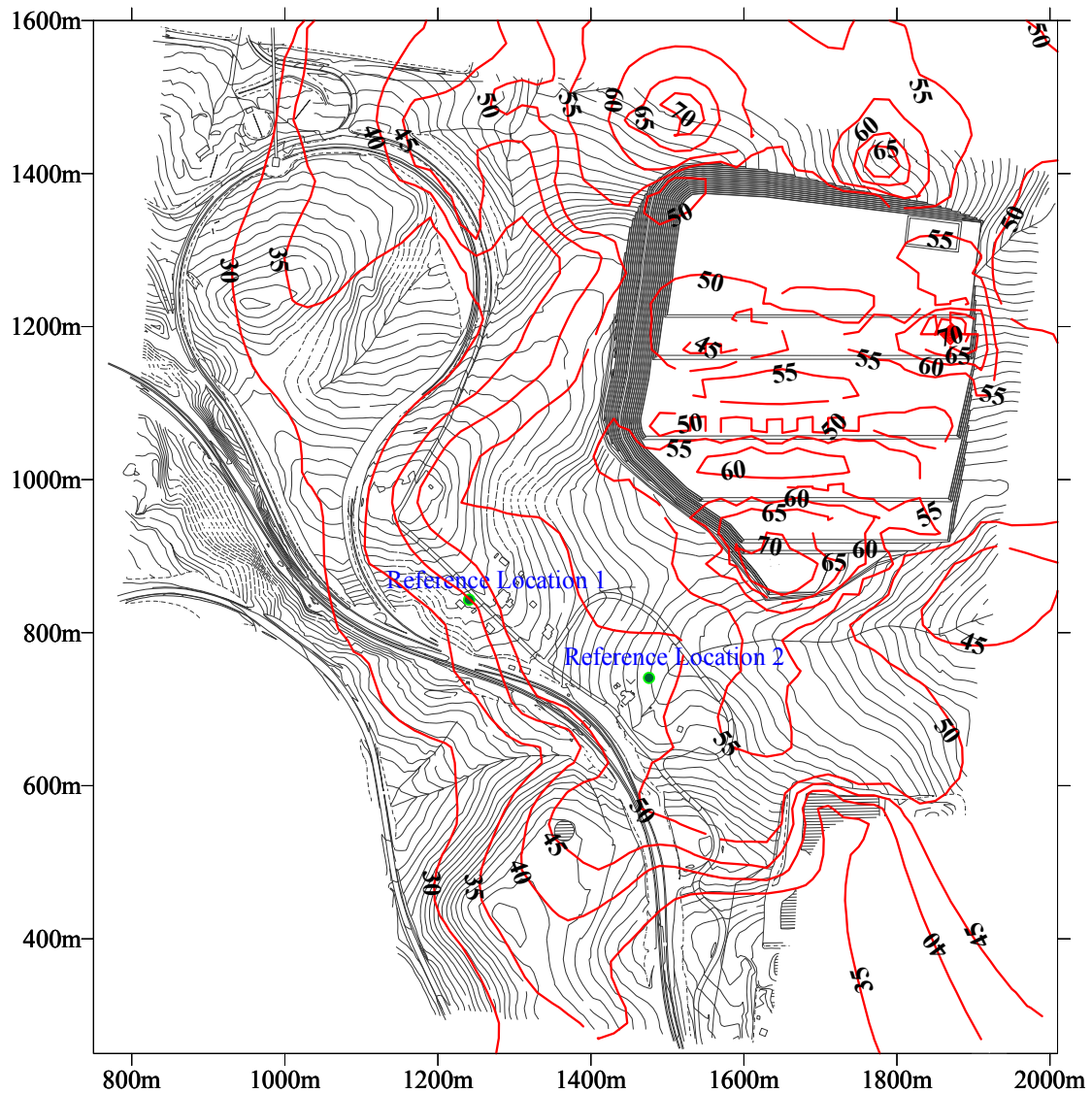
APPENDIX 5: STAGE 3 - NOISE CONTOUR PLOT - EXTRACTION (CALM)



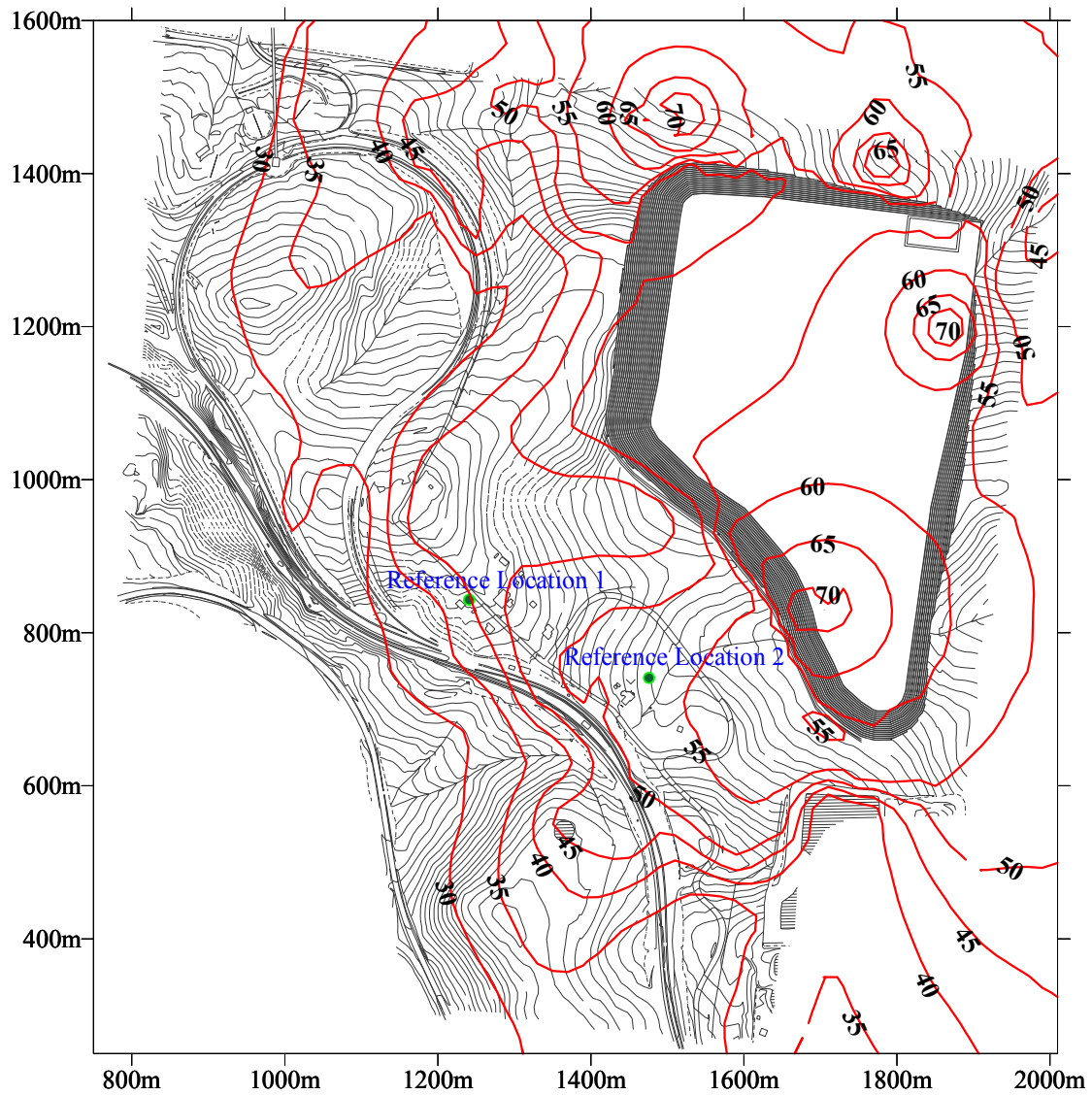
APPENDIX 6: STAGE 4 - NOISE CONTOUR PLOT - EXTRACTION (CALM)



APPENDIX 7: STAGE 5 - NOISE CONTOUR PLOT - EXTRACTION (CALM)



APPENDIX 8: STAGE 6 - NOISE CONTOUR PLOT - EXTRACTION (CALM)



Appendix H – Hydrogeological Assessment

**HYDROGEOLOGICAL ASSESSMENT OF PROPOSED
NEWNES JUNCTION KAOLIN PIT**

Dr F Kalf
Kalf and Associates Pty Ltd
January 2002

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1 BACKGROUND

1.1 General

Newnes Kaolin Pty Ltd is proposing to mine both sand and kaolin from a proposed pit at Newnes Junction, east of Lithgow. The proposed pit will be excavated over a 20-year period to RL of 993m. The kaolin material will be separated out from the crushed friable sandstone strata.

