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Penrith Lakes Scheme : development application 3 (DA3),  
extraction and rehabilitation programme : statement of  
environmental effects



# **PENRITH LAKES SCHEME**

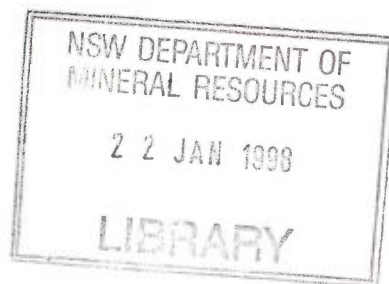
**DEVELOPMENT APPLICATION 3  
(DA3)  
EXTRACTION AND REHABILITATION  
PROGRAMME**

**Statement  
of  
Environmental Effects**

**PENRITH LAKES DEVELOPMENT CORPORATION LTD.**

# PENRITH LAKES SCHEME

## DEVELOPMENT APPLICATION 3 (DA3) EXTRACTION AND REHABILITATION PROGRAMME



## STATEMENT OF ENVIRONMENTAL EFFECTS

PREPARED BY: PENRITH LAKES DEVELOPMENT CORPORATION LTD.  
RMB 268  
CASTLEREAGH RD.  
PENRITH N.S.W. 2750

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## SUMMARY

### **PURPOSE OF DOCUMENT**

This document provides a description of the next stage of sand and gravel extraction proposed at Penrith Lakes and the associated rehabilitation works to be undertaken in accordance with the overall design for implementation of the Penrith Lakes Scheme. The likely environmental impacts of these actions are discussed together with proposed ameliorative measures where these are necessary. A review of previous extraction and rehabilitation activities is also presented as the environmental management techniques which have been developed to date provide the framework for the proposed management for the next stage.

### **BACKGROUND TO THE PROPOSAL**

The Penrith area has been a major source of supply of medium to coarse grained sand and gravel for the Sydney construction industry since the 1880's and today provides most of Sydney's requirements for these materials. The need to co-ordinate the extraction and rehabilitation activities on the Castlereagh floodplain led to the development of the Penrith Lakes Scheme and the formation of the Penrith Lakes Development Corporation Limited in 1980.

The Penrith Lakes Scheme covers an area of about 2000 hectares and through comprehensive rehabilitation of quarried areas will create a major water orientated recreation resource. Commitment to this project by the New South Wales Government is evidenced by the implementation of Sydney Regional Environmental Plan No. 11 - Penrith Lakes Scheme.

### **PROGRESS TO DATE**

Since the Corporation commenced its activities, three development applications for implementation of the Scheme have been submitted and approved. The first of these (DA1) was approved prior to SREP No. 11 being implemented while the second (DA2) and third (DA Rowing Lake) were approved under SREP No. 11

The total area of land approved for sand and gravel extraction under these applications and previous consents issued to individual companies prior to the formation of the Corporation, represents approximately 40% of the total Scheme area. Over 65 million tonnes of sand and gravel have been extracted from the Scheme area since 1980. Rehabilitation has been undertaken in accordance with approved plans and specifications. The Rowing Lake complex, which is comprised of about 100 hectares of open space recreation land and about 80 hectares of lake, is nearing completion and is scheduled to be dedicated to the Minister for Planning in June 1995.

Environmental impacts of extraction and rehabilitation activities have been monitored and are within relevant acceptable limits. The Corporation's activities are regularly monitored by the Penrith Lakes Scheme Monitoring Committee, established by the Minister for Planning to ensure compliance with conditions of consent.

## **THE NEED FOR FURTHER DEVELOPMENT CONSENTS**

The need for the approval of this development application (DA3) is influenced directly by the continued demand for sand and gravel by the construction industry in the Sydney metropolitan area, the importance of the Penrith Lakes resources in meeting this demand, and the additional economic and environmental costs and ability of alternative sources to meet the estimated demand.

The importance of the Penrith Lakes deposit in the overall regional strategy for extractive industries is highlighted in Sydney Regional Environmental Plan No. 9 and Draft SREP No. 9(2). Within a short-term period covered by this development application the Penrith Lakes deposit will be called upon to supply about 5 million tonnes per annum of medium to coarse grained sand and gravel.

If this approval is not granted or there is a delay in granting approval for the extraction planned in DA3, there would be a number of serious economic and environmental consequences. Such consequences would include a combination of increases in the cost of pre-mixed concrete, increased pressure to develop more environmentally sensitive deposits and significant increases in daily truck movements from alternative sources.

## **THE PROPOSED DEVELOPMENT**

The current application covers a total area of 407 hectares, of which 286 hectares of land will be new extraction and rehabilitation area, 77 hectares are associated with lands which have been extracted under previous consents and will be rehabilitated as an integral part of the DA3 extraction programme and 44 hectares are lands associated with the development which will not be quarried but may be required for Scheme development. The new area represents an orderly extension to the DA2 area, consistent with the planned sequence for the Scheme. It is estimated that the DA3 area will yield about 35 million tonnes of sand and gravel or about 7 years supply, based on current and projected levels of demand. About 14 million cubic metres of overburden will become available for rehabilitation within the DA3 area.

The selection of the proposed DA3 area is based on total volume requirements. Increasingly, the ratio of sand to gravel in the deposit is becoming a major determinant in commercial strategies which influence the rate of extraction from the Penrith Lakes deposit. The Corporation is currently investigating techniques to determine probable ratios in the remaining reserves. If successful techniques are developed and the distribution of sand and gravel ratios are determined and the DA3 resources are found to be inconsistent with demand requirements then the Corporation may submit a new development application to extract a different area to DA3 which would yield a mix of products closer to commercial demand. These investigations and possible resultant development application will not be completed for at least 2 years.

Except for small areas of crown and public lands, the Corporation owns or controls all of the land within the DA3 area. About 13 hectares of land is in crown or public ownership and the Corporation will negotiate with the appropriate authorities for the inclusion of these lands within the DA3 area.

A sequence of quarrying and rehabilitation has been formulated for the DA3 area. This sequence is consistent with both factors influencing the overall sequence for the Scheme and

factors which apply at the more detailed level of planning. It is proposed that the extraction and rehabilitation operations will be a continuation of the current operations using the same plant and equipment. It is planned to quarry the area near Cranebrook Village as quickly as possible by locating all three shareholders in one pit on the eastern side of DA3. In this manner the area can be quickly extracted and rehabilitated minimising the period which nearby residents might be inconvenienced.

All raw feed will be hauled to the crushing plants using off-highway vehicles. This application does not relate to any extension or change in operations of the crushing plants or to the on-highway transport of finished products from the crushing plants.

Insufficient overburden is available within the DA3 area to construct the rehabilitated landforms in accordance with the Structure Plan associated with SREP No. 11. Priorities were established to determine the design of landforms to be constructed during the life of DA3. Such designs are to facilitate subsequent completion of Structure Plan landforms during future development applications.

The overall water management plan for DA3 is directed toward the maintenance of levels in the Rowing Lake, provision for tailings management requirements and storage of surplus water from pit dewatering operations. Any discharges from the site will be to EPA licence requirements. A key feature of the water management plan is the diversion of Farrells Creek flows into a detention basin system constructed in the DA2 area. Under this arrangement, Farrells Creek would be the principal source of supply to the Rowing Lake, ultimately becoming a supplementary supply for the completed Scheme. There are significant environmental benefits to be realised using this arrangement.

### **STRUCTURE PLAN FOR THE DA3 AREA**

The DA3 area represents a further stage in the implementation of the Penrith Lakes Scheme and, as such, allows some elaboration of the Structure Plan for the Scheme contained in the Regional Environmental Plan. These elaborations, which do not modify the structure plan, relate to the likely disposition of recreational development and possible road access arrangements.

The likely distribution of recreational development is based on consideration of the conclusions of the Regional Environmental Study. This distribution has taken into account such factors as the need to locate recreation facilities above the 1 in 100 year flood level, proximity of land to the lake foreshore, and accessibility of land to road access and urban services.

Road access to the Scheme would be limited to six locations because of constraints which include the proposed route for the relocation of Castlereagh Road, the proposed disposition of high land and water areas, and the need to maintain the amenity of Cranebrook Village. These six access locations will enable the appropriate level of access to be provided to all components of the Scheme.

### **THE EXISTING PHYSICAL ENVIRONMENT AND IMPACT OF DEVELOPMENT**

The proposed development will have a range of environmental impacts, all of which are considered to be manageable within relevant acceptable standards.

## Noise

The existing noise environment at Penrith Lakes is due to three main contributions - the noise generated by the crushing, screening and washing plants, transportation noise, and the noise from quarrying and rehabilitation activities. Background noise levels, excluding quarrying noise, are generally constant during the daytime period at each of the six locations where measurements have been taken and are typical of a rural environment.

Noise level design criteria for quarrying activities during DA3 have been set, taking into account that there will be times when noise levels will be higher, particularly when land forming has to be carried out close to Cranebrook Village and the Castlereagh escarpment. Worst case noise levels for different stages of development during DA3 were calculated and compared with the design criteria. The decision to quarry the area near Cranebrook Village and the Castlereagh escarpment as quickly as possible requires the concentration of equipment in the area for a relatively short period of time. This concentration of equipment increases noise levels. The construction of a 5 metre bund at key locations will reduce noise levels to acceptable levels at Cranebrook Village and to a private property just north of the village. However, it is predicted that residents in elevated positions on the Castlereagh escarpment will be exposed to slightly higher noise levels for longer periods than desirable. Given that the predictions are based on worst case situations, opportunities are available to reduce noise impact by implementing several management strategies related to the quarry development. Such strategies involve the separation of equipment, alignment to receivers, strategically locating haul roads and varying extraction/stripping locations during the day. Such measures, coupled with appropriate monitoring would keep the noise levels to tolerable levels throughout the period of DA3 development. Given the social and economic benefits of the Scheme this would seem to be the best practical approach to meet Scheme objectives without seriously inconveniencing Scheme neighbours.

## Air Quality

The main air quality issue associated with the Penrith Lakes Scheme is the generation of dust principally from moving machines and to a lesser extent, by wind across areas of ungrassed land. Dust monitoring results on and around the Scheme area indicates that dust resulting from quarry and rehabilitation activities are within the bounds of acceptability established by the EPA. Episodic events caused by infrequent strong winds do cause some concern and require special dust management techniques to be implemented.

There will be dust emissions associated with the quarrying and rehabilitation activities under DA3 which will be similar in nature and extent to those associated with DA1/DA2/DA Rowing Lake activities. These emissions are predicted to cause no loss of amenity to neighbours. The episodic events will continue to be a cause for concern and successful dust management techniques employed in previous areas will continue through into DA3. These techniques will include:-

- \* watering of all working and haulage areas
- \* establishment of grasses on completed landforms as quick as possible.
- \* minimising exposed areas having regard to environmental noise management and safety issues
- \* ceasing activities during periods of high wind
- \* monitoring dust fall out levels where potential problems might occur.

## Water Management

The principal water management issues associated with the DA3 development will be essentially similar to those associated with the current activities and future development of the lakes:

- \* dewatering associated quarrying and rehabilitation areas
- \* flood management
- \* effects on surface drainage system resulting from removal of creeks
- \* water supply and quality behaviour of lakes.

These issues have been addressed as a composite arrangement involving both the DA3 area and areas under the previous consents. The primary objective is to utilise local resources to meet existing and possible future requirements. Water is required to meet the needs of wash water processes, dust control and completed lakes. To meet these requirements, Farrells Creek will be diverted into the Rowing Lake via a series of detention basins, surplus flows being stored in the completed portion of Main Recreation Lake A. This lake will be used to store water from DA3 dewatering operations and be capable of meeting Rowing Lake requirements during periods of drought. Surplus water from this system will be discharged to the Nepean River via Cranebrook Creek. Any such discharges will be in accord with EPA licence conditions. The tailings management system is based on re-cycling operations with supplementary supplies being obtained from Farrells Creek diversions. Arrangements made for the diversion of Farrells Creek defers the need to obtain supplies from the Nepean River.

The Scheme development is being undertaken on a floodplain and accordingly it can be expected to be affected by floods. Minor flooding of working areas can be controlled by constructing small bunds at key locations, without having any impact on local flooding. The diversion of Farrells Creek will assist in DA3 flood management. Major flooding will cause significant problems in operational areas, not so much from a damage aspect but from returning the system back to normal operations. Depending on the degree of flooding it might be necessary to establish emergency extraction areas outside the DA3 area to maintain continuity of supply while the operational areas are being returned to normal.

In respect to lake water quality behaviour, the Rowing Lake after its completion has the potential to develop blue-green algae blooms. Experiences with existing lakes in the Scheme area suggest that potential for algae blooms will diminish as the lake biologically matures. To this end the Corporation has already put in place procedures to accelerate the time to establish biological stability in the Rowing Lake. These procedures include:-

- \* establishment of cultivation ponds to supply stocks of aquatic plants,
- \* introducing 15000 aquatic plants into completed sections of the Rowing Lake,
- \* limiting nutrient loads entering the lakes.

## Flora and Fauna

The flora of the land covered by the proposed DA3 area is generally typical of that throughout the Scheme area, namely agricultural pasture with almost a complete absence of native plant cover. The remnant forests contained on the Castlereagh escarpment will not be affected by DA3 activities and rehabilitation works on lands adjoining the remnant forests will be complementary. The significance of the Farrells Creek wetlands has been diminished by changes in land use outside the Scheme area.

The process of quarrying will have a severe impact on both the flora and fauna of the affected lands. However, new habitat is available in the DA2 area and will be formed by the DA3 rehabilitation process. It is expected that these new habitats will be colonised quickly by both elements of the original flora and fauna.

## **THE EXISTING CULTURAL ENVIRONMENT AND IMPACT OF DEVELOPMENT**

### **Visual Environment**

The essentially flat terrain of the overall Scheme area is punctuated by landscape features introduced through farming, and more recently, quarrying activities. A limited number of viewing points of the Scheme area as a whole are available from the escarpments to the west and north. These offer small scale views of the DA3 area and limited views are also obtained from adjoining roads and lanes and from some adjoining residential properties.

There will be different visual impacts associated with both the extraction and the rehabilitation phases of the DA3 programme. The visual impacts of the extraction programme will be relatively short-lived and localised as they will be limited to the duration of the extraction period. The bunds required as part of the environmental noise management programme will be visually obtrusive particularly near Cranebrook Village and around the private property to the north of the village. These bunds will be required for 18 to 24 months and be removed as soon as the noise environment returns to acceptable levels.

### **Heritage Sites**

Proposed DA3 activities will completely remove any remaining physical evidence of earlier occupation, however, this loss is not significant in terms of state and local heritage concerns.

Several potential aboriginal sites exist within the DA3 area. As was the case in DA2, these sites can be better assessed during quarry operations and an archaeologist will be engaged to undertake these assessments prior to major works being carried out. Before any identified aboriginal sites are destroyed, permission would be sought from the NPWS in accord with their requirements. The Daruk Local Aboriginal Land Council will continue to be consulted on all matters related to this issue.

No items of significant European heritage exist within the DA3.

The Corporation intends to establish a visual display area at its Site Office for education and research purposes. This display will contain significant contributions from both Aboriginal and European occupation. The Daruk Land Council and Nepean District Archaeological and Historical Group will be consulted on the establishment and maintenance of this display.

### **Agriculture**

The current agricultural enterprise being undertaken on the DA3 areas, as part of a wider agricultural operation on company owned lands, is principally grazing of dairy and beef cattle. The enterprise is economically rational and is suited to the task of maintaining the attractiveness of the areas at a fairly low cost.

The proposed quarrying and rehabilitation will result in the loss of all agricultural activities

but the loss of these activities will have an insignificant impact on either production from the areas or on supplies to the metropolitan areas. Although the end use of the DA3 area will not be agricultural uses, it is possible that there could be some agriculturally related uses such as grass hay production in the interim on rehabilitated land.

### **Traffic**

The Penrith Lakes Scheme area is currently served by a rural road network of two lane roads of varying widths, with most roads being sealed with surfaces of varying quality. Flows are generally low, both on a daily and peak hourly basis, the busiest area being around the intersection of Castlereagh, Cranebrook and Andrews Road.

Raw feed is transported from the quarry faces to the crushing plants totally by off-road haulage via an under-pass to Castlereagh Road and a private bridge across the Nepean River. Vehicular and pedestrian access to the quarry areas, haul roads, crushing plants and areas undergoing rehabilitation is strictly controlled so that no unauthorised vehicles or personnel are permitted in these areas.

DA3 activities will require the closure of Farrells Lane and Thornleys Lane, and the relocation of the western end of Church Lane. These activities are not expected to cause any significant impact as alternative routes are available for Farrells Lane, Thornleys Lane will not be required and the relocation of that portion of Church Lane is a minor alteration to alignment.

### **Urban Development**

The areas that will be subject to extraction and rehabilitation under the DA2 approval are located between 5 and 7 km north west of the centre area of Penrith. Except for Cranebrook Village immediately to the east, the rest of the DA3 area is adjoined by largely rural land uses.

Quarrying and rehabilitation works are planned for the areas immediately to the north of the village. Ameliorative measures are in place to minimise any impact on residents. In the long term it is possible that rehabilitated lands surrounding the village could be developed for urban use.

### **Employment**

There are 66 people whose employment currently relates directly to the extraction and rehabilitation operations within the Scheme. This number is not expected to change as a result of the DA3 activities.

### **Energy**

Diesel fuel will continue to be the principal form of energy used by equipment and trucks engaged in extraction and rehabilitation activities. Depending on haul distances and other variables, annual average consumption of diesel fuel is estimated to be about 5 million litres during each year of the DA3 period.

## 1. INTRODUCTION

### 1.1 BRIEF HISTORY OF THE SCHEME

The Penrith area has been a major source of supply of medium to coarse grained sand and crushed river gravel for the Sydney construction industry since the 1880's and today provides most of Sydney's requirements for these materials. Initially, excavation of this sand and gravel was from deposits in the Nepean River; however, as these reserves were depleted during the late 1950's attention was turned to the reserves under the Penrith - Castlereagh floodplain. Development consents to quarry parts of the floodplain to the north - west of Penrith were subsequently obtained by four quarrying companies:

- \* BMI Limited (now a subsidiary of Boral Limited);
- \* Farley and Lewers Limited (now a unit of CSR Limited);
- \* Ready Mixed Concrete Limited (now a unit of CSR Limited);
- \* Pioneer Concrete Services Limited (now a subsidiary of Pioneer International Limited).

In the late 1960's, the piecemeal manner in which the quarrying operations were being undertaken and the restrictions that this placed on the rehabilitation of the quarried areas were causing concern. At the request of the Penrith City Council, the State Planning Authority examined concepts for co-ordinating the extraction of the sand and gravel resources with measures for rehabilitating the affected areas. As a result, the Penrith Lakes Scheme Working Party was established, comprising representatives of five State government departments, the Penrith City Council and the quarrymasters. Its aim was to examine the feasibility of a programme of orderly and economical extraction and comprehensive rehabilitation with a view to creating a regional water-orientated recreation resource in the former quarry areas. This concept became known as the 'Penrith Lakes Scheme'. In 1976 the working party prepared an interim report for the comprehensive rehabilitation of the area.

However, before the Scheme could be implemented a suitable water supply for the lakes had to be determined and a mechanism agreed upon which would enable the independent companies to co-ordinate their extraction and rehabilitation work. Also, many aspects of the Scheme required further investigation to determine whether the proposal was technically, environmentally and financially feasible. The participating companies therefore formed the Penrith Lakes Development Corporation Ltd. (referred to in this report as the Corporation), which commenced operations in 1980.

## 1.2 THE CORPORATION AND ITS SHAREHOLDERS

The Corporation is an unlisted public company formed to undertake the quarrying and rehabilitation operations of its three shareholder companies in accordance with the expressed wish of the NSW Government and the Penrith City Council that these activities be co-ordinated. The shareholders, Boral Limited, Pioneer International Limited and CSR Limited, exercise joint control by means of their ownership in the Corporation.

The Corporation was established to:-

- \* undertake detailed studies to test the technical, environmental and financial feasibility of the Scheme;
- \* obtain approvals for quarrying and rehabilitation;
- \* co-ordinate the sequential long-term quarrying and rehabilitation operations of the shareholder companies in the Penrith-Castlereagh floodplain;
- \* ensure that the quarrying and rehabilitation operations were undertaken in an economical and environmentally acceptable manner.

To achieve these objectives, the Corporation has been empowered by the shareholder companies to eventually acquire the lands owned by the shareholders as well as to make additional land purchases as necessary in the Scheme area. The Corporation undertakes the extraction of raw feed and subsequent rehabilitation work that would otherwise have been carried out separately by the shareholder companies. By selling the raw feed to its shareholders, the Corporation is able to raise sufficient revenue to progressively meet the costs of administration, planning, design, extraction, rehabilitation and associated works for the Scheme. The shareholder companies continue to process the raw feed in their existing plants, and the product is then marketed by the individual shareholder companies in competition with each other.