The proposed pit site area (Figures 1-1 and 2-1) lies within hilly topography just north of the existing Rocla Quarry, which has been mining similar material since the late 70's.

This report outlines the hydrogeology of the site and makes an assessment of the potential hydraulic and water quality impacts of the proposed pit on the surrounding groundwater system.

1.2 Report Objectives

The specific objectives of this report are to:

- 1 Review the regional hydrogeology of the site, existing bore and water quality data and hydrogeological conditions in the adjacent Rocla Quarry.
- 2 Determine the potential hydraulic impacts using simplified but rigorous numerical modelling techniques.
- 3 Indicate possible post mining conditions and mitigation measures, if any, that could be implemented at the site to reduce impacts to a minimum.

2 HYDROGEOLOGY

2.1 Rainfall

Daily rainfall analysis from Lithgow records since 1890 to 2000 indicates an average annual rainfall of 816mm. The mean rainfall from the Newnes Forest Centre is 1072mm, no doubt higher due to orographic effects.

At Lithgow average monthly rainfall is highest during the months June to August inclusive, and lowest during February. Average monthly rainfall for the two stations is given in Table 2-1 and 2-2 below.

Table 2-1

Average Monthly Rainfall - Lithgow

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
58.7	40.4	59.5	60.3	72.3	84.7	85.9	85.7	73.2	79.3	60.0	55.9

Table 2-2

Average Monthly Rainfall – Lithgow (Newnes Forest Centre)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
121.	114.	103.	79.	80.7	83.0	68.3	83.5	67.9	91.5	89.0	90.9

2.2 Topography, Drainage and Groundwater Flow System

The topography in the area is hilly. The proposed site lies inside of and along the western boundary of the Wollangambe River catchment. Within the proposed mining area the drainage is towards the east to north-east. Further west, beyond the Old Bells Line road that lies on the surface water divide, the drainage direction is to the south within the Dargans Creek catchment with elevations from about 1040m RL to 1000m RL south west of the proposed pit.

The drainage gullies in the upper part of the Wollangambie River catchment across the site are largely ephemeral with some seepages evident at lower elevations.

The proposed site area has an elevation at its centre of about 1030m RL. Along the eastern boundary the eastern corner of the site area has an elevation of about 1000m RL within a minor drainage gully that crosses the north-eastern corner of the block. The topography rises further south to about 1040m RL, and then falls away again to about 1020m RL within an easterly drainage gully. Average elevation along the western boundary is more uniform at about 1040m RL.

2.3 Geology

The mining area lies within the Triassic Narrabeen Group sandstone, shale, which is in turn underlain by the Permian Illawarra Coal Measures, comprised of coal, sandstone, shale and tuff. A representative lithological section of the entire geological layered sequence is given in the bore log of the Newnes Junction coal investigation bore sunk in the late 19 century (Figure 2-1a,b). The surface elevation of this bore, based on topographic map interpolation is at about 950m RL. The upper part of the Triassic sequence at the proposed mining site (based on exposures in the adjacent Rocla quarry) and interpolated from the bore log comprises largely a coarse grained friable sandstone with some ironstone bands. The matrix of the sandstone consists mainly of kaolin and it is this material that will be separated into product as part of the mining process.

2.4 Groundwater Distribution and Flow System

Groundwater occurs in both primary and secondary structures in the Triassic sandstone and is supplied entirely by infiltration and recharge to a shallow groundwater system in the upper sandstone. This aquifer system is distinct

from additional much deeper aquifer zones beyond 100 metres and 200m or more within the coal measure strata.

At Clarence Village some kilometres to the south-west (Figure 1-1) from the proposed pit standing water levels in shallow aquifer system are in the range 12m to 64m from ground surface. Topographic surface elevations in this area are in the range 1080m to 1140m RL.

Depth to the potentiometric surface over the site area could be expected to be at a depth from ground surface in the range less than 2m to 25m. The adjacent Rocla Quarry has no doubt influenced the water table depths to some extent in the southern part of the proposed pit site area due to drawdown effects over time. The depths to water table given above however are consistent with the emergence of seepages in the lower lying sections of the drainage gullies that cross the western boundary.

The current pre-mining inferred regional groundwater flow directions, which will be largely controlled by topography across the area, and the existing Rocla quarry in accordance with well-known hydrogeological principles, are shown in Figure 2-1. In summary, the predominate groundwater flow occurs in an easterly to north-easterly direction with some groundwater flow being re-directed towards the Rocla Sand Quarry. Beyond the main western railway line groundwater would flow in a general south-westerly direction towards Dargans Creek.

2.5 Groundwater Quality

Generally the groundwater quality from the shallow groundwater system in the area is known to have low to moderate salinity. The groundwater currently being extracted from the Clarence Village bores and the Rocla Quarry would be similar to that which could be expected from groundwater inflow in the new pit. This is so since all sites lie at a depth that is within the sandstone shallow groundwater flow system in the area.

No detailed analyses are at hand from bores in the Clarence Village although water quality is reported in the bore records to be “good” in one case and in the range 0 to 500mg/L in another (i.e. low salinity). Available groundwater results are shown below in Table 2-3 as supplied by International Environmental Consultants. The analysis shows ponded groundwater with low salinity and a salinity of 1350mg/L from sampled fresh groundwater seepage.

Table 2 - 3
Groundwater Analysis Report 19/6/00

Sample Details	Ponded Groundwater - 6/6/00	Ponded Groundwater - 6/6/00	Fresh Groundwater 6/6/00
to pH 3.7 (as CaCO₃) mg/l	<1	<1	<1
to pH 8.3 (as CaCO₃) mg/l	<1	4	20
ALKALINITY			
CO₃ (as CaCO₃) mg/l	4	<1	<1
HCO₃ (as CaCO₃) mg/l	17	6	6
OH (as CaCO₃) mg/l	<1	<1	<1
Calcium mg/l	5.0	1.9	1.9
Chloride mg/l	11.0	11.0	10.0
Specific Conductance uS/cm	60	30	35
Iron (filterable) mg/l	<0.05	<0.05	<0.05
Potassium mg/l	1.5	1.4	0.9
Langelier Saturation	-0.4	-5.3	-6.0
Magnesium mg/l	0.7	0.4	1.1
Manganese mg/l	0.11	0.09	0.06
Sodium mg/l	9.0	3.7	5.4
pH	9.2	5.3	4.6
Total Sulfur as SO₄ mg/l	3.6	1.8	8.7
Total Dissolved Solids mg/l	40	20	20
Total Hardness (as CaCO₃) mg/l	15.5	6.6	9.2
Total Suspended Solids mg/l	10	27	1350

Data supplied by International Environmental Consultants Pty Ltd.