### 1.3 WORKING ARRANGEMENTS WITH THE NSW GOVERNMENT

When the Corporation commenced operations in April 1980, the reserves of sand and gravel held by the shareholder companies within individual development consents were being rapidly depleted. One of the first activities of the Corporation, therefore, was to prepare a development application and accompanying environmental impact statement. The aim of the application (referred to in this report as DA1) was to secure further supplies of the raw feed necessary to continue operations while the preferred scheme was being investigated and awaiting approval. Table 1.1 summarises the key documents produced in relation to the Scheme since 1981 and the main result of each document as discussed below.

TABLE 1.1

**Key documents and the main results of each document.**

<b>Date</b>	<b>Document/Report</b>	<b>Result</b>
April '81	Development Application (DA1)	Consent granted in July '82 for interim extraction while preferred scheme in preparation.
Feb. '84	Penrith Lakes Scheme-Regional Environmental Study	Selection of preferred scheme and description of its effects.
Oct. '86	Sydney Regional Environmental Plan No. 9 - extractive industry	Identified Penrith Lakes as priority for extraction.
Nov. '86	Sydney Regional Environmental Plan No. 11 - Penrith Lakes Scheme	Legal framework for implementation of Scheme.
Nov. '86	Development Application (DA2)	Consent granted in February '87 for extraction of DA2 area in accord with SREP No. 11.
May '89	Amendment No. 2 to Sydney Regional Environmental Plan No 11-Penrith Lakes Scheme	Amendment extended REP boundary and made provision to incorporate international standard rowing course into Scheme.
Aug. '89	Development Application (Rowing Lake)	Consent granted in November '89 to modify DA2 and extract additional lands to construct rowing course.
Jan '94	Application to amend SREP No. 11 (Amendment No. 2) Structure Plan.	Application still under consideration at time of preparation of this report.

DA1 was approved by the Minister for Planning in July 1982, granting consent to quarry some 100ha of resource - bearing land in the Scheme area. This approval made available an estimated 12.5Mt of sand and gravel resources, sufficient to allow time for detailed planning studies of the Scheme to be completed.

In February 1981, the Director of Planning decided that, in accordance with the requirements of the Environmental Planning and Assessment Act, a draft regional environmental plan and study should be prepared for the Penrith Lakes Scheme area. The Department of Planning (D o P) sought and obtained the Penrith City Council's support for this decision.

The Regional Environmental Study (RES) was exhibited in 1984 and submissions were duly considered by the Minister for Planning. Based on the RES and associated submissions, a draft Regional Environmental Plan was prepared by the D o P and was exhibited in early 1986. Arising from the draft REP and submissions received, the D o P prepared Sydney Regional Environmental Plan No. 11 - Penrith Lakes Scheme (SREP No. 11), which was gazetted on November 18, 1986.

Following the exhibition of the RES, the Minister established a Management Working Party (Government Negotiating Committee) to investigate the most appropriate mechanisms for the effective implementation and future management of the Penrith Lakes Scheme. A formal proposal was presented by the Corporation to the NSW Government in November 1985 for construction of 'the large main lake alternative' which was the preferred alternative. This proposal was considered by the NSW Government and in August 1986 the Government and the Corporation entered into a Deed of Agreement which defined the rights and responsibilities of each party, in relation to the implementation of the Penrith Lakes Scheme.

A development application for the second stage of Penrith Lakes Scheme was approved by the Minister for Planning in February 1987. The DA2 area contained 327ha of resource bearing land, providing an estimated 39Mt of sand and gravel, sufficient to meet requirements for an estimated 8 years.

Arising from submissions received on the RES exhibition, the Director of Planning requested the Corporation to investigate the possibility of incorporating an international standard rowing course into the Penrith Lakes Scheme. In August 1989, the Minister for Planning, the Minister for Sport and Recreation, and the Corporation entered into an agreement for the construction of such a course within the Scheme. SREP No. 11 was amended in May 1989 to extend the boundary of the Scheme which would permit construction of the course to international standards. In November 1989 the Minister for Planning granted consent to:-

- \* an application to modify the DA2 consent to incorporate the rowing course, and
- \* an application to extract and rehabilitate on additional lands adjoining the DA2 area to accommodate course requirements.

The additional lands associated with these applications provided an another 8Mt to the DA2 resources.

More recently, the Corporation has lodged an application to amend the Structure Plan associated with SREP No. 11 (Amendment No. 2). The amendments detailed in this application are necessary to incorporate findings of flood and stormwater management studies into the Structure Plan.

#### 1.4 PENRITH LAKES SCHEME

The Penrith Lakes Scheme, which involves rehabilitating sections of the Nepean River floodplain concurrently with quarrying operations, is a complex engineering undertaking, requiring the excavation of overburden, sand and gravel to a typical depth of about 14m below ground level over a total area of about 2000 hectares. Approximately 50% of the material to be excavated will be processed and sold, while the remaining overburden will be redistributed to create a variety of landforms. In order to consider the widest possible range of concepts, twenty-seven scheme alternatives were evaluated in the RES in terms of Scheme objectives, technical considerations and environmental implications.

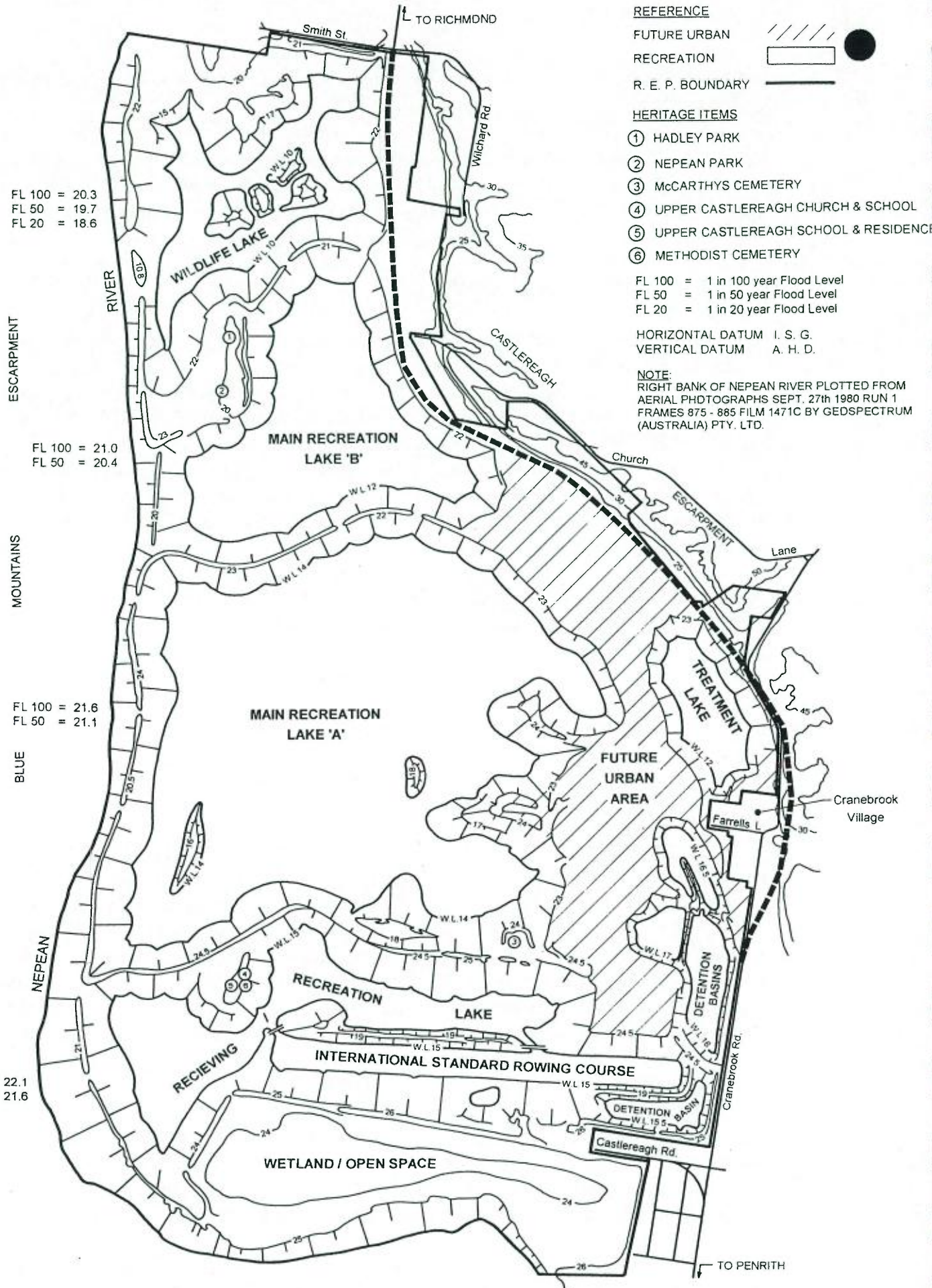
Three scheme alternatives emerged that were technically, environmentally and financially feasible and that best met the Scheme objectives. These were:-

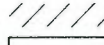


- \* the large main lake scheme (which maximised the size of the main recreation lake);
- \* the small main lake scheme (which retained Castlereagh Road and Farrells Lane);
- \* the wetlands scheme (which had a lower cost and was technically less complex to construct than the other schemes).

Of the three alternatives, only the first two schemes (which incorporate a main lake) provided the water-oriented recreation opportunities envisaged in the original (1976) concept, although the small main lake alternative could not accommodate a rowing course and the standard of a sailing course which it could offer would also be restricted. While the wetlands alternative offered potentially significant regional water resource benefits, it did not meet the recreation objectives embodied in the original concept, although some water-oriented recreation opportunities could be provided. The large main lake alternative was selected as the preferred scheme, as it best met scheme objectives in relation to recreation benefits and provided the greatest potential to accommodate a variety of water-oriented and land use activities.

The Scheme design as provided in SREP No. 11 (Amendment No. 2) has been modified as a result of on-going investigations over the last few years (see Figure 1.1). The main differences between the SREP No. 11 (Amendment No. 2) Structure Plan and that proposed in the Corporation's recent application, are:

- \* the general shape of the rowing lake has been slightly changed to meet agreed standards and design requirements;



**REFERENCE**  
 FUTURE URBAN   
 RECREATION   
 R. E. P. BOUNDARY 

**HERITAGE ITEMS**  
 ① HADLEY PARK  
 ② NEPEAN PARK  
 ③ MCCARTHY'S CEMETERY  
 ④ UPPER CASTLEREAGH CHURCH & SCHOOL  
 ⑤ UPPER CASTLEREAGH SCHOOL & RESIDENCE  
 ⑥ METHODIST CEMETERY

FL 100 = 1 in 100 year Flood Level  
 FL 50 = 1 in 50 year Flood Level  
 FL 20 = 1 in 20 year Flood Level

HORIZONTAL DATUM I. S. G.  
 VERTICAL DATUM A. H. D.

**NOTE:**  
 RIGHT BANK OF NEPEAN RIVER PLOTTED FROM  
 AERIAL PHOTOGAPHS SEPT. 27th 1980 RUN 1  
 FRAMES 875 - 885 FILM 1471C BY GEDSPECTRUM  
 (AUSTRALIA) PTY. LTD.

FL 100 = 20.3  
 FL 50 = 19.7  
 FL 20 = 18.6

FL 100 = 21.0  
 FL 50 = 20.4

FL 100 = 21.6  
 FL 50 = 21.1

FL 100 = 22.1  
 FL 50 = 21.6

**PROPOSED MODIFIED  
 STRUCTURE PLAN SREP No.11  
 (AMENDMENT No. 2)**

**FIGURE 1.1**

- \* landform heights have been more precisely defined to incorporate flood protection measures including the deletion of one flood weir and the inclusion of another.
- \* the river bank landforms have been re-designed to retain the existing river bank in lieu of extracting the bank downstream of Jacksons Lane.
- \* the detention basin system adjoining Cranebrook Road has been re-designed to utilise collected drainage water in the Scheme;
- \* the shape of the northern recreation lake has been changed to remove urban lands from the embankment between the two recreation lakes;
- \* the south east corner of the southern recreation lake has been re-designed to dispose of localised surplus overburden.
- \* the wildlife lake has been re-designed to increase its amenity and to utilise additional overburden.

A total of four lakes and other water-related areas with a combined water area of 725 hectares are proposed for the 2000 hectares of land embraced by the Scheme. The largest lake would be about 380 hectares in area, with the maximum dimensions being approximately 2.3 by 2km. This lake system would require about 26,000 ML of water per year, to be supplied from the Nepean River, of which 85% would be returned to the river system.

The total land area excluding lakes would be 1275 hectares, with about 400 hectares of this land being 1m above the 1-in-100 year flood frequency level. About 230 hectares of this land has been designated for possible future urban uses, which are discussed in more detail in Section 5.1 of this SEE.

## 1.5 STRUCTURE OF THE DOCUMENT

The structure of this report and scope of each section is as follows:

- Chapter 2      Outlines the scope of DA1, DA2 and DA (Rowing Lake), and the conditions attaching to their approval. It then reports on their progress in terms of the rate of extraction achieved, the rehabilitation undertaken, and the environmental impacts experienced and the ameliorative measures implemented.
- Chapter 3      Discusses the need for DA3 in the context of the Sydney Region's reserves of gravel and sand and the management strategy adopted for

their exploitation. The reserves of the Scheme area are presented in the context of the short term demand for sand and hard rock aggregate. Consequences of no approval or delay in approval of DA3 are discussed.

- Chapter 4 Describes the proposed development in terms of its extent and its relationship to the overall Scheme. The staging sequence within the DA3 area is presented together with a description of the extraction, tailings management, rehabilitation and water management methods to be used.
- Chapter 5 Discusses structure planning for the DA3 area in relation to the structure plan for the overall Scheme. This structure plan is elaborated for the DA3 area in terms of possible disposition of recreational development and road access arrangements.
- Chapter 6 Describes the existing physical environment of the DA3 area in relation to noise, air quality, water quality, and flora and fauna. The likely impacts of the DA3 development on each of these aspects of the physical environment are presented together with proposed ameliorative measures to ensure that likely impacts are within acceptable limits.
- Chapter 7 Describes the existing cultural environment of the DA3 area in relation to heritage sites (Aboriginal and European), agriculture, traffic and urban development. The likely impacts of the DA3 development on each of these aspects of the cultural environment, together with the employment and energy requirements, are presented together with proposed ameliorative measures to ensure that likely impacts are within acceptable limits.

## 2. PROGRESS OF THE SCHEME

### 2.1 BACKGROUND TO PREVIOUS DEVELOPMENT APPLICATIONS

The basis for seeking approval of DA1 was the need to ensure a continuing supply of raw feed necessary to continue plant operations and supply to the construction industry while the preferred scheme was being investigated and awaiting approval.

Approval for DA2 was sought to ensure continuity of raw feed supplies following completion of DA1. It was the first development application under SREP No. 11 - Penrith Lakes Scheme.

Approval for DA (Rowing Lake) was sought to incorporate an international standard rowing course within the Scheme. The SREP No. 11 had to be modified to extend Scheme boundaries to ensure the course could be constructed to the necessary standards.

### 2.2 SCOPE OF DA1, DA2 AND DA (ROWING LAKE)

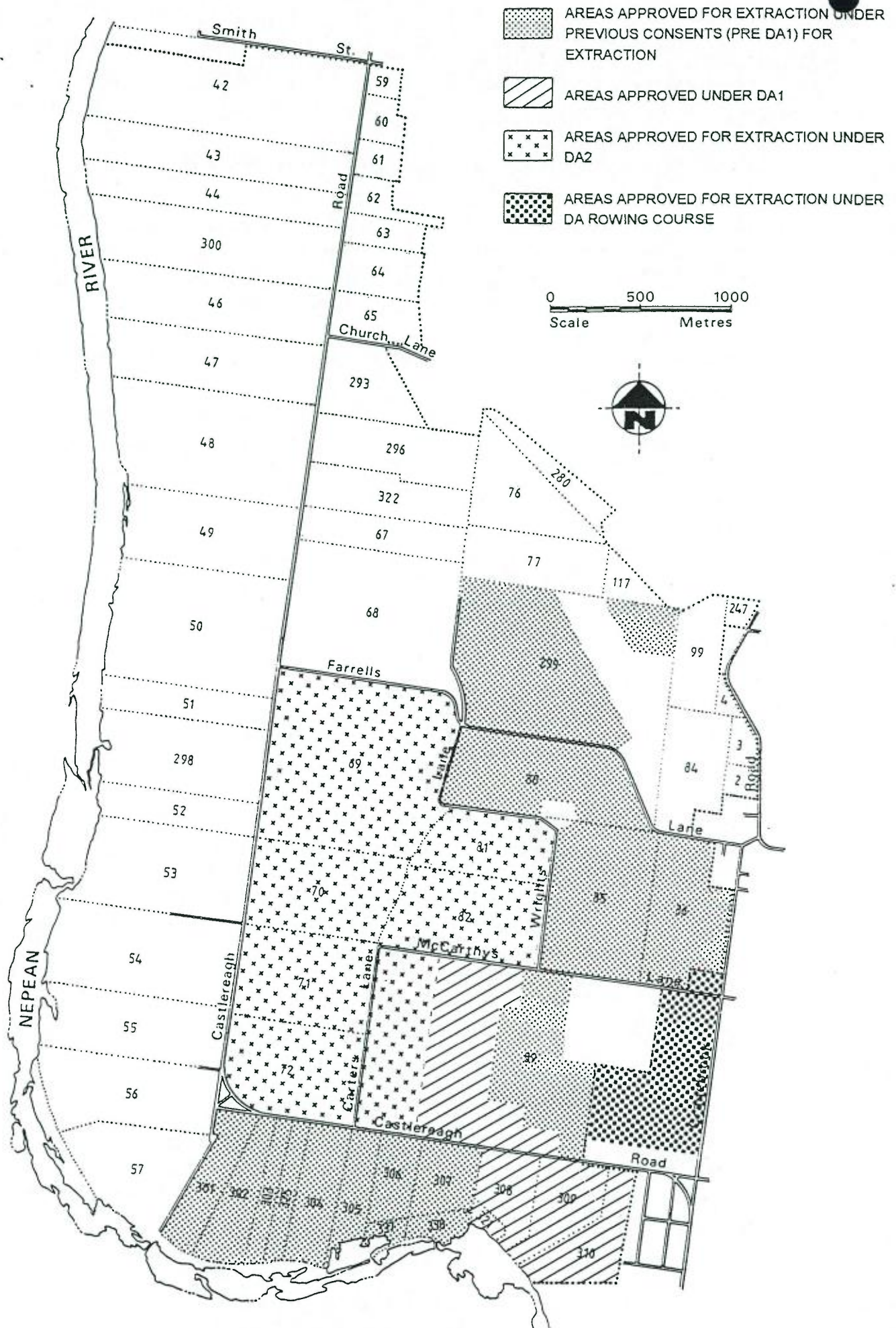
Areas which have been extracted under previous approvals are shown in Figure 2.1. In the case of DA2 and DA Rowing Lake, extraction is still continuing, albeit there is only a small quantity of resource remaining.

The total land area involved in these previously approved extraction and rehabilitation areas represents approximately 40% of the Scheme area.

The scope of rehabilitation works required as a condition of approval varied depending upon when such approvals were issued. Extraction of the pre-DA1 areas was undertaken by the individual companies operating at that time. Rehabilitation requirements related to these approvals were relatively limited in scope and were unco-ordinated. It was these piecemeal approvals and works which highlighted the need for a co-ordinated approach such as the Scheme. Approvals and rehabilitation requirements were the responsibility of the individual operators.

The DA1 application and subsequent approval preceded the SREP No. 11 and, accordingly, arrangements for implementation of the Scheme were not in place at the time of application.

Provision was made in the DA1 EIS for a 'stand alone concept'. This concept was formulated on the basis that if the RES concluded that no future quarrying, or that only limited quarrying, should take place, then the areas to be rehabilitated under the DA1 application would be compatible with a stand alone concept. This involved the



APPROVED EXTRACTION AREAS

preparation of rehabilitation designs directed toward constructing stable landforms and lakes to the extent that their successful completion was not dependent upon further quarrying. The Corporation proposed in the DA1 application that areas subject to extraction would be subject to rehabilitation detailed in the EIS and that areas which were extracted under previous approvals would be also subject to the same rehabilitation standard. A guarantee or bond was to be posted as a surety that rehabilitation works were to be undertaken in accordance with the approval.

The DA2 application and subsequent approval followed the gazettal of SREP No. 11. Accordingly, rehabilitation works proposed in the DA2 SEE were consistent with the concept of the Penrith Lakes Scheme and with standards/specifications agreed with the NSW Government. Conditions related to DA1 were modified to include all the conditions pertaining to the DA2 consent. A guarantee was required to cover the cost of remedial works necessary in the event that the Corporation did not undertake rehabilitation to agreed standards.

The DA Rowing Lake application and subsequent approval provided for the construction of an international standard rowing course. The applicant for works on the additional lands adjoining the DA2 was the Minister for Sport and Recreation with the Corporation being nominated as the development manager for the works. Conditions related to DA Rowing Lake are a replication of the DA2 conditions of consent, requiring similar rehabilitation standards/specifications to be reflected on the additional lands. The DA2 guarantee was broadened to include the land/works subject of the DA Rowing Lake.

### **2.3 CONDITIONS ATTACHED TO APPROVAL OF DA1, DA2 AND DA ROWING LAKE**

Conditions attached to DA1 consent have been replaced by the DA2 conditions. Similarly, the DA Rowing Lake conditions are equivalent to the DA2 conditions. The following outline of DA2 conditions is provided for comparison with the progress reported in section 2.4.

The DA2 conditions can be broadly grouped into administration, technical and environmental requirements to be met by the Corporation during the currency of DA2. For its part, the Minister for Planning established a Penrith Lakes Scheme Monitoring Committee to monitor Corporation activities in relation to the conditions. This Committee meets at six monthly intervals to review progress and compliance.

In respect of administrative requirements, the Corporation must submit every two years, detailed plans of works to be carried out within the subsequent two years. In the preparation of these plans, the Corporation is required to consult with nominated authorities having interests in the Scheme. The Corporation is also required to submit every two years, a detailed report which contains all monitoring information required

to be collected throughout the previous two year period. The level of guarantee is reviewed at two yearly intervals and, if necessary, adjusted to reflect changes in the scope of works covered by guarantee. Special provisions are made for circumstances where extraction works are temporarily suspended.

The conditions specify a variety of technical aspects related to rehabilitation works, Scheme development and water management. A water management plan was required to be prepared, detailing studies proposed, modelling and monitoring programmes. Survey and preliminary design for the future relocation of Castlereagh Road was to be carried out.

Conditions related to environmental aspects involved consideration of noise levels, hours of operations, control of dust, provision for heritage and cultural items, access requirements and protection of neighbouring properties.

## **2.4 PROGRESS TO DATE**

To provide background to this current development application, the progress of the Scheme to date is examined in this section in terms of rate of extraction achieved, the rehabilitation undertaken and the environmental impacts experienced and ameliorative measures implemented.

### **2.4.1 Rate of Extraction**

The rates of sand and gravel extraction from the Scheme area are shown in Table 2.1.

Prior to 1982/83 resources available to the Corporation were contained in lands over which Penrith City Council had granted consent to extract to individual quarry companies.

In July 1982 the Minister for Planning approved DA1. The Environmental Impact Statement which supported the DA1 application stated that 12.4 million tonnes were contained in the DA1 extraction area and that this would be sufficient resource for 3 and a half years. This was to provide sufficient time to allow the finalisation of the RES/REP.

TABLE 2.1

Rates of extraction, Penrith Lakes Scheme 1980/81-1993/94

Year	Tonnes (millions)	Area of Extraction
1980/81	3.9	9.6 million tonnes under previous individual consents
1981/82	4.3	
1982/83	2.8	
1983/84	3.2	
1984/85	4.0	
1985/86	4.4	
1986/87	4.9	16.2 million tonnes under DA1 consents
1987/88	5.0	
1988/89	5.5	
1989/90	5.2	
1990/91	5.8	
1991/92	5.8	
1992/93	5.0	
1993/94	4.8*	

\* Forecast: based on July-December actual extraction and January-June estimated extraction process.

The actual DA1 area yielded more resources than the 12.4 million tonne estimate. This was primarily due to the fact that the estimate was based on a historical average yield of 135,000 tonnes per hectare. The actual lands contained deeper than average resource depth and the area yielded approximately 16.2 million tonnes.

As foreshadowed in the DA1 EIS, the CSR processing plant was completed and the general level of extraction increased from 1983/84.

The DA1 resources lasted about 4 and a half years, in comparison to the 3 and a half years forecast in the DA1 EIS.

The Minister for Planning approved DA2 in February 1987 and the DA Rowing Lake in November 1989. These two approvals provided an additional 47 million tonnes of resource - 39 million tonnes DA2 and 8 million tonnes DA Rowing Lake. An estimated 5.6 million tonnes will remain at the end of 1993/94. Estimated resource extracted from this area is 45.4 million tonnes which is within 3% of the quantities estimated in the Statement of Environmental Effects supporting both DA's. This is considerably more accurate than the DA1 estimate. The improvement in estimates is related to a change in the method of determination. The DA2/DA Rowing Lake reserve estimates were based on computer models developed from drill hole information, while DA1 was estimated using historical yields.

The DA2 resources were expected to last 8 years, with the DA Rowing Lake adding an additional 1 and a half years life, for a total period of 9 and a half years. The DA2/DA Rowing Lake resources are expected to be fully consumed by about July 1995. This would give an operational period of these DA's of 8 and a half years. The average extraction rate assumed in the SEE (DA2) was 4.85 million tonnes per annum. The average extraction rate achieved during the period to date is slightly higher at 5.4 million tonnes per annum, which accounts for the timing difference between estimate and actual.

## 2.4.2 Operations

### (a) Overburden Stripping

Volumes of overburden stripped by the Corporation are shown in Table 2.2.

TABLE 2

#### Overburden Stripping 1982/83 to 1993/94

Year	Volume Stripped (million cubic metres)
1982/83	1.12*
1983/84	1.37
1984/85	1.69
1985/86	1.24
1986/87	1.01
1987/88	1.46
1988/89	2.18
1989/90	3.11
1990/91	2.46
1991/92	2.47
1992/93	3.51
1993/94	2.51**

\* Estimate: detailed recording commenced late 1982

\* Forecast: based on July-December actual stripping and January-June estimated stripping

Annual variations generally reflect changes in depth of overburden, rate of raw feed extraction and adjustments to pre-stripped reserve levels.

Prolonged periods of wet weather cause difficulties in maintaining adequate stocks of pre-stripped reserves. During such periods overburden stripping operations cease because the site conditions deteriorate to the extent that stripping machinery cannot operate satisfactorily nor safely. However, gravel extraction can continue during such periods. This results in a consumption of the pre-stripped reserves.

In general, the Corporation aims to maintain at least six months pre-stripped reserves available. Between July 1988 and August 1989 significant falls of rain were experienced. Pre-stripped reserve stocks were reduced to 2 months in March 1989 and were less than 3 months for almost the whole period from July 1988 to August 1989. Safe gravel extraction operating conditions are extremely difficult to maintain at this level of pre-stripped reserves. Hours of operations were extended to 11.00 pm, five days per week for a five month period in 1989 and a six month period in 1990. These extended hours permitted increased overburden stripping rates to adjust the pre-stripped reserves to a normal operational level.

**(b) Tailings Management**

Raw feed extracted from the Scheme area is washed in the three processing plants to remove clays and silts. This washing produces residues known as tailings. These are pumped as a slurry from each of the processing plants to a long term disposal area just south of Castlereagh Road. Here the clays, silts and fine sands are allowed to settle with clarified water being recycled to the washing process at the plants. The Corporation is responsible for the operations and management of this system.

Since the Corporation took over responsibility for the long term disposal of tailings in 1988 approximately 2.8 million dry tonnes of tailings were pumped to the area just south of Castlereagh Road by the end of 1993.

**(c) Dewatering**

The Corporation is responsible for the total dewatering management of the areas of operations. It has an obligation to the shareholder companies to ensure the quarry pits are dry to aid in the extraction and screening processes. Geotechnical requirements, when placing fill places constraints on operations. Fill areas have to be dewatered prior to the placement of overburden to ensure agreed geotechnical standards are achieved.

Water from these operations is generally used within the site to meet requirements of the Pioneer and CSR processing plants, maintain water levels in lakes and for dust control. There are periods when surplus water accumulates on the site, particularly after prolonged wet periods. In these circumstances stored water is discharged from the site to neighbouring creek systems. These discharges are made under conditions attached to an Environment Protection Authority (EPA) licence. This matter is further discussed in section 2.4.4.

**(d) Haul Roads**

The Corporation is responsible for the construction and maintenance of haul roads within the Scheme. Haul road locations as at the end of 1993 are shown in Figure 2.3 and are in accord with raw feed traffic arrangements detailed in DA Rowing Lake SEE.

There has been an overall increase in trucks using the haul roads with a general trend of replacing 50 tonne payload trucks with 85 tonne payload trucks.

### 2.4.3 Rehabilitation

#### (a) General

As mentioned in section 2.2, the total land area involved in previously approved extraction and rehabilitation areas represents approximately 40% of the total Scheme area. The scope and standard of rehabilitation works varied depending on when consents were issued.

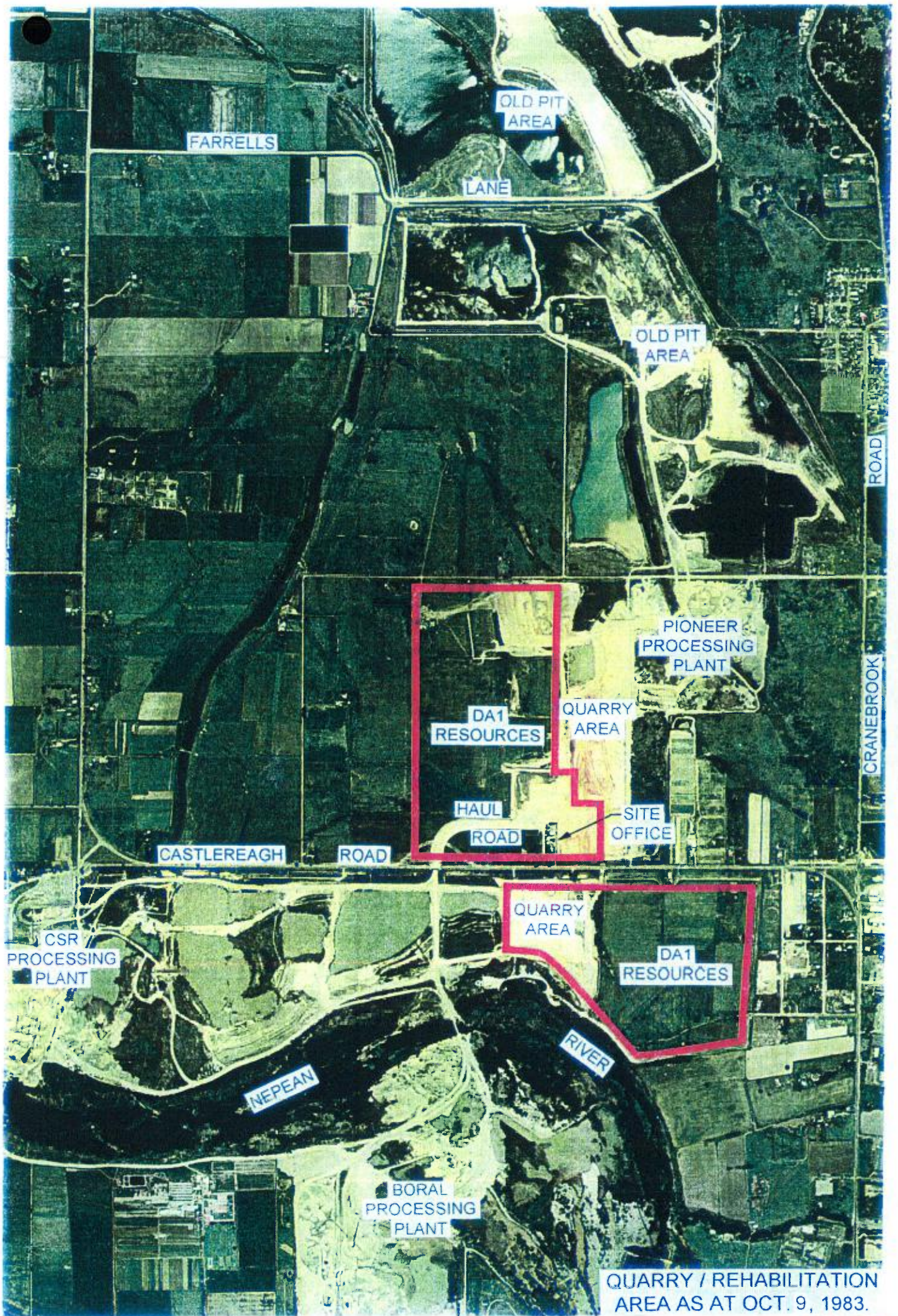
In areas where consent was issued prior to DA1, rehabilitation requirements were relatively limited in scope and were un-coordinated. The standard of rehabilitation works under these consents did not meet the standards currently required. The Corporation gave undertakings that these areas would be rehabilitated in accord with the same rehabilitation standards as apply to the total Scheme area. The timing of these works are dependent upon their location in respect to the active quarry operations. Such rehabilitation works are more economically undertaken when quarry operations are nearby.

Areas affected by DA1 consents were rehabilitated to Scheme standard, even though no formal requirement had been agreed as to standards at the time the works were undertaken. Areas affected by DA2 and DA Rowing Lake have been or will be rehabilitated to agreed standards.

Figure 2.2 shows the disposition of consent areas as at 9th October, 1983. The extraction/rehabilitation areas are generally in the southern portion, between the Nepean River and Castlereagh Road and to the west of the Pioneer Plant. Works under DA1 consents were operating at that time. Extensive areas of previous quarry activities are north of the Pioneer Plant and to the west of the DA1 workings south of Castlereagh Road.

Figure 2.3 shows the general layout of quarry and rehabilitation areas as at December 31, 1993. General features are:-

- \* only areas containing sand and gravel resources are designated as "Remaining Resource"- Area 1 is in north west corner just south of Farrells Lane. Area 2 is just to the right of Pioneer Processing Plant adjacent to Cranebrook Road.
- \* CSR wash water re-cycle system has been established immediately to the east of the CSR Processing Plant.
- \* The tailings operations described in section 2.4.2 uses the area



QUARRY / REHABILITATION AREA AS AT OCT. 9, 1983.

FIG. 2.2

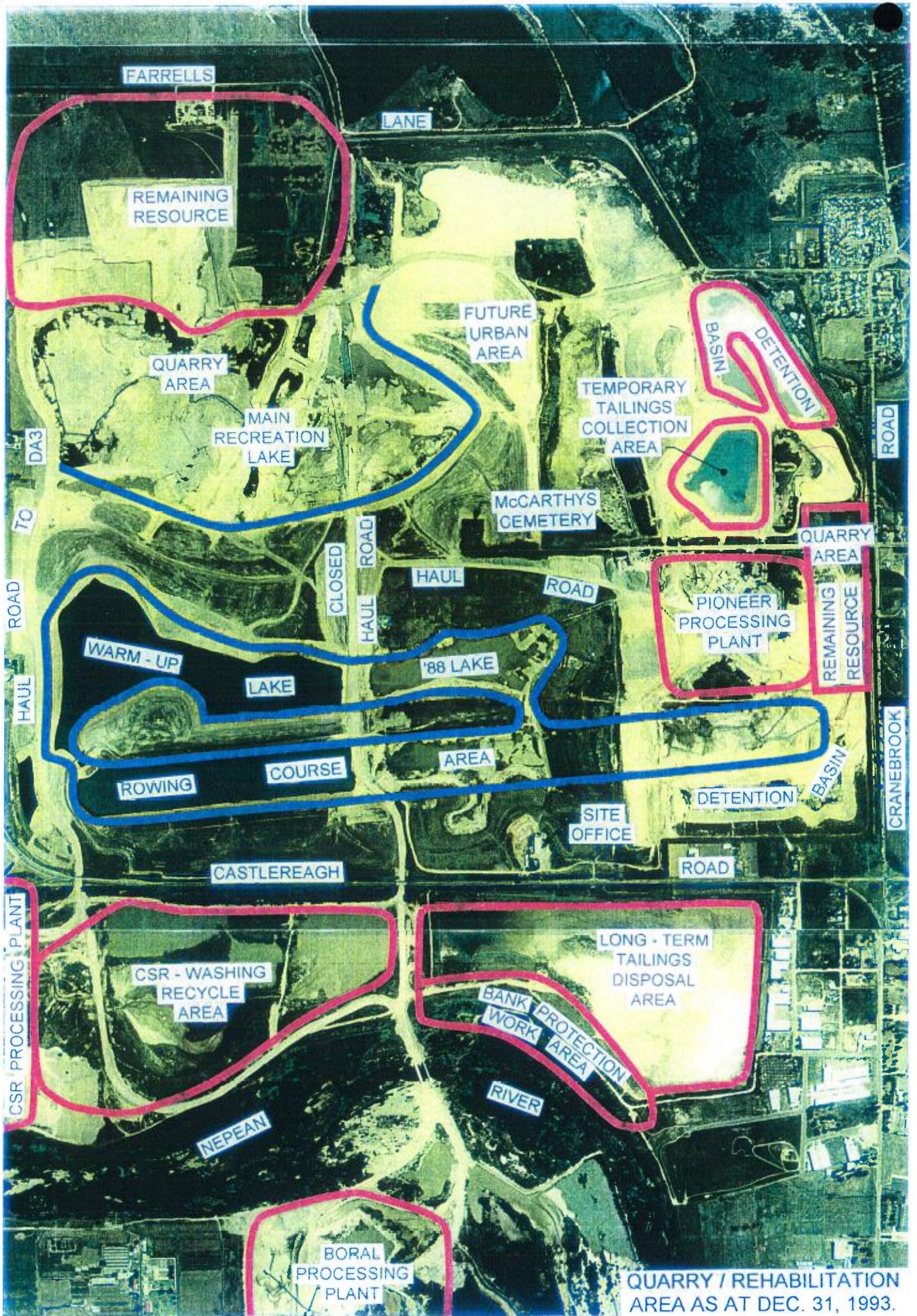


FIG. 2.3

immediately south of Castlereagh Road as a site for the permanent disposal of tailings. The area shown has sufficient capacity for the next 4 to 5 years.

- \* Between the tailings area and the Nepean River, special works have been undertaken to ensure the long term stability of this section of Nepean River Bank. These works are described in Section 2.4.3 (e).
- \* Immediately to the north of the tailings area is the Corporation's Site Office area. The Corporation's new administration centre is currently under construction in this area. A large shed was constructed in 1987 to house a flood model - described in section 2.4.4(g). The area also contains various structures and equipment used to service the Corporation's day to day activities.
- \* Just north of the Site Office area is the "88 Lake". This Lake was opened to the public for recreation purposes from December 1988 up until April 1993. It had to be closed at this time to permit the construction of the Rowing Lake. The "88 Lake" is further discussed in section 2.4.4(g).
- \* North of the east-west section of Castlereagh Road is the Rowing Lake area. Completion and dedication of this area is scheduled for June 1995. This matter is further discussed in section 2.4.5.
- \* On the eastern side of the site, works are proceeding with the construction of detention basins in extraction areas south of McCarthys Lane. North of this lane was quarried before DA1. In line with commitments to rehabilitate the old extraction areas, works are proceeding to rehabilitate the area north of McCarthys Lane to a series of detention basins. This matter is further discussed in sections 4.7 and 6.3.
- \* The main recreation lake is commencing to take shape in the north east corner of the currently approved extraction area.
- \* Most of the Rowing Course works are completed, future works required involve extraction of "Closed Haul Road" and excavating previously placed overburden to connect the western and eastern sections of the Course.

**(b) Administration**

In 1987, the Penrith Lakes Scheme Monitoring Committee was formed under Section 22 of the Environmental Planning and Assessment Act. This committee, comprising of representatives from eight Government departments and Penrith City Council, has the responsibility of monitoring progress of the Scheme and ensuring compliance with consent conditions. It meets at regular

intervals to review Corporation works in the preceding period and to ensure that those works are undertaken in accord with previous approvals and to the agreed standards and specifications.

In respect of rehabilitation works, the Corporation is required to lodge, at two yearly intervals, detailed rehabilitation construction plans. These plans are to cover works for the following two year period and must be in accord with the Structure Plan. The plans are prepared in consultation with nominated authorities. The Committee reviews these plans prior to them being referred to the Minister for Planning for approval. The required level of guarantee is also reviewed and adjusted if necessary during the process of preparing the two year plans.

The Monitoring Committee also reviews progress of the Scheme to ensure that rehabilitation works are undertaken in accord with agreed plans, standards and specification. The Corporation is required to submit a report every two years, providing details of works undertaken during the period and the results of all construction/environmental monitoring.

All plans and reports have been submitted to the Committee within the approved time and to a satisfactory standard. An exception to this were plans for the 1989-90 period where delays were caused by amendments to plans required as a result of incorporating the rowing lake into the Scheme.

**(c) Applications and Approvals**

Activities within the Scheme, other than those associated with agricultural land uses, require the Minister for Planning's approval under SREP No. 11 - Penrith Lakes Scheme. The Corporation has submitted and obtained approval for the following:-

- \* construction of large shed to house flood model
- \* incorporation of certain lands into DA2 area
- \* construction of administration office
- \* construction of storage and machinery sheds
- \* construction of an underpass on Castlereagh Road

**(d) Geotechnical Matters**

Landforms constructed in the Scheme have specific geotechnical requirements. In general, the main components are:-

- \* foreshores toe of foreshore slope to be compacted to minimum 95% Standard dry density ratio.
- \* cores central cores in water retaining embankments to be compacted to minimum 98% Standard dry density ratio with initial 1 metre layer to be lime stabilised.

- \* urban area top 4 metres of fill to be compacted to a minimum of 98% Standard dry density ratio and bulk fill to average not less than 95% Standard dry density ratio.
- \* structures special design requirements are placed on drainage structures/roads and the like.

The Corporation undertakes compaction tests at the rate of 1 test per 2500 cubic metres in 95% Standard zones and 1 test per 1000 cubic metres in 98% Standard zones. Results of these tests are routinely forwarded to the Penrith Lakes Scheme Monitoring Committee for its review.