3 ASSESSMENT OF HYDROGEOLOGICAL IMPACTS

3.1 Proposed Pit Development

The mining operation at the new pit is currently planned over a 20-year period. At the end of this period the pit floor would be at an elevation of 993m RL¹. During excavation the local watertable within the sandstone will be intersected, and as the pit is deepened groundwater will flow towards the mined out voids. Based on existing data the total drawdown in the pit from the initial watertable level is likely to be in the range 15m to 25m. As groundwater flows into the pit the watertable will be lowered progressively around the periphery of the pit. The drawdown will migrate outwards from the pit until it reaches an equilibrium (i.e. steady state). This will occur when rainfall recharge into the sandstone strata, within the created cone of drawdown depression, balances the inflow to the pit. Once equilibrium conditions are established further migration of the watertable drawdown will not occur once the final pit depth has been achieved.

The creation of a drawdown zone of influence will cause groundwater flow directions to be directed towards the pit. Outside of this zone of influence the groundwater flow directions will remain unaffected and unchanged from the pre-mining flow directions.

3.2 Model Simulated Impact

Drawdown Influence

A numerical groundwater model was set up to determine the extent of the hydraulic influence of the proposed pit on the local groundwater system and to long term inflow to the pit. The details and results of the analysis are given in Appendix A.

In summary, simulations were conducted to determine maximum drawdown effects by running the model to steady state conditions using a range of

parameters determined from the bore data at the Clarence Village and based on experience in similar hydrogeological environments. The simulation included the combined impact of both the proposed pit and the adjacent Rocla Quarry.

The drawdown results shown in Appendix A will lead to changing groundwater flow directions as shown in Figure 3-1. The results indicate also that the pit will not have any hydraulic effect on the groundwater system within the Clarence Village because it would lie outside the pit drawdown zone of influence.

Any significant drawdown influence will be restricted to within about 500m or so from the pit under maximum development. Ultimate steady state conditions will be reached within a year or so once the 20-year pit floor depth has been achieved. Note however that the drawdowns shown in the simulations are the maximum and will develop slowly to such levels over time as the mining progresses.

Drawdowns around the periphery of the pit will not affect vegetation since these species rely largely on soil moisture conditions. This is verified by the sound condition of tree species evident in the areas surrounding the existing Rocla Quarry where drawdown conditions occur.

The drawdown influence on the tributary streamflow will also be small. Some baseflow and surface water seepage will be lost to the easterly drainage gullies, but the volume would not be measurable in the lower reaches of the main draining tributaries. Any change would be well within the variations created by climatic variations.

Pit Inflow

Final pit inflow will average at about 0.2Ml/day, but the major proportion of this will be lost in evaporation from the high walls of the pit and storages

¹ Data supplied by IEC May 2001

within the floor of the pit. Note that no groundwater would exit from the pit during active mining operations since the watertable gradient will be directed toward the pit.

3.3 Post Mining

Once mining ceases the mined out pits will fill with both ground and rainfall and rainfall runoff. Filling will occur until a new equilibrium is established between the ponded water depth, evaporation and natural groundwater seepage. It would be expected that a new lake system would be finally established as regrowth occurs and natural seepage of good quality water re-enters the catchment area.

4 CONCLUSIONS

1. The proposed pit will be excavated within the upper sandstone formation. The 20-year pit floor is likely to be some 15m to 20m below the current water table. For the purposes of the assessment a conservative 30m drawdown at the pit has been assumed.
2. Numerical model analysis based on the most likely aquifer parameters and conservative steady-state drawdown simulation indicate a long-term drawdown which will not extend more than 500m or so from the high wall. Long-term pit groundwater inflows should be about 0.2 ML/day. However a major proportion of this inflow will evaporate from the high walls and within the pit floor and storages. During the latter stages of mining it is possible that water collected within the pit, should it become excessive, could be transferred to decommissioned storages within the Rocla Quarry.
3. The current Rocla quarry to the south established in the 70's indicates that watertable drawdown around the pit has not influenced vegetation species surrounding the pit as these plants rely mainly on soil moisture conditions. The drawdown has also not caused any demonstrated measurable influence in the surrounding area.
4. The pit construction will not measurably influence surface runoff and baseflow in the Wollangambe River system because of the relatively small area of the total catchment affected. Seepage from the area will in time be re-established to the catchment.
5. Water quality in any storages within the pit will be controlled largely by the incident rainfall and should be of good quality as evidenced by the water quality of the current Rocla quarry storages.

6. Post mining water storages within the proposed pit should fill to become artificial lakes with good quality water and will, in time, re-establish equilibrium conditions with the surrounding groundwater system.

5 CONSIDERATIONS

At least three monitoring boreholes should be sunk in a westerly direction at increasing distances from the western boundary of the proposed pit. It would be advisable to establish these holes prior to commencement of mining at the proposed pit area. The holes could be placed at suitable locations at say 50m, 150m and 300m to 400m from the edge of the proposed western high wall. The holes should be sunk to a minimum depth of 50m and airlift tested conducted during construction. Water level recovery measurements should be obtained during the airlift tests. The holes should be completed with 50mm slotted PVC and gravel filter and be completed as permanent observation holes with a surface concrete block and cap fitted in the usual manner.

Water samples collected during airlift operations should be analysed for the major ionic constituents to establish baseline conditions for the active and post mining period.

Water level measurements should also be conducted initially on a monthly basis in each hole over time to establish seasonal trends and then perhaps ever 3 monthly periods. This consideration is suggested not necessarily because the drawdown predicted in this report is uncertain but to have at hand the necessary data should there be any dispute about the extent of drawdown effects in the future. The result will also allow the drawdown estimates provided in this report to be verified.

6 FIGURES

- 1-1 Proposed Pit Site and Catchments
- 2-1a, b Newnes Junction Bore Log/Bore Site
- 2-2 Proposed Pit and Existing Groundwater Flow Directions
- 3-1 Active Mining Groundwater Flow Directions

APPENDIX A FIGURES

- A-1 Proposed Pit – Combined Max Steady State Drawdown Contours (m). Most likely situation $K=0.02\text{m/d}$. Recharge 8% of 1000mm annual.
- A-2 Proposed Pit – Combined Max Steady State Drawdown Contours (m). $K=0.01\text{m/d}$. Recharge 5% of 1000mm annual.
- A-3 Proposed Pit – Combined Max Steady State Drawdown Contours (m). $K=0.01\text{m/d}$. Recharge 10% of 1000mm annual.
- A-4 Proposed Pit – Combined Max Steady State Drawdown Contours (m). $K=0.04\text{m/d}$. Recharge 5% of 1000mm annual.
- A-5 Proposed Pit – Combined Max Steady State Drawdown Contours (m). $K=0.04\text{m/d}$. Recharge 10% of 1000mm annual.