The Corporation also installs and monitors settlement plates in particular areas following completion of rehabilitation works. These plates, installed at a frequency of 1 plate per hectare, are used to monitor the settlement characteristics of the deep fill. This information is essential to determine the fill's capacity to adequately support buildings. Survey information of these plates is routinely forwarded to the Monitoring Committee.

**(e) Bank Stability**

Special protection works are undertaken to ensure the long term stability of the foreshores. Foreshore configuration is considered during the design process is varied in slope and plan view depending on exposure to prevailing winds. Following placement of overburden, the foreshore is capped with a 500mm layer of sand and gravel (raw feed), and small hard headlands are constructed in key positions to trap littoral sediments mobilised by storm winds. This combination of measures will provide long term stability to constructed foreshores.

In the rowing course, special consideration was given to foreshore stability. Construction of headlands along the length of the course is not appropriate if international standards for the course are to be maintained. In this circumstance the fine material which will make up the littoral sediments was screened from the raw feed prior to placement as wave protection material.

Foreshore protection works constructed to date are shown on Figure 2.3. All foreshores in the 88 Lake Area and the Rowing Course/Warm Up Lake west of the central haul road have been completed. Further north, protection works have been completed in the Main Lake A area north west of McCarthys Cemetery, between the two haul roads and the tailings collection area/detention basin north of Pioneer Plant.

The stability of the southern portion of the Nepean River bank has been examined in detail by the Corporation. Groundwater wells, to track groundwater movement through the bank, were installed in several sections of the bank during 1989. Results indicated that water moving from the tailings area through the bank toward the river could induce instability in the bank's overburden. Vertical drains have been constructed along the length of the bank shown in Figure 2.3. These drains extend through the overburden into the underlying sand and gravel. This will direct groundwater from the overburden to the sand and gravel and prevent the overburden from becoming saturated.

**(f) Revegetation/Soil Erosion Control/Landscaping**

The design of landforms takes into consideration a range of inter-related issues. Prominent amongst those issues is the long term stability of the bank from the effects of erosion. All landforms are designed and constructed in accord with the provisions of the "Land Rehabilitation Manual" prepared by the Soil Conservation Service for the Corporation.

Landforms include the specially designed erosion control drains. Once the basic landforms have been constructed, topsoil taken from adjacent stripping areas is spread on the landform and trimmed by a grader. Particular attention is given to levels in the drains to ensure that it is free draining. Large rocks are then removed from the area and pasture grasses sown. The mix of seed is varied according to the time of year. During autumn and winter cover crops such as oats are used to provide temporary cover and the area re-sown with permanent pastures in the following spring.

Operational experiences gained by the Corporation during the wet period from 1989-91 indicated that greater emphasis needs to be given to erosion control during the general landform construction phase. The Soil Conservation Service was engaged to look at this particular issue and advised on techniques to reduce sediment losses from partially constructed landforms during intense rainfall periods. These techniques have now been incorporated into routine construction works.

**2.4.4. Environmental Impacts**

**(a) Noise**

Site operations and environmental controls have been satisfactory with regard to noise throughout the DA1/DA2/DA Rowing Lake period. Noise control is managed by several techniques:-

- \* limiting hours of operations

- \* prescribing maximum noise levels at various locations having regard to sensitivity and duration.
- \* construction of noise berms at key locations
- \* scheduling quarry/rehabilitation works to minimise possible impacts
- \* monitoring overall operational noise levels
- \* monitoring noise produced by individual pieces of earthmoving equipment

All monitoring results are routinely forwarded to the EPA and Penrith City Council. Monitoring and general noise issues are considered each six months by the Scheme Monitoring Committee.

The DA2 SEE predicted noise levels for various periods throughout the DA2 operations as did the DA Rowing Lake SEE. These predictions suggested that at times design goal criteria of 55dBA might be exceeded by 1-2 dBA. The transient nature of the operations mean that key neighbouring properties will receive varying noise levels depending on where the operations are located at a particular time.

Two such key locations are the closest residence on Castlereagh Road and on Farrells Lane near Cranebrook Village. Predicted noise levels at these locations were:-

**TABLE 2.3**

**Predicted Noise Levels (dBA)**

	<b>Castlereagh Road</b>	<b>Farrells Lane</b>
<b>DA2</b>		
* Low	53	49
* Medium	53	55
* High	54	56
<b>DA Rowing Lake</b>		
* Low	46	46
* Medium	53	48
* High	64	49

Noise levels monitored at these sites throughout the period are shown in the following table:

**TABLE 2.4**

**Monitored Noise Levels (dBA)**

	<b>Castlereagh Road</b>	<b>Farrells Lane</b>
1988	46	42
1989	45/40	40/39
1990	51/na	42/53
1991	*/*	na/na
1992	*/*	*/36/*
1993	*/**	na/44/45
1994	76/62/73	50/52

Notes: division by "/" are separate tests throughout year.

- \* - quarry noise not measurable, although just audible it could not be distinguished from other intruding noise
- na - quarry noise not audible

The monitoring indicates that the actual noise levels are below predicted levels. The site on Castlereagh Road is subjected to traffic noise from the adjoining road. While quarry noise can, on occasions, be detected at this site it is generally masked by other noise sources. The high levels recorded in 1994 at this site were measured on one day. On that particular day special rowing lake rehabilitation works were being undertaken, including the removal of a berm previously constructed to mitigate noise impact. The high levels recorded would be regarded as construction noise and are not typical of day to day operations. The expected high levels of noise did not extend beyond 1 to 2 days.

In general, it can be concluded that the adopted noise control management approach is effective. However, there are special circumstances where nearby construction must be undertaken and in these circumstances elevated noise levels may be expected for very short durations. Construction and removal of noise bunds fit this category.

Environmental noise management included the construction of noise bunds around Cranebrook Village and adjacent to Cranebrook Road. These were constructed in the early stages of the respective DA's.

**(b) Dust**

Dust control is managed by:-

- \* application of water to working areas,
- \* early establishment of grasses in rehabilitation areas,

- \* minimising the extent of operational areas consistent with quarry development and safe working practices,
- \* ceasing, operations in extreme conditions, and
- \* monitoring

All monitoring results are routinely forwarded to the EPA and Penrith City Council. Monitoring and air quality issues are considered each six months by the Scheme Monitoring Committee.

The dust monitoring programme approved by the EPA involved:-

- \* the continuation of an existing programme for two years after consent was granted. Its discontinuation was conditional upon satisfactory results,
- \* the re-commencement of the programme at least two years prior to the lodgement of the next development application,
- \* samples to be regularly collected from:-
  - \* 8 depositional gauges
  - \* 5 directional gauges
  - \* 1 high volume sampler
- \* an anemometer to be maintained on site
- \* the EPA being advised of periods when quarry/rehabilitation operations were within 200 metres of Cranebrook Village.

Limitations on dust levels were set at 4g/m<sup>2</sup>/month (annual average) for the depositional gauges and 260ug/m<sup>3</sup>, 24 hour maximum concentration for the high volume sampler.

Composite monitoring results for 3 key sites are shown in Table 2.5.

**TABLE 2.5**

**Monitored Dust Levels**

	<b>Castlereagh Road</b>	<b>Farrells Lane</b>	<b>North Cranebrook Village</b>
<b>Depositional Gauge g/m<sup>2</sup>/month</b>			
1987/88	2.06	1.20	1.36
1988/89	10.25*	1.20	1.69
1992/93	3.23	3.68	3.22

- \* Average annual figures influenced strongly by two months of high dust loadings associated with Rowing Lake works adjacent to gauge.

The above data suggests that on average dust levels are below the  $4\text{g}/\text{m}^2/\text{month}$  annual average with exception for the particular circumstances in 1988/89 at the Castlereagh Road site.

The High Volume Dust Sampler was initially located adjacent to quarry operations near the Corporation's Site Office in the early periods of DA2. Maximum recorded levels in this situation was less than the  $260\text{ ug}/\text{m}^3$ .

As operations moved towards Cranebrook Village the High Volume Dust Sampler was relocated to Farrells Lane. Maximum recorded level at this site was  $187.4\text{ ug}/\text{m}^3$  with the average being  $54.0\text{ ug}/\text{m}^3$ .

Again the dust monitoring indicates that, on average, the dust management programme is effective.

The monitoring programme does not account for episodic events. The Penrith area is subjected to strong westerly winds during spring to early summer. On occasions these winds are sufficiently strong to mobilize dust from the operational areas, rehabilitated areas, road verges, agricultural lands and the like. Water applications have little effect on reducing dust generated under these conditions. The only effective management option is to stop operations so as to not exacerbate the extreme conditions. Water applications are still maintained in these periods. This has been done on several occasions since DA2 was approved. Fortunately, these events only occur on very infrequent occasions.

### **(c) Traffic**

The DA2 SEE indicated that several local roads would be closed and that the internal haul road system would be extended to access northern resource deposits. The DA2 Rowing Lake SEE identified the need to relocate the principal haul road to the western edge of the DA2 area, requiring the construction of a new underpass on Castlereagh Road. It also identified the need to close the eastern section of McCarthys Lane and to provide an alternative access road south of the existing lane.

Roads which have been closed include the western section of McCarthys Lane, Carters Lane and Wrights Lane. Alternative access arrangements have been provided for private landholders affected by the changed traffic arrangements. The eastern section of McCarthys Lane will be closed in the near future.

The internal haul road network has been extended to access the northern deposits and to relocate operations away from the Rowing Lake area. The general layout of the haul road network can be readily identified on Figure 2.3. No raw feed is transported on public roads.

**(d) Heritage**

Conditions of consent related to DA2 and DA Rowing Lake required the Corporation to:-

- \* prepare a conservation plan for heritage sites to be retained in the DA2 area including, McCarthys Cemetery and the Methodist Church complex.
- \* report and record other sites identified in the Regional Environmental Study.

A conservation plan for McCarthys Cemetery and the Methodist Church complex was submitted to and approved by the Director of Planning. Both these sites are not in the ownership of the Corporation or its shareholders. The conservation plan identified landscaping works which could be undertaken by the Corporation on its land with the view to enhancing the quality of the heritage sites. A post and rail fence has been constructed around McCarthys Cemetery and general landscaping works undertaken as part of overall rehabilitation programmes. Works on lands adjoining the Methodist Church complex has been held over until such time that detailed landscaping works are undertaken for development of the Rowing Lake complex.

The Corporation entered into arrangements with the Nepean District Historical and Archaeological Group to undertake recording and reporting works on other sites identified in the RES. These reports, which have been submitted to the Director of Planning, form a valuable resource, detailing particular features of structures and their ownership history. Any special items have been collected and stored for future use in a visual display.

**(e) Archaeology**

The RES studies indicated that there were no significant archaeological sites contained within the Scheme area. The studies did identify a number of potential sites, principally along Cranebrook Creek, which could not be assessed at that time because of visibility problems associated with vegetation.

In advance of quarry operations, the Corporation through its consultant archaeologist sought permission to remove vegetation and topsoil from the potential site areas to enable a more accurate survey of the site. These surveys revealed a number of artefacts, but insufficient to warrant retention or further investigation of the sites. The sites have been extracted by quarry operations after obtaining consent from the NPWS and Daruk Local Aboriginal Land Council.

**(f) Flora and Fauna**

The RES studies indicated that there are no significant or unique populations of flora and fauna within the Scheme area. No special conditions of consent have been issued in relation to flora and fauna.

A grove of twenty Eucalyptus benthamii was established in the spring 1985 planting. This rare species of tree was formerly distributed along the banks of the Nepean River and its tributaries. The trees, which were provided by the Forestry Commission, are now well established.

The Corporation has now planted approximately 28000 trees in the Scheme area.

**(g) Water Management**

The Corporation was required to prepare and submit a Water Plan detailing future studies, monitoring and associated works. This Plan provided the framework for assessment of water management issues related to the development of the Scheme.

Major works undertaken since DA2 approval include:-

- \* Water Source an automatic water quality sampling station has been established on the Nepean River at Victoria Bridge. The station has provided valuable information for future quality modelling works.
- \* Flooding an extensive flood management study of the Scheme has been undertaken. The study involved the use of a large physical model and was directed at firming up design details of the flood protection system.
- \* Lake Behaviour extensive monitoring has been undertaken to gain a better understanding of lake water quality dynamics. Monitoring included biological, physical and chemical assessment. Research works were also undertaken to assess impacts of various management strategies.
- \* Local Runoff a water quality monitoring station and associated rainfall gauging station was established on a catchment created by rehabilitation works. Results are to be used in future modelling works.
- \* Aquatic Biology associated with lake water quality behaviour studies. Works directed toward mechanisms to establish favourable aquatic biological structure in lakes after rehabilitation work completed. Macrophyte cultivation ponds established to provide stock for establishing structure.
- \* Stormwater studies undertaken to examine possibility of renovating urban drainage as supplement to Nepean River diversions for Scheme supply.

Results favourable, indicating that Farrells Creek suitable as interim source of supply.

- \* Nutrients studies undertaken to assess potential water management problems associated with various nutrients. Addressed nutrient status and mix, potential recycling and availability.
- \* Groundwater monitoring undertaken to identify any possible adverse impacts caused by development of Scheme.

A small lake was opened for public use in 1988. It was closed in April 1993 to permit the continued construction of the Rowing Lake. Water supply to the lake during this period was from local runoff and diversion from quarry operations. Aside from providing a recreational area for the public, the lake also provided the Corporation with an ideal opportunity to increase its understanding of local lake water quality behaviour and to assess possible future water management implications.

In general, the lakes water quality behaviour was very satisfactory. Its behaviour did, however, highlight the need to establish a complete biological structure in the lakes as quickly as possible. The lake responded to the lack of an appropriate structure by producing four blue-green algae blooms in as many years. Typically, the blooms occurred in late March, early April and were of sufficient severity to close public access to the lake. Importantly, the intensity and the duration of the blooms diminished each year, indicating that as the lake matured and the aquatic biology structure developed the possibility of further blooms would be reduced. Monitoring indicated that the lake commenced to become thermally stratified in late November promoting anaerobic conditions on the bottom of the lake. During autumn when thermal stratification destabilised the algae took advantage of the favourable growth conditions.

Arising from this behaviour, a possible management option is to artificially prevent the thermal stratification. The Corporation installed a 2 metre diameter underwater propeller to mix and destratify the lake. While the mixing of the lake was successful the incidence of algae bloom was not avoided. In fact the timing of the bloom was advanced from autumn into late summer.

Other older lakes within the Scheme area exhibited similar stratification behaviour. However, they did not produce algae blooms. These lakes, being much older, have well established macrophyte populations.

The Corporation now concentrates on introducing macrophytes into the lakes as soon as possible. It has had to establish macrophyte cultivation ponds to provide sufficient stock for planting in completed lake areas. Some 15000 aquatic plants have been introduced into the western end of the Rowing Lake.

In relation to discharges made from the site to the Nepean River, via local

In relation to discharges made from the site to the Nepean River, via local nearby creeks, the Corporation holds a current EPA licence for two discharge points:-

- \* Cranebrook Creek at Farrells Lane (max. discharge 10ML/day)
- \* Farrells Creek at DA2 Boundary (max. discharge 10ML/day)

The need for the Corporation to make such discharges arises from the accumulation of water on-site following prolonged periods of wet weather.

The discharges must contain less than 50 milligrams per litre of non-filterable residue. The application of this licence condition has created operational difficulties in the past because insufficient storage volume was available to store all the accumulated water sufficiently long enough to settle out suspended sediment loads. Regular use of flocculating agents has kept discharges within licence limits. However, even the use of these agents does not totally avoid the circumstances of accumulating too much water in operational areas. As the Scheme develops it will eventually become a net importer of water and the frequency of these types of discharges will diminish.

The Corporation's direction in completed Scheme water management during DA2 has been to firm up identified design issues and to broaden its data and knowledge base for future studies. The flood studies are typical of this direction. Design issues have now been resolved and will be incorporated into subsequent construction plans for implementation. Recent announcements in the catchment have been made by the Government with regard to new estimated flood heights and possible upgrading of Warragamba Dam. While these matters may have implications for the Scheme they will not change the fundamental concept of the Scheme. Specific design issues, their possible implications and arrangements for resolution are matters to be negotiated between the Corporation and the Minister for Planning. Any necessary significant variation to the Scheme will be administered by way of variation to SREP No. 11 - Structure Plan. Resolutions of this matter lies outside the scope of this development application.

Similarly, the Corporation has been requested to examine the potential for using treated sewage effluent in the DA3 lakes. The Water Board has undertaken some preliminary studies regarding use of effluent as a source of supply to the lakes. These studies indicated that it may be feasible in respect of water quality behaviour. However, legal and commercial matters need to be addressed prior to changing Scheme principles. Again this matter lies outside the scope of this development application.

#### **2.4.5 Rowing Lake**

Works related to the development of an international standard rowing course within the Scheme are progressing in accord with plans presented in the DA Rowing Lake SEE.

These works commenced in December 1989 and were scheduled for completion by June 30, 1995. Current progress indicates that works will be completed slightly ahead of schedule.

The design and development of the Rowing Lake has been undertaken in close consultation with the international bodies administering rowing and canoeing, FISA and ICF respectively.

Attention was given to the rowing course foreshore design, in particular wave reflection and wave protection matters. Research, funded by the DSRR, provided economical solutions to a complex problem and designs were amended to incorporate the use of screened raw feed and slope angles changed to reduce the volume used. Results of the research were discussed with FISA and, with their concurrence, the design amendments were implemented.

Additionally, wind tunnel tests were undertaken at critical sites within the course to determine the fairness of the course and effectiveness of landscaping. The testing showed:-

- \* the alignment of the course to be correct,
- \* provision of a tree windbreak would enhance the all year round use of the course,
- \* two breaks in the southern landform would cause some anomalies across the lanes.

Arising from these tests it was decided to provide a windbreak around the entire course and to reshape the two breaks in the southern landform. The windbreak will involve the provision of an additional 5000 trees over and above the number of trees provided in general landscaping works.

#### **2.4.6 Education and Community Involvement**

The Scheme has generated significant interest locally, regionally, nationally and internationally. The Corporation has responded to this increasing interest in several ways:-

- \* an Open Day is held once per year for local residents
- \* facilities have been provided to accommodate lecture presentations
- \* providing staff to make presentations, answer questions etc.
- \* making available literature, brochures and other material

Approximately 30 secondary schools and tertiary institutions visit the Scheme per year along with numerous professional, business, community and environmental groups.

#### **2.4.7 Sydney Olympics**

The Corporation worked closely with Sydney Olympic 2000 Bid Ltd in preparing technical information, assisting in special functions and site tours associated with the successful bid for the 2000 Olympic Games. A preliminary design and cost estimate for a white water canoe course was prepared as a possible inclusion in the games.

Significant interest in the Scheme has been expressed since the announcement that Sydney will host the Games. The Corporation is continuing its close liaison with SOCOG to ensure the site is appropriately developed.

#### **2.4.8 Conclusion**

Development of the Scheme is progressing generally in accord with plans and concepts envisaged during the preparation of the Regional Environmental Study. The environmental safeguards are working, landforms and associated works are being undertaken in accord with agreed plans and specifications. Importantly, the supplies of sand and gravel to the Sydney market have been maintained while a valuable community asset is being developed.

The advent of the Rowing Lake has added a new dimension to the Scheme, in particular its relatively early completion will provide for active public participation in the Scheme concurrently with future quarry works

### 3. THE NEED FOR DA3 DEVELOPMENT

The need for approval of DA3 has to be considered in the context of the total sand and gravel resources estimated to be available in the Sydney region, future demand for these resources and the contribution made to them by the Penrith Lakes reserves. The demand for sand and gravel and the cost and availability of alternative supplies have a direct bearing on the need for this development application to be approved.

#### 3.1 SYDNEY'S REGION'S RESERVES

##### 3.1.1 Sydney Regional Environmental Plan No. 9 - Extractive Industry

In the early 1980's the NSW Government became increasingly concerned that changing land uses were, or had the potential to, sterilise many of Sydney's naturally occurring extractive resources. It undertook a major assessment of these resources and, where appropriate, took action to ensure the future uses of them. Such actions were detailed in SREP No. 9. Extractive Industry which was gazetted on October 17, 1986. The aims of this plan were to:-

- \* help develop extractive resources close to the Sydney metropolitan area so that the cost of supplying extractive materials to the community can be kept to a minimum.
- \* control the development of extractive industries on certain lands, and
- \* ensure that extractive industries are carried out in an environmentally acceptable manner.

It was foreshadowed that this plan be periodically reviewed as regional resources become depleted and additional resources are identified or refined. A major review of the plan is currently in progress. The Department of Planning released a draft plan (Draft SREP No. 9 (2) - Extractive Industry) in December 1993 for public comment. This document contains current information on regional resources and likely future demands for those resources.

Much of the following information is derived directly from the document associated with Draft SREP No. 9 (2). Acknowledgement of this is made at appropriate locations.

It should be noted that the provisions of SREP No. 9 do not apply specifically to the Penrith Lakes Scheme. Its resources are incorporated in a separate planning instrument - SREP No. 11. However, the continued supply of extractive material from the Scheme area is recognised as a significant contributor to management strategies promoted in SREP No. 9 and Draft SREP No. 9 (2).

It should be also noted that the Penrith Lakes Scheme area is regarded as a deposit capable of supplying both medium to coarse grained sand and hard rock aggregate. Overall Scheme production levels are primarily determined by marketing strategies adopted by the individual shareholders, having regard to their currently available alternative resources, market requirements and market location.

### 3.1.2 Sydney Reserves - Medium to Coarse Grained Sand

Draft SREP No. 9 (2) identified the reserves shown in Table 3

**TABLE 3.1**

**Estimated Sand Reserves  
(million tonnes)**

<b>Medium to Coarse Grained Sand</b>	<b>Secured</b>	<b>Total</b>
1. Penrith Lakes	53.2	53.2
2. Hawkesbury Nepean River		
* Penrith to Pitt Town	11.0	30.0
* Downstream of Pitt Town		46.5
3. Richmond Lowlands		114.0
4. Colo River		25.9
5. Berowra Creek		2.0
<b>Total</b>	<b>64.2</b>	<b>271.6</b>

**Friable Sandstone-Fine Medium to Coarse Sand**

1. Newnes Plateau	34.2	500.0+
2. Somersby Plateau	11.4	75.0+
3. Maroota	3.8	40.0
<b>Total</b>	<b>49.4</b>	<b>615.0</b>

**Notes:**

1. Not included in the above table are estimates for fine-medium sand and fine-medium clayey sand which are not produced at Penrith Lakes.
2. Secured reserves are identified reserves in company ownership that have development consent for extraction, or in the case of Penrith Lakes, company ownership with a separate planning instrument for extraction.
3. Total deposit size includes secured reserves, those in company ownership without development consent and those not in company ownership.

4. Friable sandstone varies in grain size from fine to coarse. It can be used as a substitute for both medium-coarse and fine-medium sands traditionally obtained from rivers, floodplains, estuaries and beaches. For this reason it has been included in the above table.

### 3.1.3 Sydney Reserves - Hard Rock Aggregates

Draft SREP No. 9(2) identified the reserves shown in Table 3.2

**TABLE 3.2**

**Estimated Hard Rock Aggregate Reserve  
(Million Tonnes)**

	Secured	Total
1. Sydney Region Quarries	9.5	9.5
2. Somersby Plateau Quarries	41.0	64.0
3. Penrith Lakes	80.0	80.0
4. Illawarra Region Quarries		
Existing	77.5	161.0
Potential	59.0	2119.0
<b>Total</b>	<b>276.0</b>	<b>2433.5</b>

**Notes:**

1. Definition of reserves is same as Table 3.1.
2. Richmond Lowlands contains substantial resources of hard rock aggregate, but is primarily regarded as a sand resource and is not included in Table 3.2

### 3.2 THE RESERVES OF THE SCHEME AREA

The Scheme area is generally underlain by the Ashfield Shale, which forms an approximately horizontal east-west basement sloping downward from the south to the north. A gravel and sand horizon (which forms the resource deposit) has been laid down by the Nepean River in a layer of about 6-8m thick. Overlying the sand and gravel is a layer of sands, sandy silts and some clays 6-8m thick which forms the overburden. The total depth of the extractable material plus overburden is about 14-16m. While the total strata depth is fairly uniform across the area, there is considerable variation in depths of sand and gravel, and overburden.

The sands and gravels in this deposit are suitable construction materials for a range of uses, but are particularly suited as aggregate for high quality concrete with about 70% being consumed in pre-mixed concrete. A further 20% is used in asphalt manufacture. As the reserves of sand and gravel are intermingled, these materials must be extracted and marketed together.

As at December 1993, reserves of gravel were estimated to be 76.7 million tonnes, with 51.1 million tonnes of medium to coarse grained sand, giving a total reserve of 127.8 million tonnes. The proportion of reserves within the Scheme are determined on a 60:40 split. There is no firm data on which this split is based, other than applying general past data to future extraction areas.

In the deposit, fine sand occurs in both the overburden overlying the sand and gravel, and within the sand and gravel itself. The fine sand in the overburden is uneconomical to process and sell. In the sand and gravel deposit, it can be processed out and sold as fine sand for various purposes, although this accounts for a very small fraction of the total product.

Within the Scheme area's gravel bearing lands, 66.5 hectares or about 3% of the total area is privately owned by parties other than the Corporation. If the reserves of these private lands are not extracted, substantial limitations would be placed on the design of the final landforms of the preferred Scheme. Consultations between the private property owners and the Corporation will continue.

### 3.3 SHORT-TERM DEMAND FOR SAND AND HARD ROCK AGGREGATE

Factors affecting the future demand for sand and hard rock aggregate products are complex. Short term demands are generally affected by market fluctuations in the building and construction industries, while long-term demands are more influenced by population growth and variations in per capita consumption.

Scheme extraction rates, shown in Table 2.1, exhibit a high degree of variability which has been generally in response to building and construction industry fluctuations. General growth in Scheme extraction rates is also derived from demands for higher quality products which are not able to be supplied from other existing quarries.

Draft SREP No. 9(2) provides forecasts for future demands as:-

**TABLE 3.3**

**Demand for Sand and Hard Rock Aggregate  
(Million Tonnes)**

	Sand		Hard Rock Aggregate (Sydney Region)
	Low	High	
1993/94	5.23	5.23	7.70
1994/95	5.23	5.29	7.72
1995/96	5.23	5.35	7.74
1996/2001	26.15	27.60	38.94
2001/2006	26.15	29.04	39.39
2006/2011	26.15	30.49	39.83

Draft SREP No. 9 (2) also indicated that in 90/91 the proportion of medium-coarse grained sand of the total sand market was 44.3% and that 34.2% of the total market was supplied from the Penrith Lakes deposit. For the same period the Penrith Lakes deposit supplied about 65% of the hard rock aggregate produced in the Sydney Region.

Based on the above information and combining the two products, the following demand for medium-coarse grained sand and hardrock aggregate is estimated.

**TABLE 3.4**

**Demand for Medium Coarse Grained Sand and Hard Rock Aggregate  
(Million Tonnes)**

	<b>Medium Coarse Grained Sand</b>	<b>Hard Rock Aggregate</b>	<b>Total</b>
1994/95	2.33	7.72	10.05
1995/96	2.34	7.74	10.08
1996/97	2.35	7.75	10.10
1997/98	2.37	7.76	10.13
1998/99	2.38	7.79	10.17
1999/00	2.39	7.81	10.20
2000/01	2.41	7.83	10.27
2001/02	2.42	7.85	10.27

Production levels shown in Draft SREP No. 9(2) for the period 90/91 from the Penrith Lakes deposit was:-

* medium coarse grained sand	1.764 million tonnes
* hard rock aggregate	<u>3.159</u> million tonnes
<b>Total</b>	<b>4.923 million tonnes</b>

This compares to a reported extraction rate for 5.8 million tonnes from Penrith Lakes (Table 2.1). The reason for the difference is related to:

- \* tailings component (approximately 8% waste is generated when the raw feed is washed).
- \* stockpile adjustments to opening and closing stocks

To compare Penrith Lakes extraction rates with demand an adjustment is required for these factors. Stockpile adjustments occur at discrete annual intervals and need not to be accounted for over long periods. Tailings must be accounted for to factor product quantities to extraction quantities.

Draft SREP No. 9 (2) showed that for 90/91, of the market (7.1 million tonnes) which can be supplied by Penrith Lakes, it supplied 4.923 million tonnes or almost 70% of the market.

If this proportion is to be maintained then expected demand from the Penrith Lakes deposit could be as shown in Table 3.5

**TABLE 3.5**

**Potential Demand from Penrith Lakes  
(Million Tonnes)**

	<b>Table 3.4 Demand</b>	<b>Proportion of Market (70%)</b>	<b>Raw Feed Requirement (Tailings 8%)</b>
1994/95	10.05	7.04	7.65
1995/96	10.08	7.05	7.66
1996/97	10.10	7.07	7.68
1997/98	10.13	7.09	7.68
1998/99	10.17	7.12	7.74
1999/00	10.20	7.14	7.76
2000/01	10.24	7.17	7.79
2001/02	10.27	7.19	7.81

The nature of the Penrith Lakes deposit requires that commercial matters must be considered in determining supply arrangements. As stated in section 3.2 the sand and gravel is intermingled throughout the raw feed. Past experience shows the approximate proportion of sand to gravel is about 40:60. If the total demand from Penrith Lakes, as estimated in Table 3.5, is to be satisfied then extraction levels of 7.65 million tonnes in 94/95 will produce 4.22 million tonnes of gravel and 2.82 million tonnes of sand.

Gravel production of 4.22 million tonnes will be less than total demand of 7.72 million tonnes (Table 3.4). However, sand production of 2.82 million tonnes exceeds total demand of 2.33 million tonnes (Table 3.4). At this stage, sand then determines the commercial strategies of the shareholders by balancing rates of extraction from Penrith Lakes with resources available from other deposits.

The Corporation is currently investigating methods to assess the ratio of sand and gravel in future extraction areas. A result of this investigation might be the determination of development application areas based on deposit quality matched to estimated component demand. At this stage future development applications are based

on quantity, with shareholders balancing component requirements against market using both Penrith Lakes and alternative resources. The basis of this DA3 application is quantity. Should these investigations determine that quality be the major issue and that appropriate quality resources lay outside the DA3 boundary, then a fresh development application for an alternative to the currently proposed DA3 might be lodged. It is expected that these investigations and resultant considerations will be finalised within the next 2 years.

The raw feed requirements determined in Table 3.5 need to be adjusted to account for commercial strategies. The Corporation adopted a 2% growth rate over 93/94 extraction levels as the basis for its planning of future works. Adopted rates compared with market determined rates (Table 3.5) are shown in Table 3.6.

**TABLE 3.6**

**Adopted Extraction Rates from Penrith Lakes  
(Million Tonnes)**

	<b>Adopted</b>	<b>Table 3.5</b>	<b>Difference</b>
1994/95	4.80	7.65	2.85
1995/96	4.90	7.66	2.76
1996/97	5.00	7.68	2.68
1997/98	5.09	7.70	2.61
1998/99	5.20	7.74	2.54
1999/00	5.30	7.76	2.46
2000/01	5.40	7.79	2.39
2001/02	5.50	7.81	2.31

The base used in determining the adopted figures is extraction levels for 1993/94 and probably better reflects current commercial marketing strategies than the 1990/91 figures used to determine Table 3.5 extraction rates. The difference between the two methods of assessment will be strongly influenced by these strategies and the ratio of sand to gravel in the future extraction areas. Table 3.6 has been adopted as the basis for DA3.

**3.4 CONSEQUENCES OF NO APPROVAL OR DELAY IN APPROVAL OF DA3**

As at June 30, 1994 there will be approximately 5.6 million tonnes of raw feed remaining in the DA2 area. This material is not available to all three shareholders. The resources being extracted in the eastern area as part of the Rowing Lake works

are accessible to Pioneer only. Deposits to the north west are being worked by Boral and CSR. It is the north west deposits which determine the timing of DA3.

It is estimated that the <sup>DA2</sup> DA3 north west deposits will be totally extracted by June 1995. Stripping of overburden in DA3 must commence no later than January 1995 in order to maintain a safe level of pre-stripped reserves available for extraction. This requires that DA3 must be determined no later than December 1994, in order for the Scheme to continue to provide sand and gravel to the Sydney market. The above timing is based on current knowledge of remaining resources and current extraction rates. Recent works indicate that there may not be as much raw feed in the north west area as first expected. Should this prove to be the case then DA3 will need to be determined much sooner than December 1993, probably by August 1993.

The proposed development for DA3 is an orderly extension of works already undertaken by the Corporation and is consistent with the overall development of the Penrith Lakes Scheme. Chapter 2 details the performance of the Corporation in terms of environmental management and Scheme development. It demonstrates that Scheme development is progressing generally in accord with plans and concepts, environmental safeguards are working and sand and gravel supplies are being maintained to the Sydney market. Chapter 3 highlights the significance of the Penrith Lakes deposit in terms of contribution to the Sydney market for medium-coarse grained sand and hard rock aggregate. In 90/91 it supplied 70% of Sydney market for products available from the Penrith Lakes deposit.

If approval to this development application is not granted, or if it is delayed, there would be a number of serious economic and environmental consequences. Draft SREP No. 9 (2) identifies possible alternative sources of supply.

- |                                   |   |
|-----------------------------------|---|
| * Medium-coarse grained sand      | - Hawkesbury Nepean River<br>- Richmond Lowlands<br>- Colo River    |
| * Friable sandstone as substitute | - Newnes Plateau<br>- Somersby Plateau<br>- Maroota                 |
| * Hard rock aggregate             | - Somersby Plateau<br>(Kulnura / Peats Ridge)<br>- Illawarra Region |

It should be noted that Draft SREP No. 9 (2) did not consider Richmond Lowlands as a potential source of hard rock aggregate.

If there is a delay, consequences will depend on the extent of delay. Pre-stripped reserves can continue to be extracted but no further reserves will be exposed. Reduction in pre-stripped reserves leads to unsafe working conditions. Prior to the pre-stripped reserves being totally exhausted, the Corporation shareholders would implement contingency plans to continue supply from existing sources. In respect of sand, this would involve increased productions from Hawkesbury Nepean River, Newnes Plateau, Somersby Plateau or Maroota. In respect of hardrock aggregate, supply would be from Somersby Plateau or Illawarra Regional quarries.

If this development application is not approved then the market would need to be satisfied from alternative sources, albeit applications would need to be lodged for those which are not secured at present. In respect of sand, Richmond Lowlands and Colo River are potential sources, while extension of Hawkesbury Nepean River deposits, Newnes Plateau, Somersby Plateau or Maroota deposits are also possible. Choices for hard rock aggregate are limited to the Somersby Plateau and quarries in the Illawarra Region.

In either case, consequences of delay or non approval are similar, increased cost of supply or increased pressure for development on other deposits. Infra-structure already exists for the Penrith Lakes deposit to supply more than 5 million tonnes of product annually. At this level of production there is approximately 600 truck loads per day leaving the Penrith area. These truck movements would be transferred to routes associated with other deposits, most of which are not capable of supporting such traffic loads. The Richmond Lowlands, Maroota and Hawkesbury Nepean River deposits are in environmentally sensitive areas and careful consideration will need to be given to their potential development. Development of other areas will increase the cost of supply as they are much more remote from the market. In economic terms, it is estimated that if other sources had to be used, the cost of pre-mixed concrete would increase by more than 20%, which will cause substantial increases in building costs.

This development application is an orderly and logical extension of an existing development. The likely environmental and economic consequences of being forced to use other sources make the approval of this development application essential if building and construction in the Sydney metropolitan area are to continue without interruption.

#### 4. THE PROPOSED DEVELOPMENT

##### 4.1 EXTENT OF THE PROPOSAL

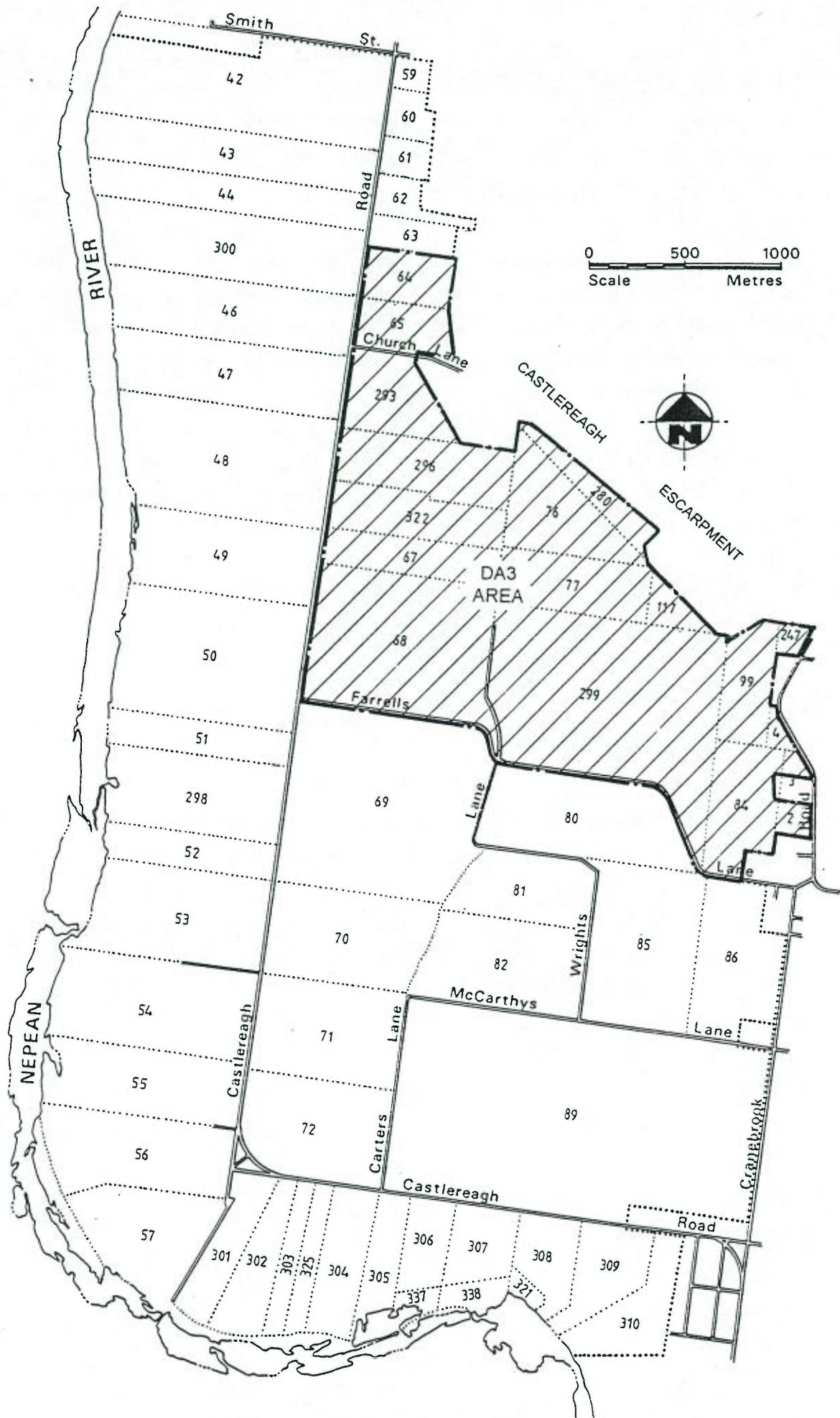
The extent of this development application to enable continued quarrying and rehabilitation work is shown in Figure 4.1. It covers a total area of about 407 hectares. The size and boundaries of the DA3 area are in accordance with the staging of the overall Scheme presented in the Planning Report associated with the Draft SREP No. 11 - Penrith Lakes Scheme.

The boundaries of the DA3 area are formed by the northern boundary of the DA2 (Farrells Lane) in the south, the Castlereagh escarpment in the east, Castlereagh Road in the west, and a private property in the north.

It is estimated that the DA3 area will yield in the order of 35 million tonnes of sand and gravel, sufficient to meet the Penrith Lakes deposit's contribution to the Sydney market for about seven years (see Table 3.6).

Table 4.1 and Figure 4.2 contain property details for lands included in this application. Within this area about:-

- \* 286 hectares of land will be new extraction and rehabilitation areas,
- \* 77 hectares of land has already been quarried under previous consents and will be subjected to rehabilitation works.
- \* 44 hectares of land have been included in this development application although not required for quarry purposes, some may be required for rehabilitation purposes.