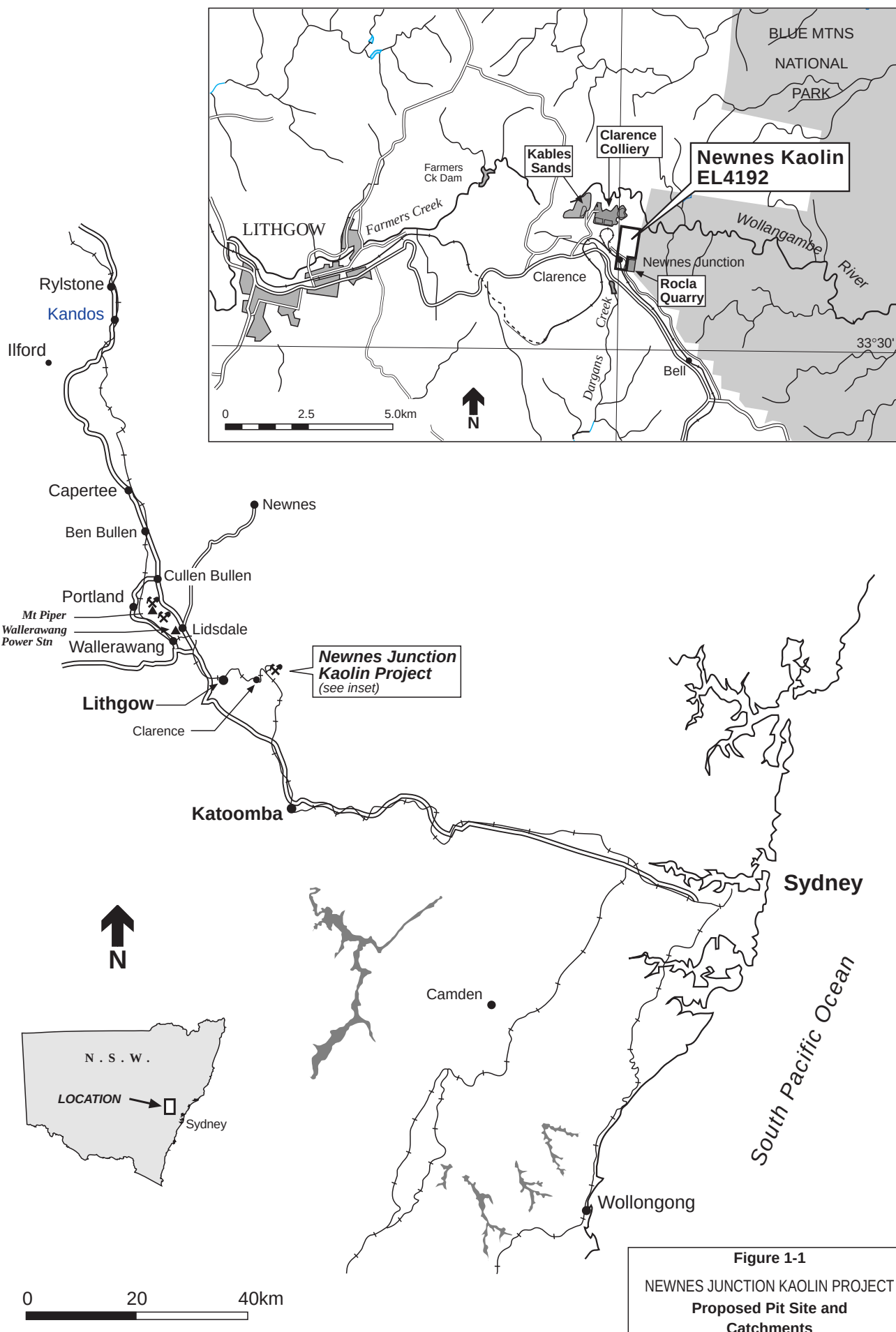
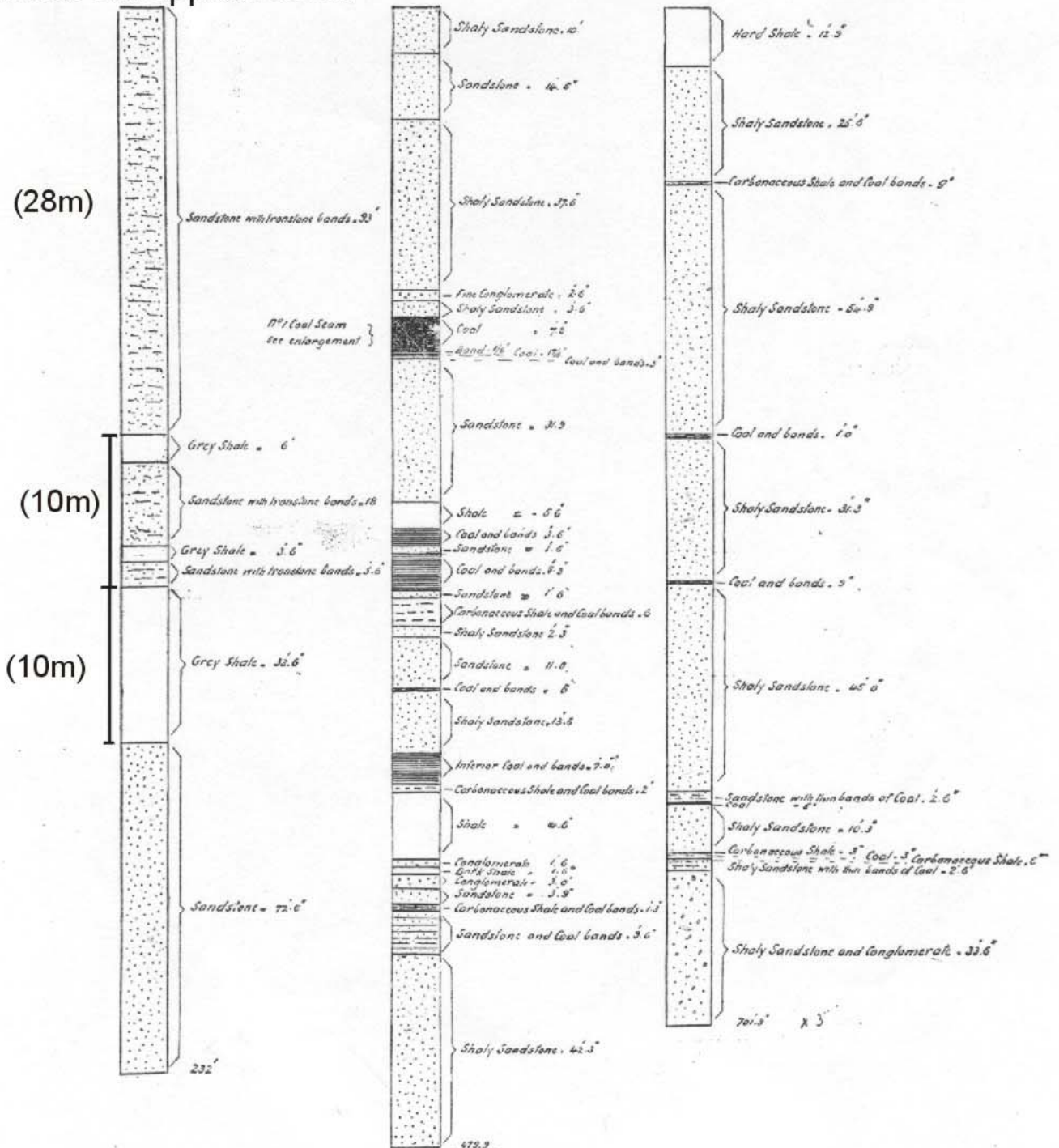


Figure 1-1
NEWNES JUNCTION KAOLIN PROJECT
Proposed Pit Site and
Catchments

NEWNES JUNCTION BORE

Surface RL approx 950m



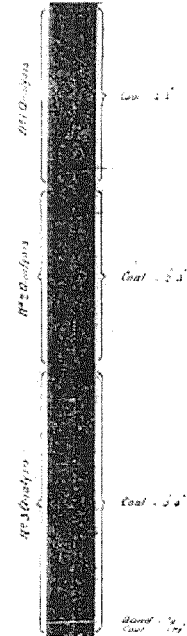
From Dept of Mines Library files.

FIGURE 2-1a
Newnes Junction
Bore Log

NEWNES JUNCTION BORE.

No. 1 Coal Seam.

No. 1 Coal Seam									
Station	Distance from Newnes Junction	Depth	Coal	Shale	Shale	Shale	Shale	Shale	Shale
0.000	0.0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Note - Shale slightly harder than coal seam.									
No. 2 Coal Seam									
0.000	0.0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Note - Shale slightly harder than coal seam.									
No. 3 Coal Seam									
0.000	0.0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Note - Shale slightly harder than coal seam.									



PLAN SHOWING POSITION OF NEWNES JUNCTION BORE, PARISH OF CLWYDDO, COUNTY OF COOK.