PROPOSED DA3 AREA

FIG. 4.1

TABLE 4.1

**Property Details for DA3 Area  
(Refer to Figure 4.2)**

<b>Land</b>	<b>Title Reference</b>	<b>Area (ha)</b>	<b>Description</b>
<b>PLDC Land</b>			
1. Pt.Por 64	F/I 111/589818	7.052	Lot 111 DP 589818
2. Pt.Por 117	F/I 16/605777	5.333	Lot 16 DP 605777
3. Por. 4	F/I 4/752021	1.998	Por 4
4. Pt.Pors 84,3	F/I 3/235324	2.023	Lot 3 DP 235324
5. Pt. Por. 84	F/I 1/501273	2.023	Lot 1 DP 501273
6. Por.66 rem	Conv.No 423 Bk 3659	0.404	Por. 66
7. Pt.Por 64,65	F/I 2/574481	16.180	Lot 2 DP 574481
8. Pt.Por 293	F/I 5/229536	0.320	Lot 5 DP 229536
9. Pt. Por 67 rem	F/I 1/973311	17.307	Lot 1 DP 973311
10. Pt.Por 293	F/I 1/229536	20.230	Lot 1 DP 229536
11. Por. 296	F/I 296/752021	26.620	Lot 296 DP 752021
12. Pt.Por 299	F/I 299/752021	94.750	Lot 299 DP 752021
13. Pt.Por 299	Vol 15429 Fol 195	3.617	Lots 1-3 DP116802 (closed roads)
14. Por.322	F/I 322/752021	19.990	Lot 322 DP 752021
15. Pt. Pors. 76, 77 & 280	Vol. 8094 Fol. 226	39.082	Pt. Pors. 76, 77, &280
16. Pt. Por 77	F/I 13/2223	24.320	Lot 13 DP 2223
17. Pt.Por 68	Conv.No 117 Bk 2588	40.634	Pt.Por 68
18. Pt. Por 68	F/I 1/69147	30.319	Lot 1 DP 69147
19. Por 99	Conv.No 162 Bk 2814	16.187	Por. 99
20. Pt.Pors 84 & 3	F/I 2/235324	6.534	Lot 2 DP 235324
21. Pt. Pors 84 & 2	F/I 2/519892	18.280	Lot 2 DP 519892
	<b>Subtotal</b>	<b>393.203</b>	
<b>Crown Land</b>			
<b>Land</b>		<b>Area (ha)</b>	<b>Description</b>
24. Por. 247		2.150	R63860 Reserve of Water Supply and Resting Place
25. Church Lane North Por 66 and Lot 1 DP 229536		0.494	Confirmed Parish Road
26. Farrells Lane east of DP 375804		5.650	Crown Subdivision Road
27. Thornleys Lane		1.370	Public Road
28. Road west of Por 117		0.564	Non Public Crown Road
29. East-west Road in Por 299		0.380	Non Public Crown Reserved Road
30. Road between Por. 84 and 299		1.366	Non Public Crown Reserved Road
31. Bed of Lagoon adjoining south east south east corner of Por. 68		0.360	Cranebrook Creek
	<b>Subtotal</b>	<b>12.334</b>	

### Dedicated Public Roads

Land	Area (ha)	Description
32. Church Lane	0.170	Pt.Por 293 being Pt.Lot DP 229536
33. Farrells Lane	0.14	Pt.Por 80 being Lot 1 DP 400734
34. Farrells Lane	0.06	Pt.Por 69 being Lot 1 DP 399425
35. Castlereagh Road	0.165	Pt.Por 64 being Lot 28 DP 234746
36. Castlereagh Road	0.349	Pt.Por 64 & 65 being Lot 27 DP 234746
	-----	
<b>Subtotal</b>	<b>0.884</b>	

### Uncategorised Lands

Land	Area (ha)	Description
23. Pt. Pors 76, 77 and 117	0.147	See notes below
	-----	
<b>TOTAL</b>	<b>406.568</b>	

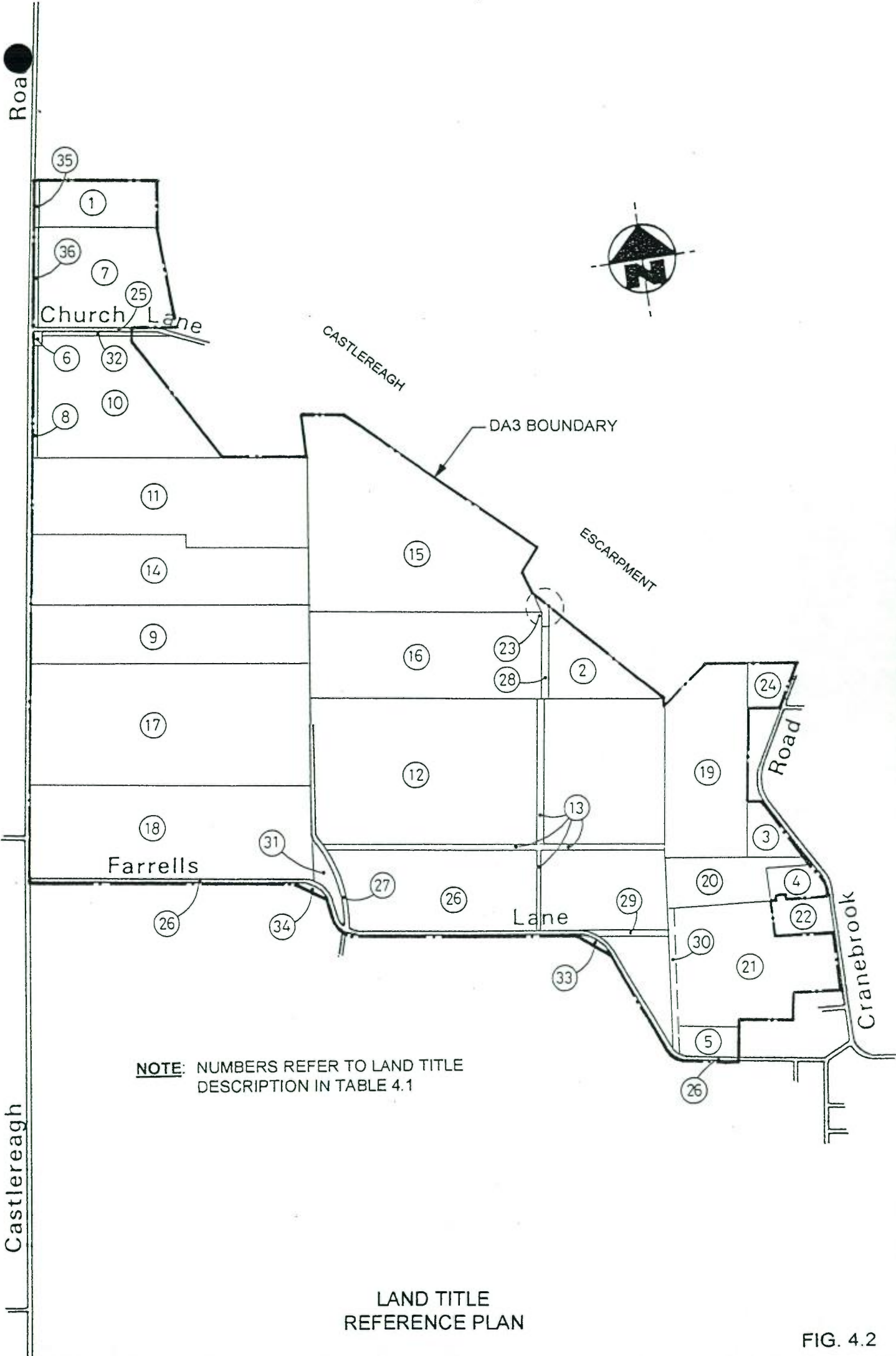
Within the DA3 area, all freehold land is owned by the Corporation or its shareholders, with the exception of lands detailed below. The northern boundary of the DA3 area was determined by the fact that Portion 63 is in private ownership and acquisition by the Corporation was not possible at this stage. Similarly, negotiations for the purchase of Part Portion 3 on the eastern boundary adjoining Cranebrook Road were not successful at the time this application was being prepared. This property has been excluded from this development application. If negotiations on these properties are successful in the future then a fresh development application will be lodged for their inclusion in DA3.

About 13.2 hectares of land within the DA3 area is under the ownership of the Crown and/or Council. The Corporation will negotiate with the appropriate authorities for the inclusion of these lands within the DA3 area.

A detailed search was undertaken of the small parcel(s) of land, listed as "Uncategorised land" in Table 4.1. These titles totalling 0.147 hectares, have been fragmented after subdivision, provision of roads and the like. The search revealed the three owners as:-

- \* Old System Title, Con.Bk 77 No. 116 Joseph Daniel Single, February 25, 1862.
- \* Part Por. 77 Old System Title, Deed of Settlement Book 1, No. 267-Martha Foxlowe Hoskings June 11, 1842.
- \* a parcel of Crown Land for which no grant or folio was ever issued.

The Corporation will discuss the inclusion of this small parcel into DA3 with the Department of Conservation and Land Management and the Department of Planning. Its inclusion for quarry purposes is not essential but is important for proposed rehabilitation works.



**NOTE:** NUMBERS REFER TO LAND TITLE DESCRIPTION IN TABLE 4.1

LAND TITLE REFERENCE PLAN

The DA3 works, described in detail in the following section, provides for the closure of Farrells Lane between Cranebrook Village and Castlereagh Road, and the relocation of the western end of Church Lane.

#### 4.2 RELATIONSHIP TO THE OVERALL SCHEME

The overall Scheme design as defined in SREP No. 11 - Penrith Lakes Scheme - Structure Plan represents the broad framework for the implementation of the Scheme through to its completion. The main features of the Scheme are a large main lake intended for a variety of recreational activities complemented by several smaller lakes which will provide for both recreational and conservation activities. When fully implemented, the Scheme will include both land-based recreation and potential future urban areas located in the eastern part of the Scheme area adjacent to Cranebrook Village. An immediate benefit of the Scheme is the completion of the rowing/canoeing course. This precinct will be dedicated, and available for public use, in June 1995.

The Corporation has sought amendments to the SREP No. 11 - Penrith Lakes Scheme - Structure Plan, firstly to account for inclusion of the rowing course. More recently, an amendment to the Structure Plan was sought to account for results of detailed technical studies and the consequences to landforms arising from unexpected inconsistencies in the sand and gravel formation. The proposed amended Structure Plan is shown in Figure 1.1. It is apparent that the Scheme design is a dynamic process which must account for variations in assumptions/estimates as time and development progresses.

An orderly sequence of extraction and rehabilitation is required to achieve the progressive construction of the lakes and landforms. Factors that were considered and are subject to regular review, in the development of the sequence of extraction and rehabilitation included the following:-

- \* public access to completed stages should be available as soon as practicable after completion of quarrying and associated works, but should not be allowed to uncompleted stages,
- \* Castlereagh Road should be retained in its present position until the requirements of extraction require its relocation. The proposed route for relocation of Castlereagh Road must be extracted and rehabilitated prior to the relocation of the road.
- \* stockpiling and double handling of overburden should be avoided where possible.
- \* raw feed haul distances and routes should be chosen to minimise cost and possible environmental impacts.
- \* roads for the haulage of raw feed must be able to reach the various plants by direct routes, free of public access and without interfering with the Rowing Course.
- \* the raw feed quality north of Farrells Lane will be of similar consistency as south of Farrells Lane.

- \* areas adjacent to the Scheme boundaries should be quarried as early and as quickly as practicable to ensure that impacts of quarrying and rehabilitation are quickly reduced, and that benefits of the Scheme are offered as early as possible to adjoining landholders.
- \* the Scheme must be affordable to maintain the viability of the Scheme.
- \* internal road access for private landowners within the total Scheme area, and access to the Church and cemeteries need to be maintained.
- \* commitments given in the formulation of SREP No. 11 related to overall development and staging.

Based on consideration of these factors, the third stage (DA3) of the Scheme's development is immediately to the north of the second stage (DA2). Its area and configuration being determined by local and time related issues.

#### 4.3 STAGING SEQUENCE WITHIN THE DA3 AREA

Within the DA3 area, a sequence of quarrying and rehabilitation has been formulated which is consistent with both the factors influencing the overall sequence for the Scheme and factors which apply at a more detailed level of planning, namely:-

- \* the need to rationalise quarry areas for the three shareholders, consistent with timing issues related to commitments for the Rowing Lake, optimisation of raw feed and overburden haulage and site constraints.
- \* staging and location of quarrying operations so that areas are extracted at the appropriate time to permit sequential fill operations without the need to stockpile.
- \* the need to schedule operations to ensure any impacts on adjoining neighbours are minimised.

Based on these considerations, an eight stage plan has been developed for the DA3 area which is illustrated on Figure 4.3. The first stage, immediately north of Farrells Lane is designed to hold CSR/Boral until such time that Pioneer has completed commitments for Rowing Lake works and are ready to move to the DA3 area proper.

Once the three shareholders are present in the DA3 area the principles underlying the sequence become:-

- \* minimising the amount of time neighbours are exposed to quarry operations.
- \* exposing appropriate quantities of fill areas, and
- \* scheduling the rehabilitation of previously quarried areas.

In general, the principal thrust of the sequence is to extract and rehabilitate along the eastern boundary as quickly as possible to minimise potential adverse impacts. This sequence recognises the transient nature of the operations, those nearby will be affected, but the level of disruption will be reduced as the operations move further away.

Road

Castlereagh

Church Lane

STAGE 7

STAGE 6

STAGE 5

STAGE 4

STAGE 8

STAGE 1

Farrells

Lane

STAGE 2

STAGE 3

Road

Cranebrook

CASTLEREAGH

DA3 BOUNDARY

ESCARPMENT

AREA NOT SUBJECT TO EXTRACTION WORKS



STAGING SEQUENCE PROPOSED FOR DA3 AREA

The overburden stripped during the various sequences will be used to construct landforms appropriate for the completed Scheme. Within the DA3 boundary there is approximately 14 million cubic metres of overburden. The current Structure Plan requires 22 million cubic metres of overburden to complete the desired landforms. The deficit of 8 million cubic metres is scheduled to be supplied from the next stage of development, west of Castlereagh Road. This matter is further discussed in section 4.6.

The incremental and cumulative amounts of raw feed and overburden expected to be generated from each stage are shown in Table 4.2. These amounts represent sufficient raw feed to meet projected Scheme contributions to the Sydney market for sand and hard rock aggregate, and to allow a balanced earthworks programme detailed in the next section.

**TABLE 4.2**

**Projected Raw Feed and Overburden by stages in DA3**

Stage	Raw Feed ('000 tonnes)		Overburden ('000m <sup>3</sup> )	
	Incremental	Cumulative	Incremental	Cumulative
1	2000	2000	1760	1760
2	2500	4500	1190	2950
3	5000	9500	2200	5150
4	5100	14600	1280	6430
5	5300	19900	1100	7530
6	5400	25300	1490	9020
7	5400	30700	2400	11420
8	3900	34600	2550	13970

Features of the proposed staging within DA3 are summarised in Table 4.3. It should be noted at this stage, that Scheme plans and commitments are based on information known at the time. Based on DA2 experiences, these plans and commitments must be adjusted in accord with practical realities. As quarry operations proceed, the extent and nature of material for rehabilitation becomes visible and day to day decisions must be made within the context of overall commitments and within keeping the Scheme affordable. For this reason the above figures can be only used as a guide within the context that it is the Corporation's intention to quarry the entire area and build landforms consistent with the overall Scheme design using the volumes of overburden which are available. Significant inconsistencies within the overall strata need to be evaluated with the context of urgency related to quarry activities and overall commitments related to Scheme design.

Within the staging framework described above, and commitments to the Scheme's development, detailed rehabilitation plans will be developed each two years as the nature and extent of operations in the previous stage will affect the detailed planning of the next stages. These plans, to be submitted to the Department of Planning, will include design plans related to the various components of the overall Scheme, including landscape and engineering plans. Based on the timing of DA2 approval it is intended that the two year interval is maintained. Accordingly, detailed plans associated with the first stage of DA3 works will be submitted in November 1994 for the period February 1995 to March 1997.

TABLE 4.3

Summary of features of proposed staging sequence within DA3.

Stage	Extraction	Haulage	Overburden/ Construction of Landforms	Other Actions
1	Immediately north of Farrells Lane (Boral & CSR only)	Access to plants via existing haul road adjacent Castlereagh Rd. Construct east-west haul road to Cranebrook.	Bulk fill used to complete previously quarried areas immediately north Farrells Lane.	Dewater existing lakes north of Farrells Lane. Close Farrells Lane and divert Farrells creek.
2	Just north of Cranebrook Village.	All three shareholders operating in area. Haul road from area to Pioneer plant constructed.	Fill used locally to construct final landforms and to fill previously quarried area adjacent escarpment.	Dewater old pit adjacent Escarpment.
3	Adjacent Escarpment north west of Cranebrook Village.	Construct haul road north of portion 299 to link with road adjacent Castlereagh Road.	Complete lake immediately north of Cranebrook Village.	
4	North Portion 299 and adjacent to Escarpment.	Extend Pioneer haul road.	Landforms adjacent Escarpment in Stage 3 extraction area.	
5	North Portion 299 adjoining Stage 1 in the South.	Pioneer to haul on road adjacent Castlereagh Road.	Landforms adjacent Escarpment in Stage 3 and 4 extraction area.	Close and rehabilitate Pioneer haul road
6	West of Stage 5 adjoining Stage 1 in the South.	Extend haul road adjacent Castlereagh Road	Landforms adjacent Escarpment in Stage 4 and 5 extraction area	
7	West of Stage 6.	All haulage via road adjoining Castlereagh Road	Landforms adjacent Escarpment in Stage 5 and 6 extraction areas.	
8	West of Stage 7 and adjoining Castlereagh Road.	All haulage via road adjoining Castlereagh Road.	Landforms adjacent Escarpment in Stage 6 and 7 extraction areas.	

#### 4.4 EXTRACTION / STRIPPING OPERATIONS

It is proposed that the extraction operations would be a continuation of current operations using similar plant and equipment.

Topsoil would be stripped as a separate open - bowel scraper operation prior to overburden stripping and would be transported directly to specific rehabilitation locations for immediate placement. Some stockpiling of topsoil might be necessary where rehabilitation has not been completed or landforms are not intended to be constructed to its final profile. Any stockpiling would be for a short period of time (less than 4 weeks) in order to maintain the productivity of the soil.

Overburden would be stripped by open - bowled scrapers in general. There may be circumstances where trucks and excavators are used. The overburden would be stripped to provide sequential blocks for the winning of raw feed. The margin by which the stripping of overburden precedes the extraction operations allows for factors such as wet weather, continuity of stripping and safe working conditions. The stripping of overburden would precede the extraction of gravel by an area equivalent to approximately six months raw feed supply.

The Corporation currently runs two separate pits to supply its three shareholders with raw feed. Boral and CSR work a common pit in the north - west section of the DA2 area while Pioneer work an area immediately east of their plant in the south east corner of the DA2 /Rowing Lake area. It is intended that during the course of DA3 one pit be developed, primarily to extract material in the noise sensitive areas as quickly as possible, while keeping haul road distances minimised. Front end loaders and excavators are used to extract and load the raw feed into fleets of off-highway trucks. Typical haulage arrangements are shown in Figure 4.4 No raw feed will be hauled on public roads.

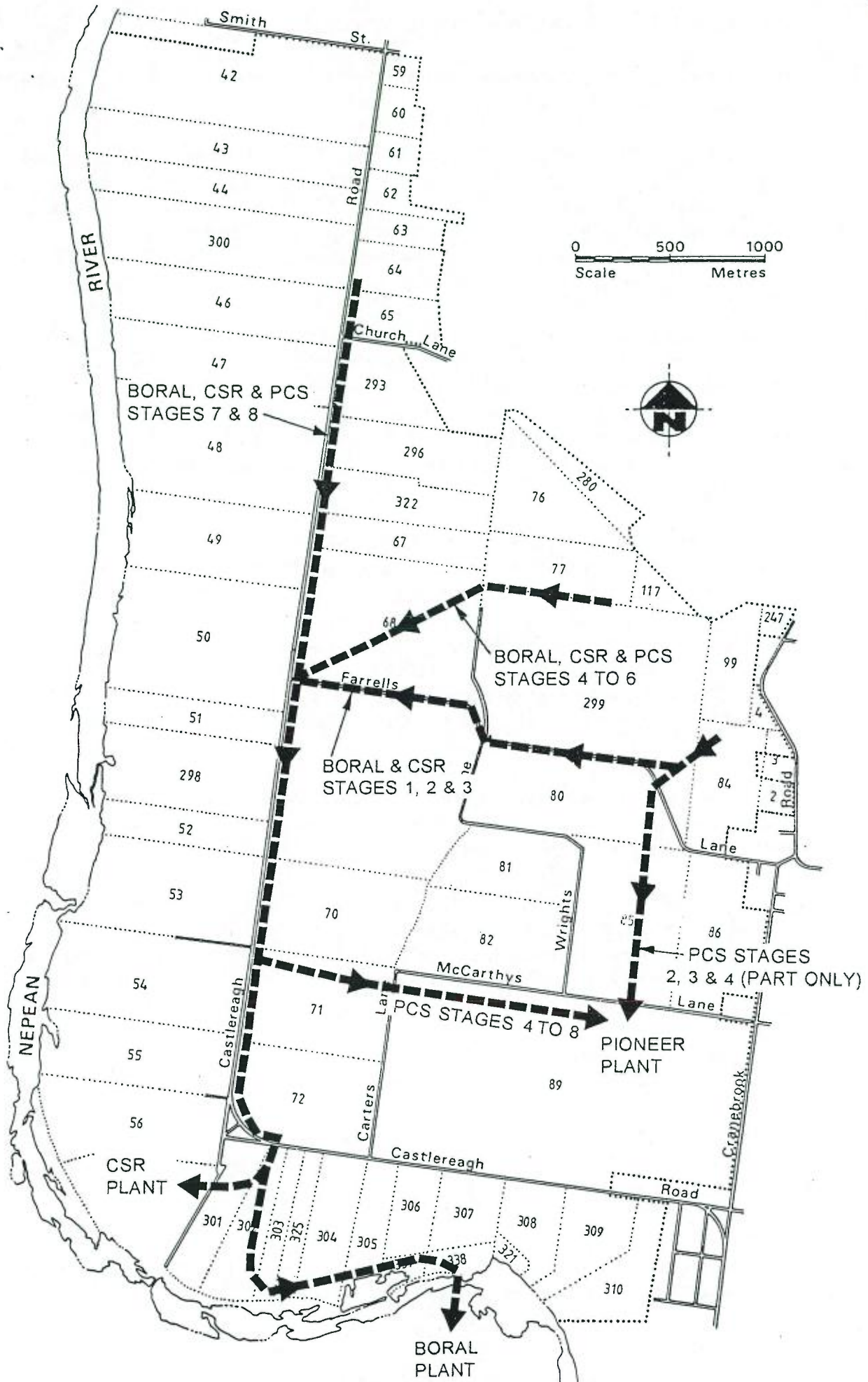
An excavator would win and load the lower, wetter sand and gravel layers, while front end loaders would win and load the drier, more sandy layers. This system provides the blend of raw feed necessary for the processing plants.

In response to increasing haul road distances, shareholders have reviewed, and will continue to review, in their in-pit and haulage operations. Recently a full face shovel was introduced into the system and haul trucks are being loaded from the shale floor. There has been a general move to increase the size of haulage trucks. The average number and type of equipment used in the excavation, loading and haulage operations are:-

* excavators	2
* shovel	1
* front-end loaders:	2
* off highway trucks (50 - 85t capacity)	14

These numbers vary to meet maintenance schedules, peak workloads and variations in haul distances.

Overburden stripping operations are undertaken by contractors. The size and mix of the equipment fleet varies depending on production requirements, material type, operating



HAUL ROAD ARRANGEMENTS

FIG. 4.4

conditions, haul distance and overburden depth. A typical mix of equipment is:-

*	bulldozers	2
*	open-bowled scrapers	6
*	compacters / rollers	2
*	graders	2
*	watercarts	2

Operating hours differ between companies and are varied to meet demand requirements. Generally one shift is worked, but during peak demand periods, two shifts have been worked. Proposed hours of operation are:-

*	sand and gravel extraction	6.00am to 7.00pm Monday to Saturday
*	overburden removal	7.00am to 7.00pm Monday to Saturday

No extraction or stripping operations would be undertaken on Sundays or Public holidays.

The companies will vary actual operating hours within these time bands to suit circumstances.

As mentioned in Section 2.4.2, overburden stripping operations are susceptible to disruption by prolonged periods of wet weather. To maintain safe gravel extraction conditions, it may be necessary to run the overburden removal operations outside the above time band. This was the case in DA2 for relatively short periods, five months in 1989 and six months in 1990. In these circumstances the Corporation must lodge an application to vary the hours of operation with the Department of Planning and the Environmental Protection Agency. Such applications must detail the reason for variation and be accompanied by a detailed assessment of potential noise impacts and proposed ameliorative measures, if necessary. The two periods in DA2, extended operations through until 11.00pm and were undertaken without any adverse noise impact.

The location of operations near Cranebrook Village and along the Escarpment will require special consideration with regard to noise impacts. An option to minimise impacts is to control the working hours in particular locations within the quarry. This matter further discussed in Section 6.1

#### **4.5 TAILINGS MANAGEMENT**

Raw feed extracted from the Scheme area is washed in the processing plants to remove clay and silt materials. This washing produces residues known as tailings. These are usually piped to a special pond where clay, silt and fine sand are allowed to settle. Surplus water is then re-cycled to the washing operations in the processing plants.

As mentioned in Section 2.4.2, the Corporation is responsible for the operations and maintenance of tailings within the Scheme. An initial settlement pond has been established at the individual processing plants. This settlement pond is used to collect

tailings at the plant and form part of the wash water re-cycle system. A dredge operates full time within the Scheme, rotating between individual settlements ponds. It removes tailings from these ponds and disposes of them in an area specially set aside for the ultimate disposal of tailings. This area is located in the southern portion of the Scheme between Castlereagh Road and the Nepean River. The total area south of Castlereagh Road was quarried as part of DA1 works and previous consents, and provides about 110 hectares for continued disposal of tailings until Scheme end. There is sufficient storage volume contained within this area to hold the estimated total volume of tailings which will be produced by the processing of the remaining raw feed.

Tailings do not settle uniformly. Coarser particles settle first, close to the tailings discharge point, while other finer particles settle very slowly and further from the outlet. The particles gradually consolidate under their own weight. Although the tailings become firmer as they dry and consolidate, it can take several years for a tailings area to drain and consolidate sufficiently to support vehicular traffic. Potential for future land use of the tailings area is therefore limited. Several techniques are available for promoting a faster drying rate and enhancing consolidation rates.

Within a limited range of practical options, the Corporation arranges the tailings discharge points to be relocated within the disposal area at fairly regular intervals. This allows for a more even distribution of particles, prompting a more uniform settlement over the area. Surplus water is removed from the pond by pumping to the plant settlement ponds at nights. This will aid the consolidation rate and promote earlier use of the tailings area.

During DA3 it is expected that approximately 2.3 million cubic meters of tailings will be produced by the processing of 35 million tonnes of raw feed. The current configuration, which utilises the eastern section of the tailings area south of Castlereagh Road, does not have sufficient capacity to retain all of these tailings. It will need to be modified towards the end of DA3 to commence tailings disposal in the western section of the area. The form that works associated with this modification are to take is best determined just prior to the need to modify the works. This will allow proper consideration of constraints and operational requirements prevailing at that time.

## **4.6 REHABILITATION**

### **Scope of Works**

In Section 4.3 mention was made of the fact that within the DA3 area there is approximately 8 million cubic metres deficit between the volume of overburden required to construct Structure Plan landforms and the volume of overburden available. To construct the landforms in accord with the Structure Plan it will be necessary to import overburden from subsequent stages of the Scheme, generally the areas west of Castlereagh Road.

This feature imposes limitations on the scope of works that can be undertaken within DA3. The Corporation adopted the following approach in assessing rehabilitation priorities for DA3:-

- \* It is essential that final landforms for the eventual relocation of Castlereagh Road be constructed during DA3.
- \* Overburden already placed by previous operations to remain in place.
- \* Landforms in noise sensitive areas be completed.
- \* DA3 landforms to be consistent with Structure Plan landforms and facilitate their eventual construction to Structure Plan design.
- \* DA3 landforms to be constructed in accord with usual stability and erosion control provisions.

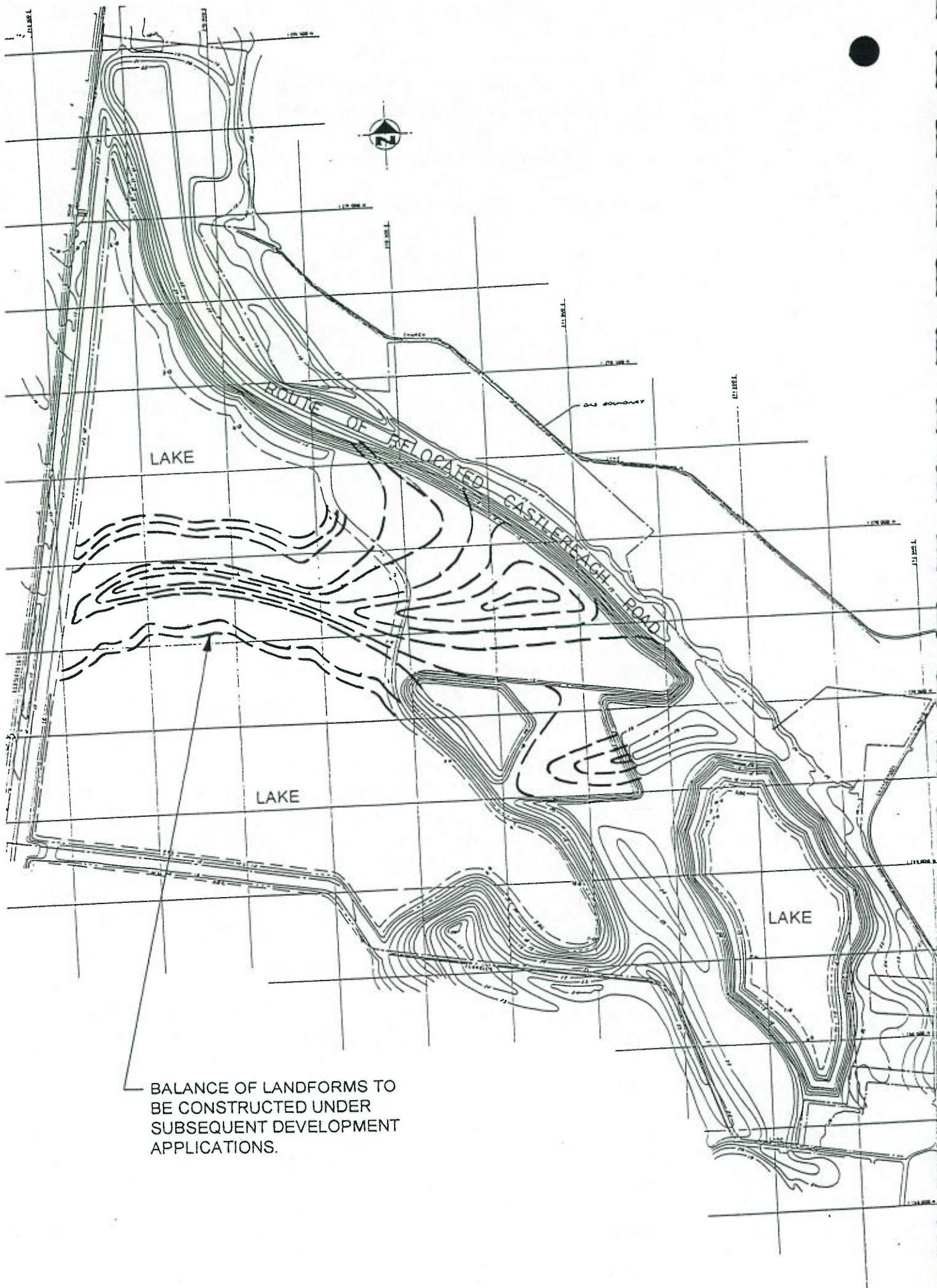
Figure 4.5 shows the general landform arrangements for the DA3 area in relation to the Structure Plan. Salient features of the DA3 design are:-

- \* final landforms associated with the route for Castlereagh Road relocation would be completed.
- \* overburden placed by previous operations would not be moved,
- \* land and lake forms adjoining Cranebrook Village and along the Escarpment would be completed.
- \* future works would involve the placement of the bank separating the two main recreation lakes and increasing the landform height in the central flat area north of Portion 299.

Rehabilitation of extracted areas would be directed towards constructing the landforms shown in Figure 4.5 in accordance with the principles and guidelines contained in the Scheme's Land Rehabilitation and Landscape Manuals. The principles and guidelines detailed in these manuals have been applied throughout the Scheme's development since their preparation in 1986 and 1987, respectively. Results of progress reported in Section 2.4 indicate that these principles and guidelines are appropriate and accordingly should be carried out into the DA3 works.

An item which will require special attention is the relatively flat areas created as a result of overburden deficits in the DA3 area. These areas will need to be properly graded and drained to ensure stability during the intervening period between when they are constructed and when they are modified to conform with the Structure Plan. This period could be in the order of 4 to 8 years depending on where the next stage of Scheme development is located. In these areas it is intended that:-

- \* they be properly drained
- \* they be topsoiled and grassed (to be removed and replaced during future works)
- \* no trees be planted until final landforms are completed
- \* they be properly maintained.



BALANCE OF LANDFORMS TO  
BE CONSTRUCTED UNDER  
SUBSEQUENT DEVELOPMENT  
APPLICATIONS.

DA3 LANDFORMS

FIG. 4.5

It is intended that the route for the relocation of Castlereagh Road be constructed to standards appropriate for the facilitation of future road construction. This will involve sub-basement compaction and provision of a functional profile. It will not include sub-grade compaction or provision of a pavement. Special drainage structures will be constructed appropriate for general landform rehabilitation. Some of these structures may be required to be upgraded appropriately for the standard of road to be subsequently constructed.

#### **4.7 WATER MANAGEMENT**

##### **4.7.1 Water Issues Related to the Proposed Development**

###### **(a) Tailings Management**

The Corporation is responsible for the operation of the tailings pond system south of Castlereagh Road. Operational and evaporative losses from this system are estimated to be in the order of 1000 megalitres per year.

###### **(b) Interim Lakes**

###### Rowing Lake:

The Corporation has a commitment to complete the Rowing Lake complex by June 30, 1995. The 80 hectare lake will contain approximately 4000 megalitres at full design level and will require about 300 megalitres per year on average to maintain that level

###### Main Recreation Lake A:

About 145 hectares of this lake will be completed by the time works in the DA2 area are finished. At full design level this section of the Main Recreation Lake A will contain about 5800 megalitres and require about 600 megalitres per year to keep it at its design water level.

###### Main Recreation Lake B:

About 30 hectares of this lake will be completed at the end of DA3. It is not intended to fill this section of the lake until after landforms have been constructed to final design during subsequent development applications.

###### Treatment Lake:

This lake of about 30 hectares will be completed during the early stages of DA3. Based on the sequencing described in section 4.3, it should be completed by the end of Stage 3. At that time, the Corporation will fill the lake and use it to service other lakes in the south. This lake will contain about 1500 megalitres and require about 150 megalitres per year to maintain it at full design level.

### Detention Basins:

This series of lakes will be completed within 12 months of DA3 commencing. They cannot be completed until Pioneer have completed their extraction works in the area. The basin's total area is about 30 hectares and will contain about 2000 megalitres, requiring about 150 megalitres per year to maintain them at full design level. The basin immediately to its north of the Pioneer Plant has been set aside as a settlement pond for tailings management. Overflows from this pond will spill into the basin immediately to the north. The Pioneer plant will extract its wash water requirements from the pond east of the plant.

#### **(c) Surface Drainage**

Two creeks traverse the DA3 area - Cranebrook Creek and Farrells Creek. The portion of Cranebrook Creek which flows through the DA3 area will be removed. Parts of Farrells Creek will also be removed, however, in other parts where it is expected that no gravel exists under the Creek, it will be retained and filled during rehabilitation works.

#### **(d) Dewatering**

It is necessary to dewater operational areas to:-

- \* dry the bottom layer of sand and gravel for processing purposes,
- \* provide haul truck access across the shale floor, and
- \* prepare the foundation areas for placement of overburden to specified geotechnical standards

Water associated with dewatering operations is derived from groundwater seepage, stored water in old pits and surface runoff.

#### **(e) Nepean River Flooding**

The DA3 area is subject to flooding from the Nepean River. Consequences of the area being flooded would include:-

- \* loss of production until excavation pits and haul routes have been dewatered, and
- \* possible damage to rehabilitation works

#### **4.7.2. Proposed Management**

Specific management actions will vary throughout the DA3 period to meet changing site requirements and management objectives.

Figure 4.6 shows the configuration of the Scheme towards the completion of DA3 in respect of water management arrangements. Features of this system are:-

- \* Farrells Creek is diverted into the detention basin system. Studies undertaken by the Corporation (refer section 2.4.4(g)) indicate that

1 171 000 N

1 172 000 N

1 171 000 N

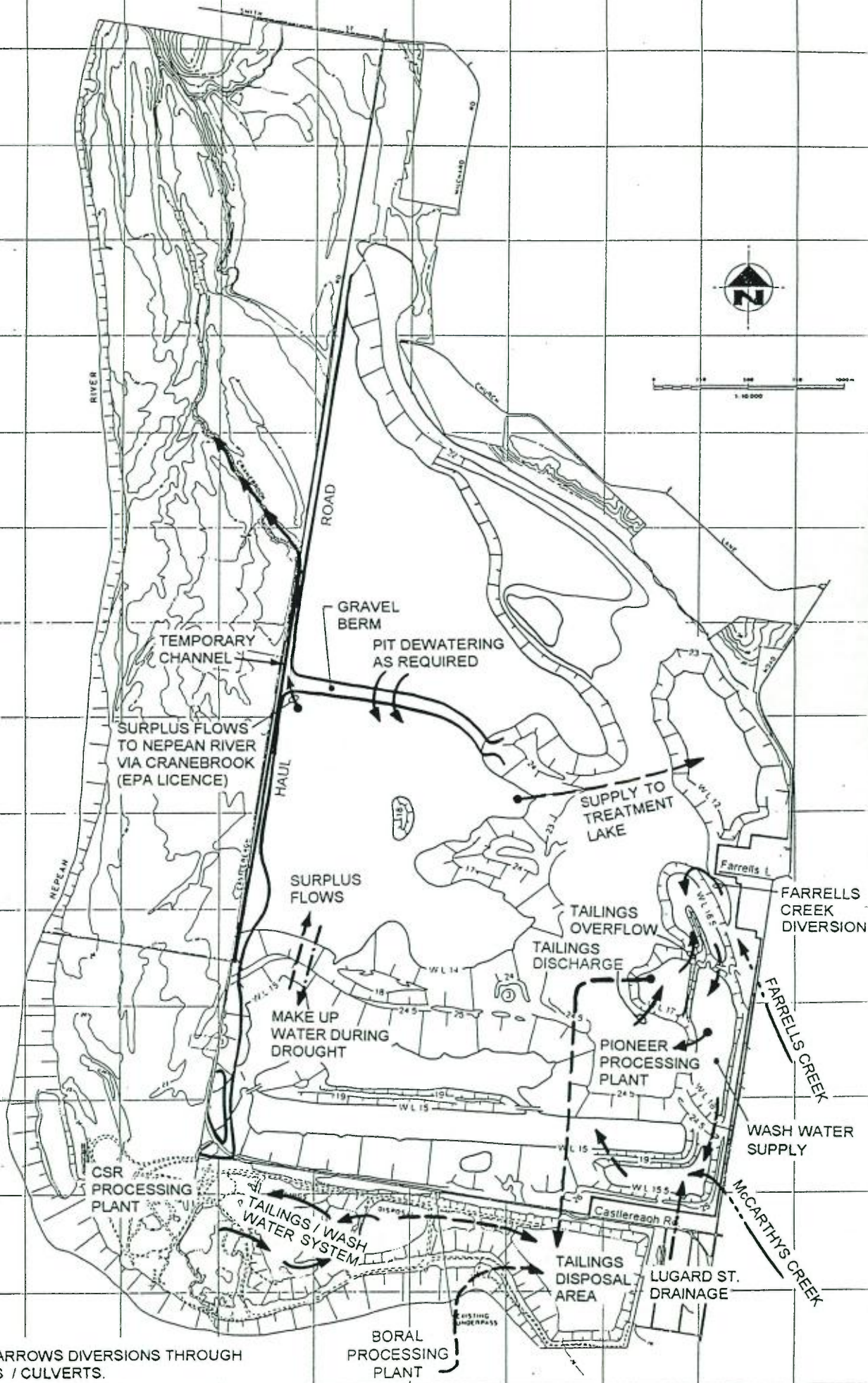
1 170 000 N

1 171 000 N

1 174 000 N

1 187 000 N

1 184 000 N



**NOTE:** BROKEN ARROWS DIVERSIONS THROUGH PIPELINES / CULVERTS.

### WATER MANAGEMENT ARRANGEMENT

FIG. 4.6

this Creek is suitable as a source of supply to the Rowing Course, provided appropriate managements arrangements are in place. Such arrangements include provision of trash rack, booms etc., to eliminate litter and sufficient detention to reduce nutrient loadings.

- \* Flows in the detention basin system are directed southward and into the Rowing Lake. [Arrangements are being made with Penrith City Council regarding inflows from McCarthys Creek and Lugard Street].
- \* Flows will spill into the Rowing Lake 0.5 metres above full design level. A pipeline, with its invert set a full design level, has been constructed through the landform separating the Rowing Lake and Main Recreation Lake A. Surplus flows from the detention basin system will spill from the Rowing Lake into the Main Recreation Lake A.
- \* Main Recreation Lake A, south of Farrells Lane, will be used as a balancing storage. Its principal functions are to:-
  - \* absorb surplus water from Rowing Lake spills
  - \* receive water from dewatering operations in the DA3 area
  - \* provide water to the lake north of Cranebrook Village
  - \* detain water for sufficient periods to allow settlement of fines
  - \* be the principal point for discharging surplus water from the site - such discharges will be via a temporary channel connecting into Cranebrook Creek for discharge to the Nepean River. These discharges will be made in accord with EPA licence conditions.
  - \* provide make up water to the Rowing Lake during periods of drought.
- \* tailings management will continue similar to DA2 arrangements. A dredge pipeline will be placed under the Rowing Course to connect the Pioneer settlement pond to the disposal area south of Castlereagh Road. Water requirements for Boral/CSR operations can be made up from either direct pumping from the Nepean River using existing licences or indirectly from the Farrells Creek system by not pumping return water back to the Pioneer settlement pond. The system used will depend upon prevailing conditions at the time.

In the DA2 SEE it was suggested that the DA2 Lakes may need to be serviced by constructing the Scheme's long term water supply arrangement on the Nepean River just upstream of Penrith Weir. Commitments made in the DA2 SEE were:-

- \* the Corporation would apply for a licence under the Water Act to enable diversions to be made from the Nepean River,
- \* final designs for diversion works be completed prior to the end of DA2.

- \* construction to commence toward end of DA2 or in the early stages of DA3.

The Corporation has made application and has received a licence to divert water from the Nepean River at a site just upstream of Penrith Weir. Conditions attached to the licence are consistent with the long term management of the Scheme. Design and hence construction have not yet been undertaken.

The above commitments were based on water management principles embodied in the Scheme design approved in 1987. At that time, the Corporation made commitments to review and undertake various technical studies related to the possible use of Farrells Creek as a supplementary source of supply. These studies have been completed and formed part of the application to vary the SREP No. 11 Structure Plan currently under consideration by the Department of Planning. These studies indicated that, with appropriate water quality management structures, Farrells Creek could be used as a source of supply. Water management arrangements described above incorporate the use of Farrells Creek diversions. In doing so, one of the implications arising from using Farrells Creek water is to defer the need to divert from the Nepean River. Ultimately, the Scheme will still require Nepean River diversions, but it is not required at this stage nor is it likely to be required until after the completion of DA3.