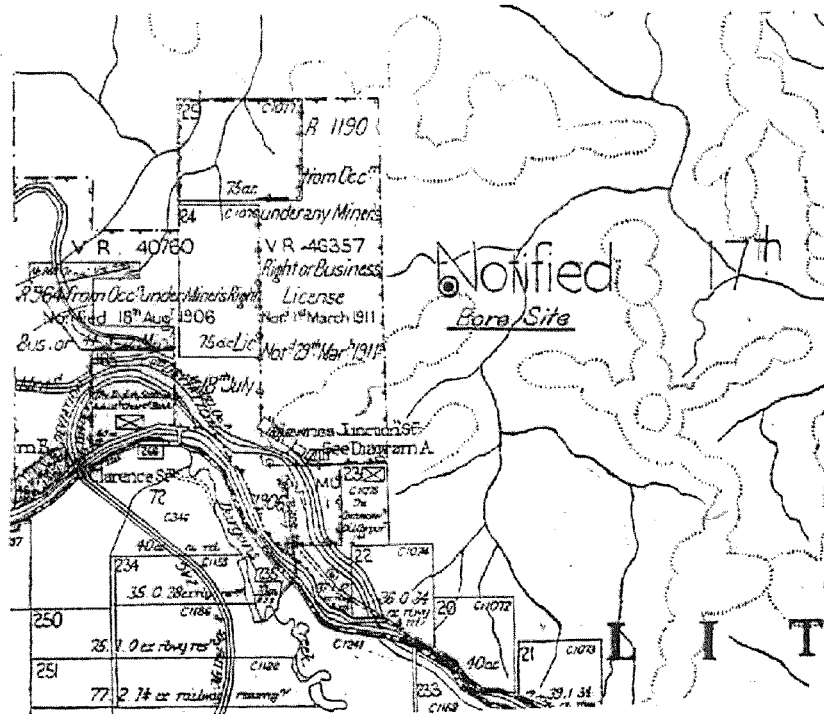
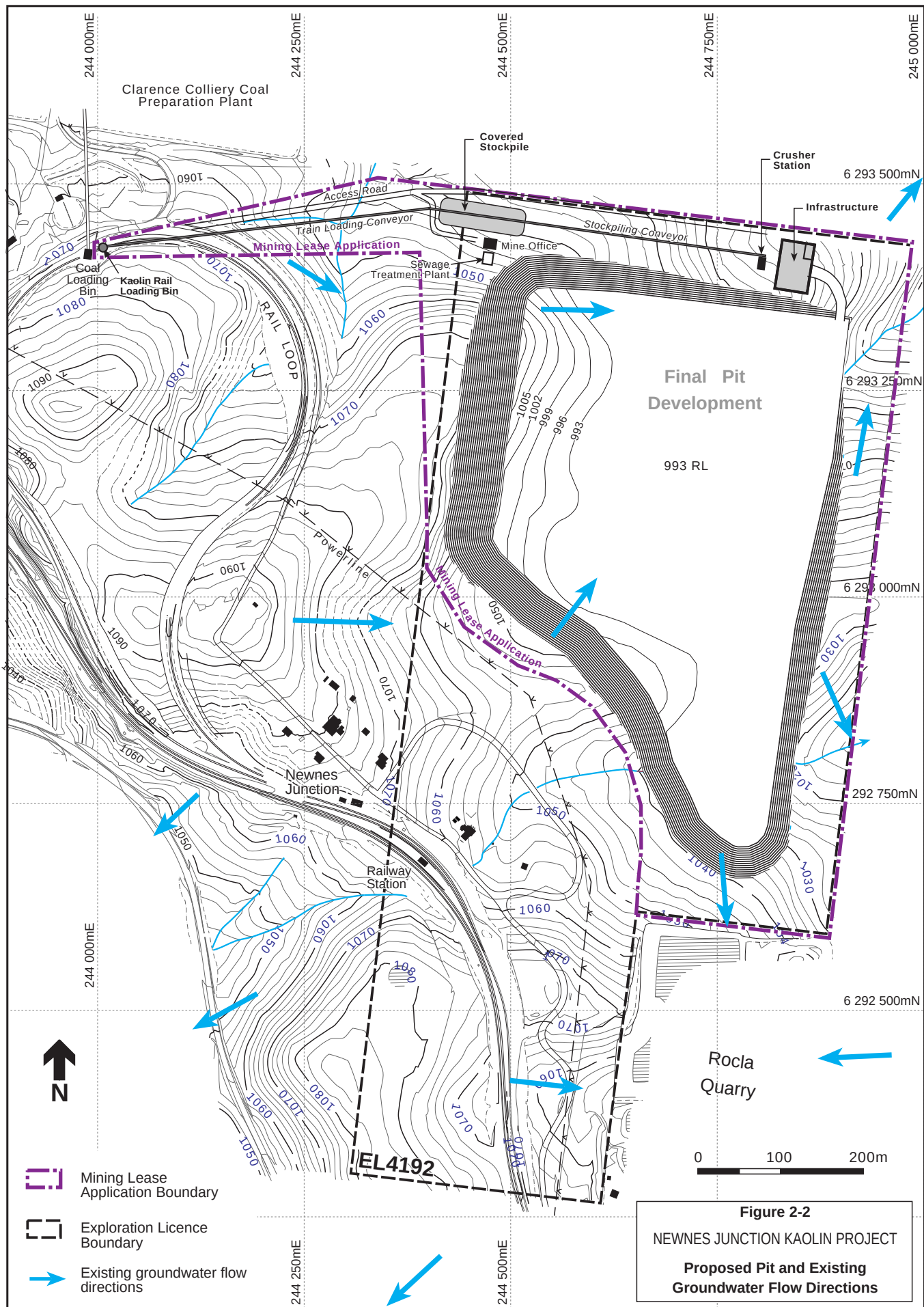


FIGURE 2-1b
Newnes Junction
Bore Site



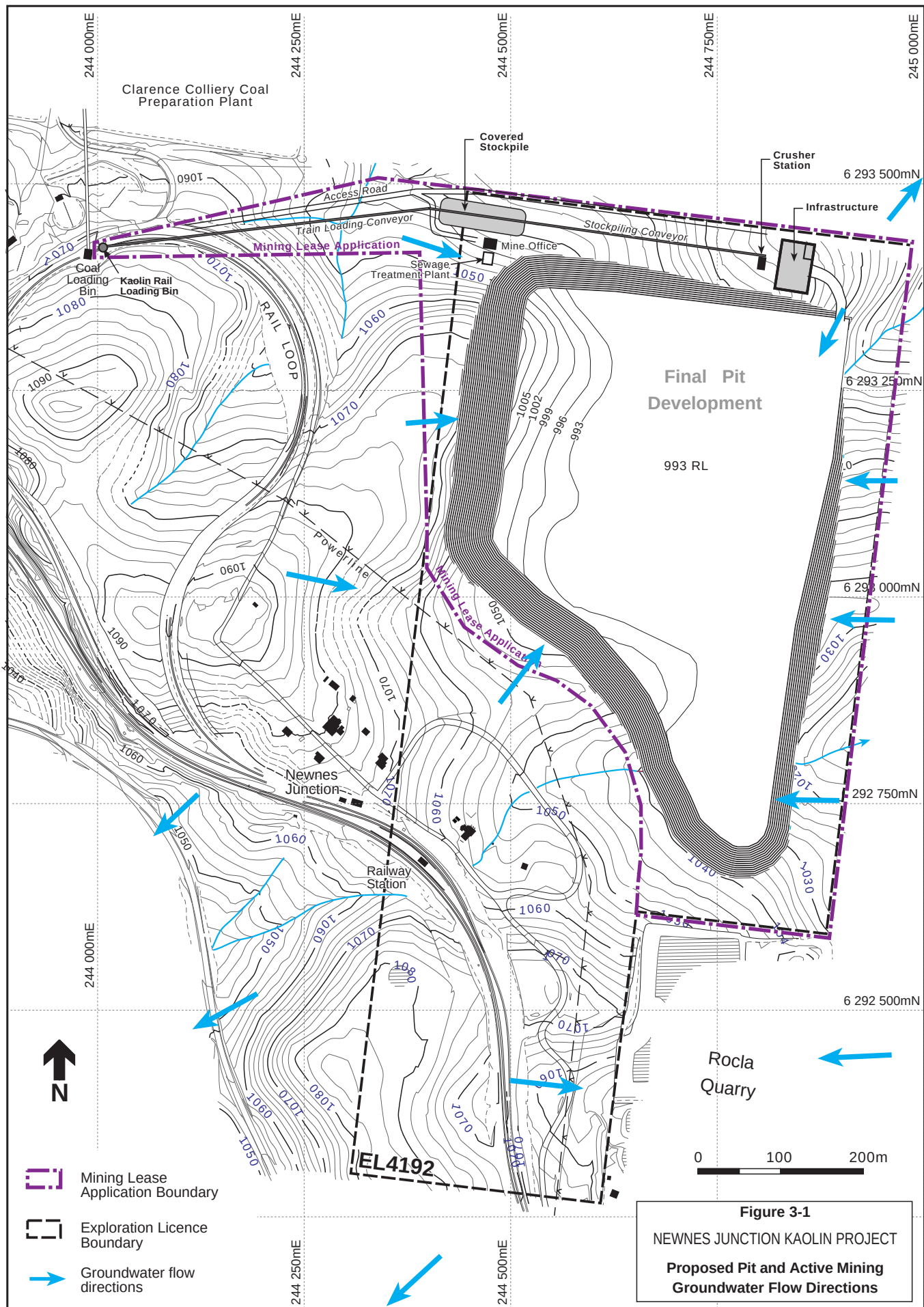


Figure 3-1
NEWNES JUNCTION KAOLIN PROJECT
Proposed Pit and Active Mining
Groundwater Flow Directions

APPENDIX A

Numerical Model Assessment of Hydraulic Effects of the Proposed Pit

Appendix A

A-1 Modelling Methodology

A simplified although rigorous numerical model was set up to determine the hydraulic influence of the proposed pit on the local groundwater system and also to determine the long term inflow to the pit. The computer code used was the internationally recognised MODFLOW-SURFACT (MS) program.

The model was set up using 100 x 100 50m square cells with no flow boundaries around the edges. Transmissivities were determined from the bore data at the Clarence village using approximate one drawdown estimates. These calculations yielded transmissivities in the range 0.5 to 3.2m²/day.

Because simulations were conducted under steady state conditions no storativity values were required. Steady state conditions are conservative because they ignore aquifer storage characteristics.

The model was run for permeabilities of 0.01m/day and 0.04m/day for an assumed saturated thickness of 80m. Average recharge for each case was assumed to be 5% and 10% of the average annual rainfall of 1000mm expressed in metres/day. The most likely situation was considered chosen to be one with a permeability of 0.02m/day and a recharge of 8%.

The surface “ponding” option was used in the MS model to prevent artificial model build up of recharge under the “no-flow” boundary condition. Under this option a flat pre-mining equilibrium watertable condition suitable for this type of simulation were set up as an initial condition.

The maximum (conservative) constant drawdown of 30m was then applied to the model pits and the model run to steady state conditions. Note that the combined effect of both the current pit and the existing Rocla quarry were included together in the simulation.

A-2 Results

The results of all simulations are shown in Figures A-1 to A-5. Note that the effect of the existing Rocla quarry south of the proposed pit has also been included in these figures.

The figures show the steady-state drawdown contours around the pit in metres. The actual water table heads created would be approximately equal to the simulated drawdown shown, superimposed on the existing long-term pre-mine watertable/potentiometric surface for the area.

Figure A-1 shows the most likely situation whilst the other figures A-2 to A-5 show the sensitivity of changing both permeability and recharge percentage. An outer 0.5m drawdown limit is shown on all diagrams, which is considered to lie within the expected accuracy of the simulation.

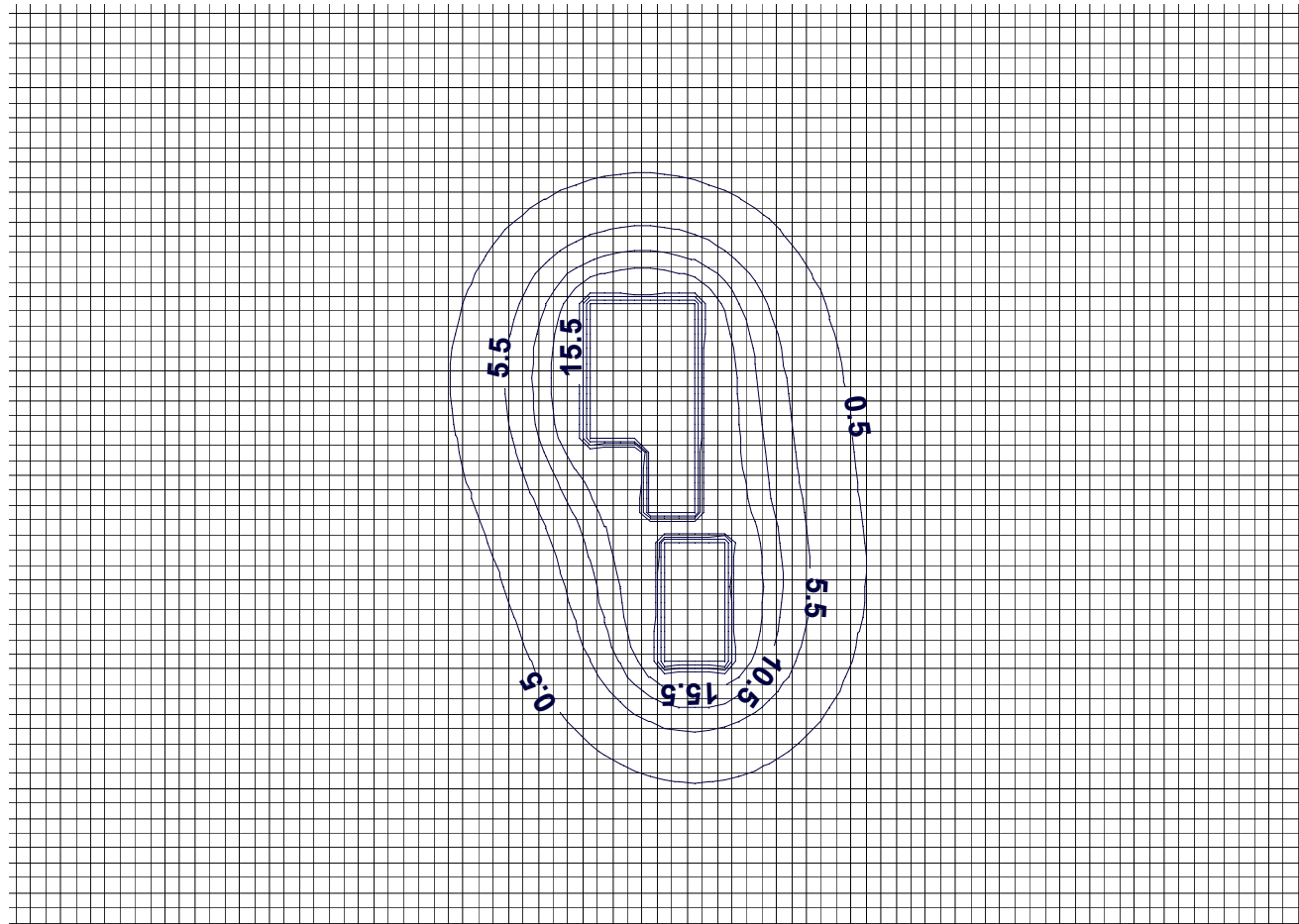


**Figure A-1 Proposed Pit – Combined Maximum Steady State Drawdown Contours (m).
Most Likely Situation. $K=0.02$ m/d. Recharge 8% of 1000mm annual.**

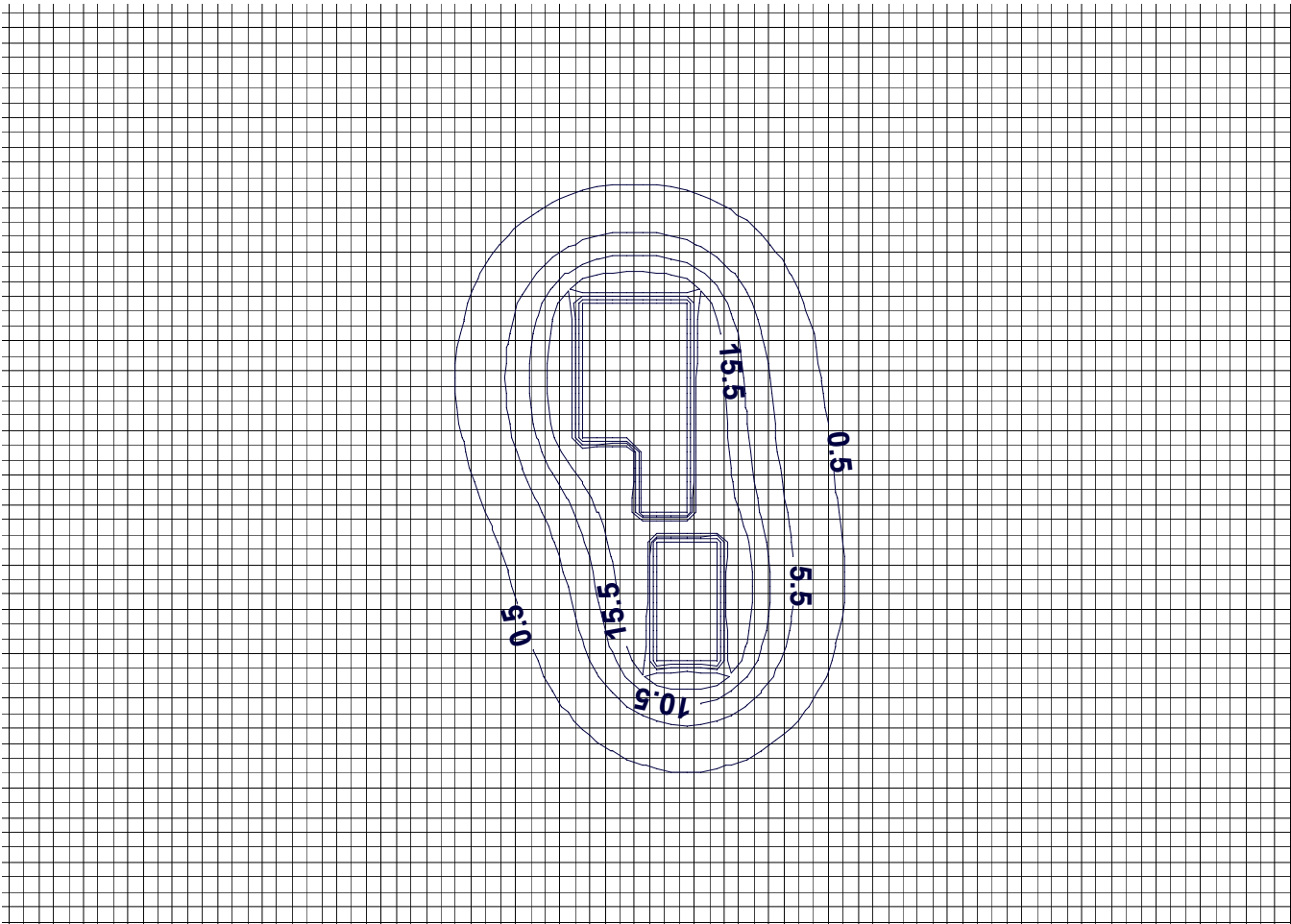


**Figure A-2 Proposed Pit – Combined Maximum Steady State Drawdown Contours (m).
K=0.01 m/d. Recharge 5% of 1000mm annual.**

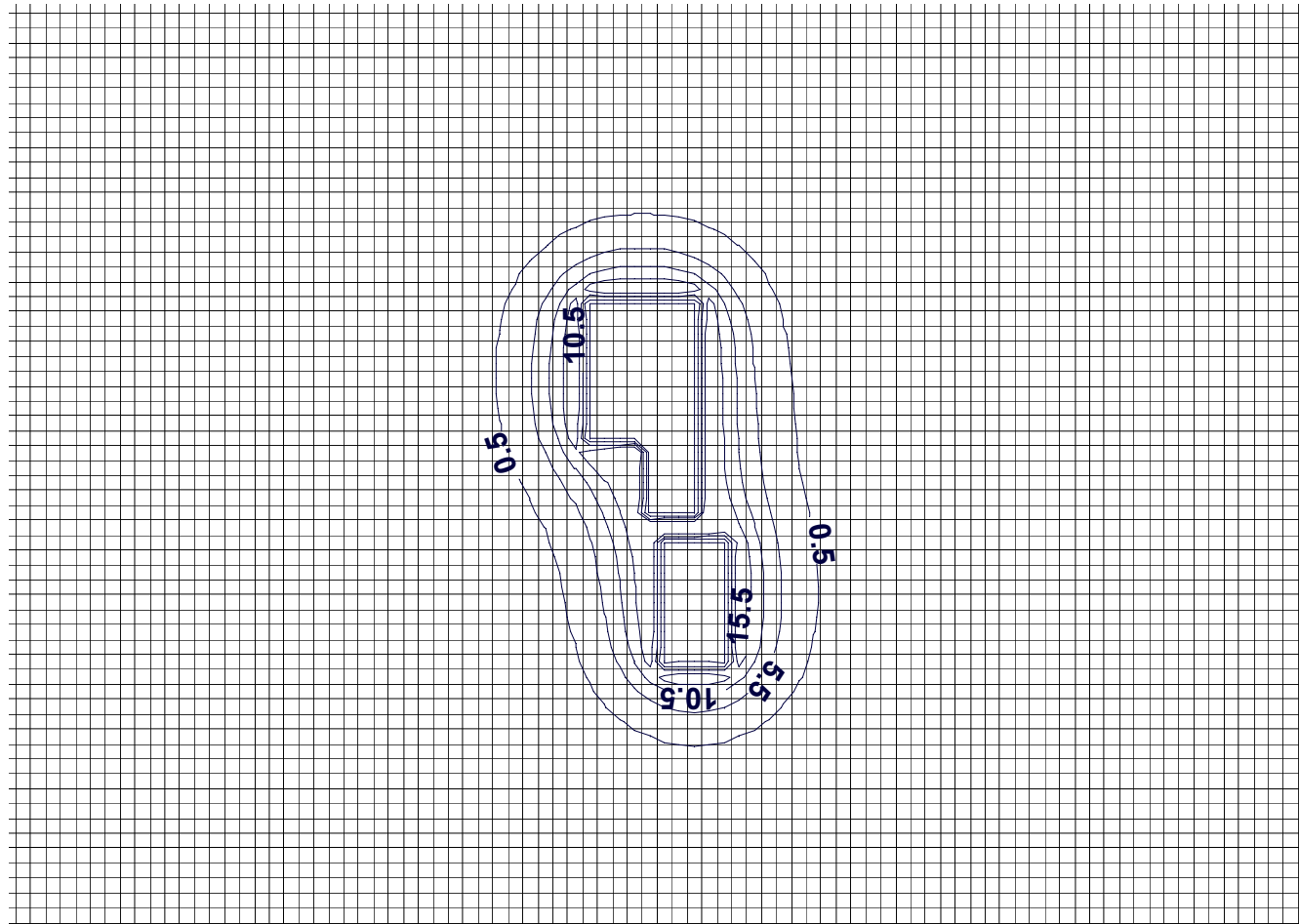


**Figure A-3 Proposed Pit – Combined Maximum Steady State Drawdown Contours (m).
K=0.01 m/d. Recharge 10% of 1000mm annual.**

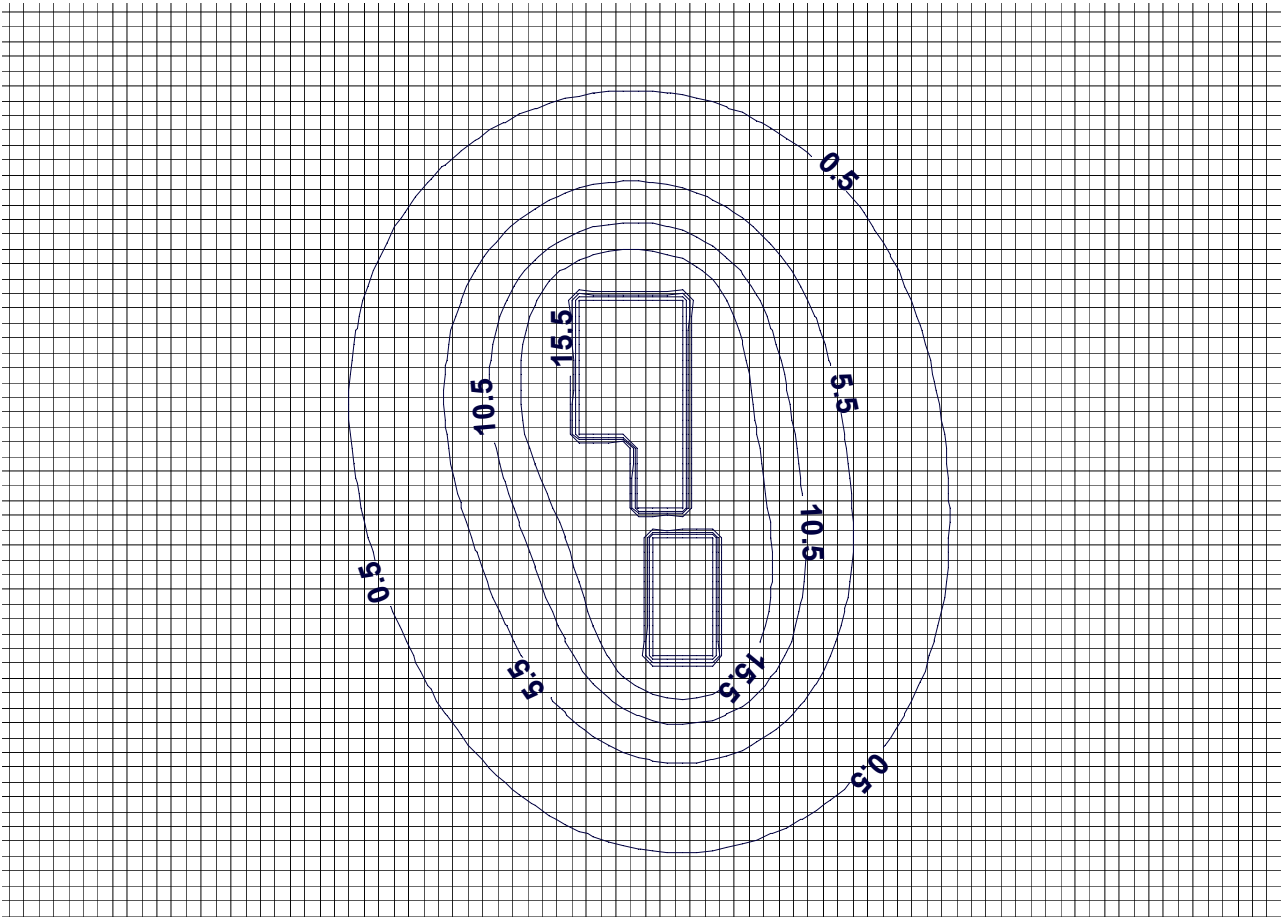


**Figure A-4 Proposed Pit – Combined Maximum Steady State Drawdown Contours (m).
K=0.04 m/d. Recharge 5% of 1000mm annual.**

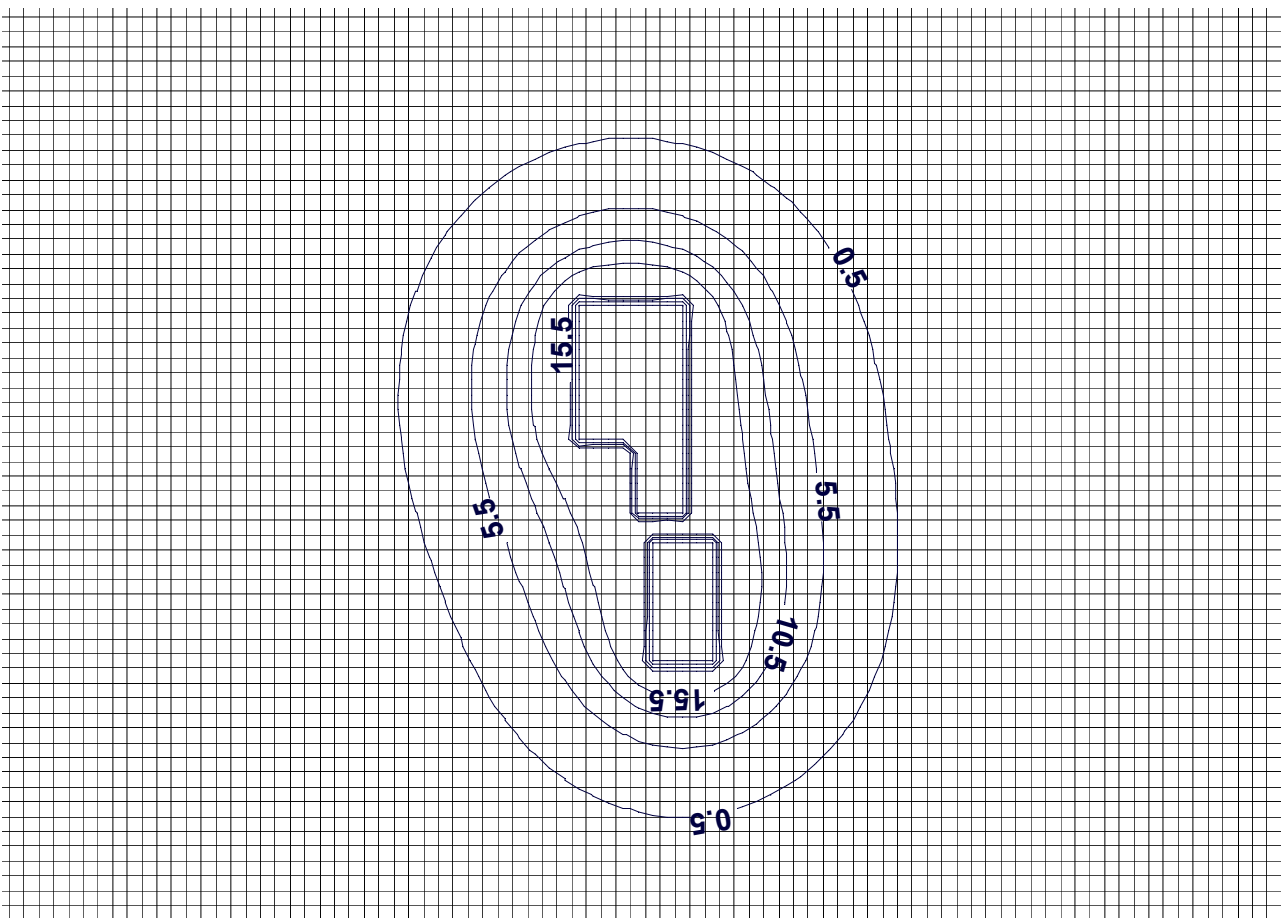


**Figure A-5 Proposed Pit – Combined Maximum Steady State Drawdown Contours (m).
K=0.04 m/d. Recharge 10% of 1000mm annual.**