The DA3 area is subject to flooding from both the Nepean River and from local catchments draining from lands to the east of the Scheme area. In the case of flooding from the Nepean River, the area is:

- \* relatively flood free up until about the 1 in 50 year flood level,
- \* subjected to backwater flooding between the 1 in 50 year and about the 1 in 250 year flood level, and
- \* exposed to broad riverine flood plain flows beyond the 1 in 250 year flood level

Local catchment flooding is principally delivered to the site by Farrells Creek which drains the Mount Pleasant/North Cranebrook area. Contributions will also come from the Escarpment and local surrounds.

The risk of flooding to the site will be reduced by:-

- \* constructing small (1.0 to 1.5m) bunds adjacent to Castlereagh Road to minimise effects of backwater flooding. These will be located at low points adjacent to the Road.
- \* diverting Farrells Creek at Cranebrook Road. Flows are to be directed into the detention basin system
- \* minor drainage and diversion works along the eastern boundary north of Cranebrook Village to Church Lane.

## 5. STRUCTURE PLAN FOR DA3 AREA

The DA3 extraction and rehabilitation programme represents a further stage in the implementation of the Penrith Lakes Scheme, and as such allows some elaboration of the Structure Plan associated with the SREP No. 11 - Penrith Lakes Scheme. In preparing this application, future road access to both recreation and possible future urban land has been considered in case modifications to the proposed disposition of land and water areas or to the development are required. This additional detail is an elaboration of the Structure Plan, not a modification of it.

### 5.1 STRUCTURE PLAN FOR THE SCHEME

The Structure Plan associated with SREP No. 11 - Penrith Lakes Scheme is currently the subject of an application by the Corporation to modify it. Changes sought to the Structure Plan relate to:-

- \* incorporation of implications arising from detailed flood protection studies
- \* implications arising from stormwater management studies
- \* minor variations to landforms arising from some inconsistencies associated with the deposit.

The proposed modified Structure Plan is shown in Figure 1.1. The plan shows in general terms, lake forms, lake uses, public recreation areas, possible future urban areas, a possible route for the relocation of Castlereagh Road and heritage items to be retained. The Structure Plan shows the overall concept of the recreational lake system, but not the detailed lake and landform design. These details are provided in the two year plans mentioned in section 4.3 which are subject to approval by the Department of Planning. This incremental approval system provides the flexibility necessary for minor changes as the design is further refined during implementation.

Three broad categories of uses are permissible under SREP No. 11. These include development to implement the Scheme, interim uses and recreational activities. Provision for retention of heritage items and for possible future urban areas are also discussed below:-

#### 5.1.1. Development to Implement the Scheme

This includes development for extractive industries, rehabilitation and reconstruction of land and Scheme infrastructure, such as a pumping station.

### **5.1.2 Interim Uses**

These are uses that are designed or intended to permit lands within the Scheme area to be used temporarily for purposes not inconsistent with the aims and objections of SREP No. 11 - Penrith Lakes Scheme. Whilst various uses could be considered as interim uses, the main purpose of this category is to prevent sterilisation of the area during the staged implementation of the Scheme.

### **5.1.3 Recreational Uses**

These uses may range from related commercial recreational activities to passive non-commercial recreational activities. It is expected that these uses would mainly apply following the rehabilitation and dedication of the recreation areas.

### **5.1.4 Heritage Items**

The plan provides for the retention of a number of heritage items. Although there are none of these items within the DA3 area, consideration needs to be given to access requirements which might be affected by the development.

### **5.1.5 Possible Future Areas**

The total landforms comprising the areas of possible future urban use would not be completed during the life of DA3. It is unlikely that any urban development would occur until the major part of the main lake has been filled with water, which may not be until some years after the completion of DA3. Detailed urban area design will be undertaken during the life of DA3.

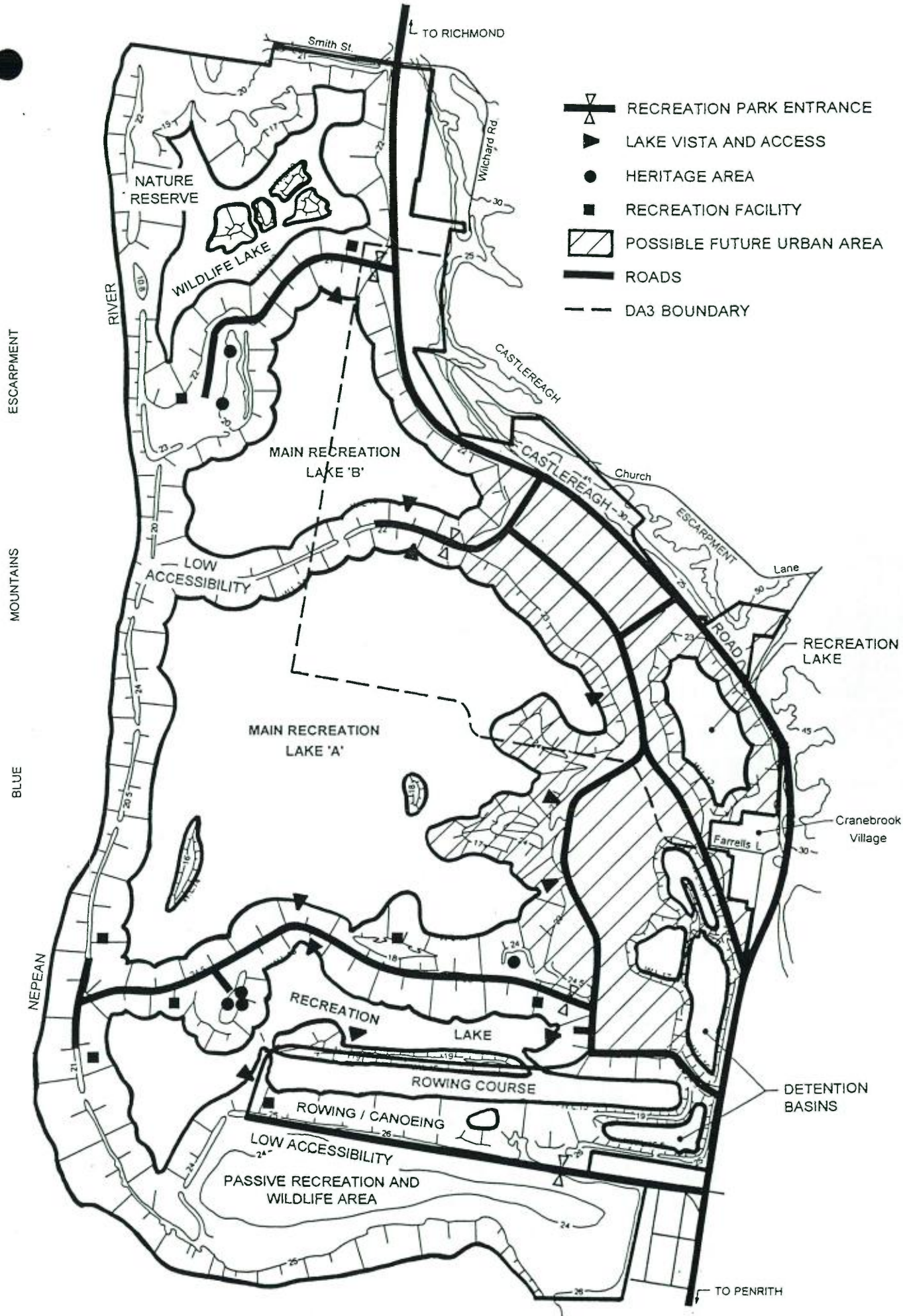
Identification of approximate boundaries of possible future urban areas on the Structure Plan enables landforms suitable for urban use to be constructed and to indicate future land use patterns for the Scheme.

## **5.2 ELABORATION OF THE STRUCTURE PLAN**

Figure 5.1 shows the Structure Plan for the DA3 area with additional details relating to the disposition of recreational development and possible road access arrangements.

### **5.2.1 Recreational Development**

The design of the Scheme allows for the creation of landforms and lakes which will permit the widest possible range of recreational uses, from related commercial recreational activities to passive non-commercial recreational activities depending upon future detailed recreation plans. The likely



STRUCTURE PLAN  
FOR DA3 AREA

FIG. 5.1

distribution of recreational development shown on Figure 5.1 was arrived at after consideration of the conclusions of the Regional Environmental Study which considered whether the land was suitable for various types of recreational development in terms of the following factors:-

- \* whether or not the land was located above the 1 in 100 year flood level (a criterion for locating recreational facilities that needs to be above flood level).
- \* access provisions during major flood events.
- \* the proximity of the land to the lake foreshore (some land uses are dependent upon a foreshore location, while others would benefit from it but not be dependent upon it).
- \* the accessibility to roads and urban services in the east and south of the Scheme area.

Other relevant conclusions of the study were:-

- \* disposal of the tailings produced by the Scheme would require an area of about 110 hectares on the south side of Castlereagh Road. The potential land uses on tailings are limited and access must be restricted until the need for tailings disposal ceases and the area is converted to recreational uses.
- \* the Scheme would provide public access to the Nepean River.
- \* given suitable zoning of activities, the main recreation lake would be large enough to accommodate all forms of water sport simultaneously (which implies supporting facilities need not be concentrated at a single location).

The suggested distribution of recreational uses, whilst not the only one possible, does conform with the conclusions of the Regional Environmental Study, and is a reasonable basis for considering future access requirements.

### **5.2.2 Derivation of Proposed Road Network**

In considering the practicality of providing suitable road access to recreation facilities and areas, and to the possible urban area, a number of constraints were identified. These constraints were:-

- \* the proposed route for the relocation of Castlereagh Road,
- \* the proposed disposition of high land and water area,
- \* the presence of Cranebrook Village
- \* the timing of various stages of development.

These constraints limit road access to the Scheme to the six locations shown on Figure 5.1. These potential access points are discussed in turn below, working from south to north.

Castlereagh Road:

This road will be the principal access to the rowing and canoeing complex and to the passive recreation area to the south. It will also be the main egress for trucks carrying finished products from the CSR plant. Once the Scheme is completed it will be only be used by recreational traffic. Development within the rowing and canoeing complex will allow traffic to enter from Castlereagh Road, travel along the island and exit to McCarthys Lane. It is likely that the island will not be available for general public traffic.

McCarthys Lane:

This lane is to be relocated south of the existing Pioneer plant as part of the Rowing Lake works. Its relocation at this stage is necessary to continue access to the Pioneer plant and provide public access to McCarthys Cemetery. In the longer term it would be developed as a principal access point to the southern portion of the urban area to the Nepean River and to a significant heritage area at Castlereagh.

Access south of Cranebrook:

Access to recreation or urban areas should not pass through Cranebrook Village. Works yet to be completed under DA2 will involve land reconstruction which would be able to provide a suitable access point to the urban area just south of the village. There may be a possibility that an alternative access route just north of the village might be provided under DA3. This possibility will be examined during the preparation of detailed rehabilitation plans.

Access between Recreation Lakes A and B:

Access to the two main recreation lakes from the relocated Castlereagh Road can be provided on the land between the two recreation lakes that will adjoin the relocated Castlereagh Road. This route will be required to give access to the possible future urban area.

Access to Wildlife Lake and Recreation Lake B:

Access from Castlereagh Road could be provided between the Wildlife Lake and Recreation Lake B. This route could be used as access to two historic buildings, the Nepean River and to reach recreation facilities on Recreation Lake B.

### Access to Recreation Areas:

Access to recreation areas could be limited to two to four major entry points to permit visitor control.

### Overall Road Layout:

The road network discussed above gives satisfactory access to the recreation lakes and possible future urban areas. It is envisaged that a spine road would run through the urban area, providing lake vistas at intervals and forming a significant part of the flood management strategy related to the access to flood free land outside the Scheme. If this spine road was a circuitous rather than a direct approach, it could provide a satisfactory bus route through the urban area, but recreation traffic would be unlikely to use it as an alternative access route to the lakes.

## **5.3 RELATIONSHIP OF DA3 TO EXISTING DEVELOPMENT, THE DA1/DA2/DA ROWING LAKE AREAS AND THE COMPLETED SCHEME**

The completed DA3 area will adjoin existing development on the northern side of Cranebrook Village. It is proposed that any permanent roads constructed within DA3 should be such as to keep traffic within the village to levels acceptable for a residential area; access routes to future recreational areas should not pass through the Village.

DA3 works include the closure of Farrells Lane at the western edge of Cranebrook Village. Implications of this are discussed in section 7.4. In the longer term it is likely that the road will be re-opened to integrate the village into the future urban area.

The relationship of the DA3 area to DA1/DA2/DA Rowing Lake is discussed in section 4.1 and shown in Figure 4.1. Whilst extensive lake and foreshore construction will take place in DA3, the use of the rowing and canoeing course will be available from June 1995 onwards. Raw feed haulage routes were amended by DA Rowing Lake to provide haulage routes at the northern and western boundaries of the rowing and canoeing lake area.

The relationship of the DA3 area to the completed Penrith Lakes Scheme is discussed in section 4.2 and shown on Figure 5.1. The DA3 area occupies the north east portion of the Scheme Structure Plan and will create parts of the main recreation lakes and the treatment lake shown in the Structure Plan. It will also create a large portion of the possible future urban area, route for relocation of Castlereagh Road and some additional land for recreation. Subsequent development applications will be necessary to provide the landform separating the two main recreation lakes.

## 6. THE EXISTING PHYSICAL ENVIRONMENT AND IMPACT OF DA3 DEVELOPMENT

This chapter contains a description of the existing physical environment, the likely effects of the DA3 works, and the environmental management measures proposed for the areas that would be subject to this development application. The environmental aspects discussed in this chapter embrace noise, air quality, water quality, and flora and fauna. The discussion is based upon material collected for the Regional Environmental Studies, DA2 and DA Rowing Lake Statements of Environmental Effects, ongoing monitoring of environmental impacts and current studies undertaken for this application.

### 6.1 NOISE

This section describes the existing noise environment of the Penrith Lakes Scheme area, presents noise level design criteria, describes the likely noise impacts associated with DA3 activities and proposes appropriate noise control measures. The contents of this section are a summary of a detailed study undertaken by a specialist consultant. The consultant's report has been submitted to the EPA and D o P in association with this application.

#### 6.1.1 Existing Conditions

Quarrying on the Castlereagh floodplain has been carried out for the past 40 years and has become an accepted activity in the area. In general, quarrying activities proposed in the DA3 area do not represent a significant departure from past activities, albeit it is a transfer of activities to a new location.

Quarry activities involve three basic operations:

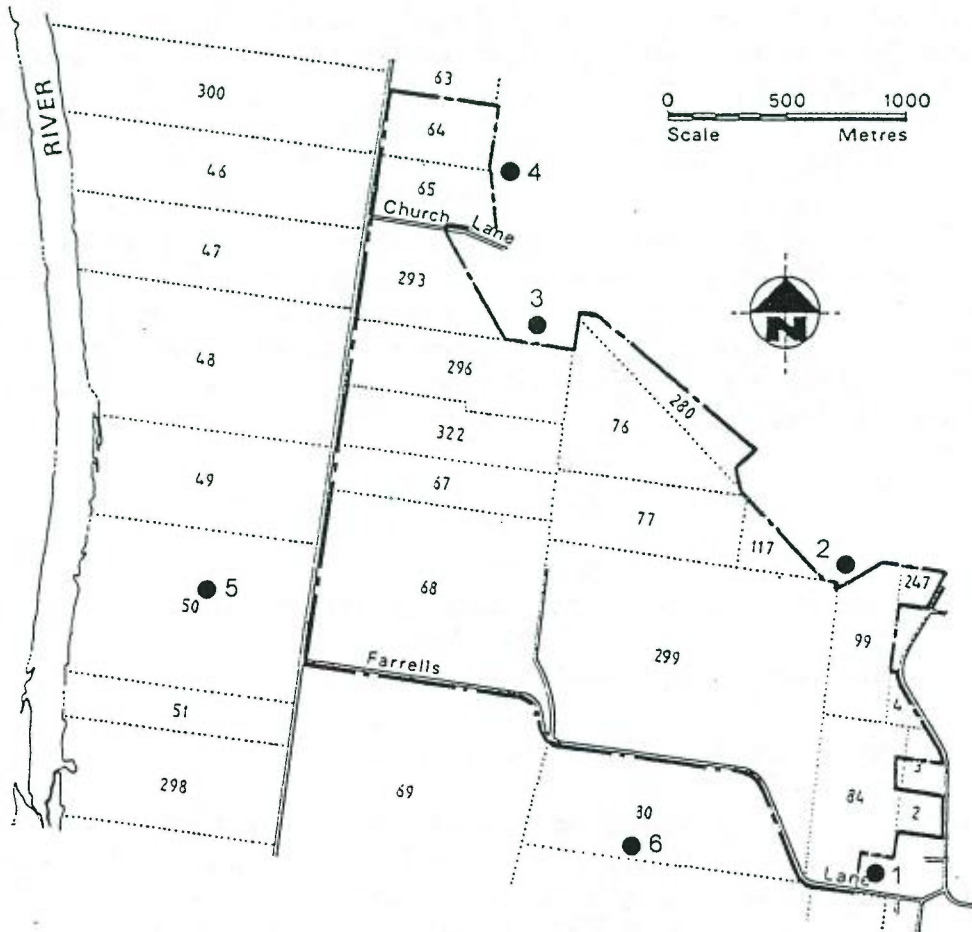
- \* removal of overburden, varying in depth from 1-8 metres,
- \* extraction of sand and gravel down to shale. The raw feed layer varies in thickness from 3-12 metres.
- \* rehabilitation works to construct the landforms.

Overburden removal, gravel extraction and rehabilitation works are sequential operations. Each of these operations generate noise.

The existing noise environment on the Castlereagh floodplain is due to three main sources:-

- \* noise generated by the crushing, screening and washing operations at the processing plants operated by the shareholder companies.
- \* road traffic on arterial roads (Castlereagh Road and Cranebrook Road)
- \* quarry activities of the Corporation.

Existing conditions were determined by measuring background noise levels at selected residences around the DA3 area. The residences are those most likely to be affected by noise from quarry operations. The location of these residences are shown on Figure 6.1. Automatic continuous noise loggers were located within 1m of the boundary of these residences and noise measurements were taken for a period of at least 3 days between January 16 and January 20, 1994. Existing background noise levels were determined after removing quarry activity noise from the measured noise levels. Typical existing background noise levels are shown in Table 6.1



NOISE MONITORING LOCATIONS

FIG. 6.1

Location (Ref.Fig 6.1)	Background Noise Level - $L_{A90}$ dB(A)
1	37
2	33
3	43
4	31
5	38
6	37

These levels are consistent with a typical rural environment

### 6.1.2 Noise Level Design Criteria

In considering noise level design criteria, the need for an acceptable noise environment must be balanced with the value of the sand and gravel resources and the significant social and economic worth of the Penrith Lakes Scheme to the region. Quarrying is an inherently noisy activity requiring a lot of heavy equipment to which local residents are generally habituated. However, reasonable noise levels should be maintained for the comfort of residents, in keeping with the rural nature of the area.

Additionally, it should be recognised that quarry activities are transient. There may be short periods of time when receptors are exposed to relatively higher noise levels, which diminish as activities move away from the receptor.

The current DA2 EPA Licence limits noise emissions from quarry activities by requiring at nearby residences:-

- \* the total period of extraction or rehabilitation work shall not exceed 1 month where the sound pressures level exceeds 65dB(A), 3 months where the sound pressure level exceeds 60dB(A) and 2 years where the sound pressure level exceeds 55dB(A). The sound pressure level shall be below 55dB(A) for the remainder of extraction and rehabilitation time. The sound pressure level shall not exceed 70dB(A) at any time.

It is appropriate that these criteria be carried on into the DA3 area.

It should be also recognised that in planning the development of the DA3 area the Corporation had two basic options:-

- (a) limit the amount of equipment near areas likely to be affected by noise. This would almost certainly require that quarry/rehabilitation works would be undertaken north of Cranebrook Village and up to the escarpment for the full seven year period of DA3, or
- (b) concentrate activities in the above area and quarry/rehabilitate the area as quickly as possible. This has the disadvantage of increasing noise levels for relatively short periods, but has the advantage of getting the work over with quickly and allowing early benefits of the Scheme to nearby residents.

The Corporation chose the latter option on the basis that its environmental noise management programme would keep noise impacts to tolerable levels while keeping the duration of inconvenience to neighbours at a minimum.

### 6.1.3 Likely Noise Impacts

Noise levels emitted from the three main activities (extraction, overburden removal and rehabilitation) have been calculated for three stages of DA3

development and then compared to criteria established in section 6.1.2. The three stages of development are stages 2, 4 and 7 (Figure 4.3) representing the worst case noise situations for receptors at Sites 1, 2, 3 and 4 in Figure 6.1

A model was used to predict noise levels from each stage. The model used information about,

- \* individual equipment noise levels
- \* location of equipment
- \* topography
- \* atmospheric conditions

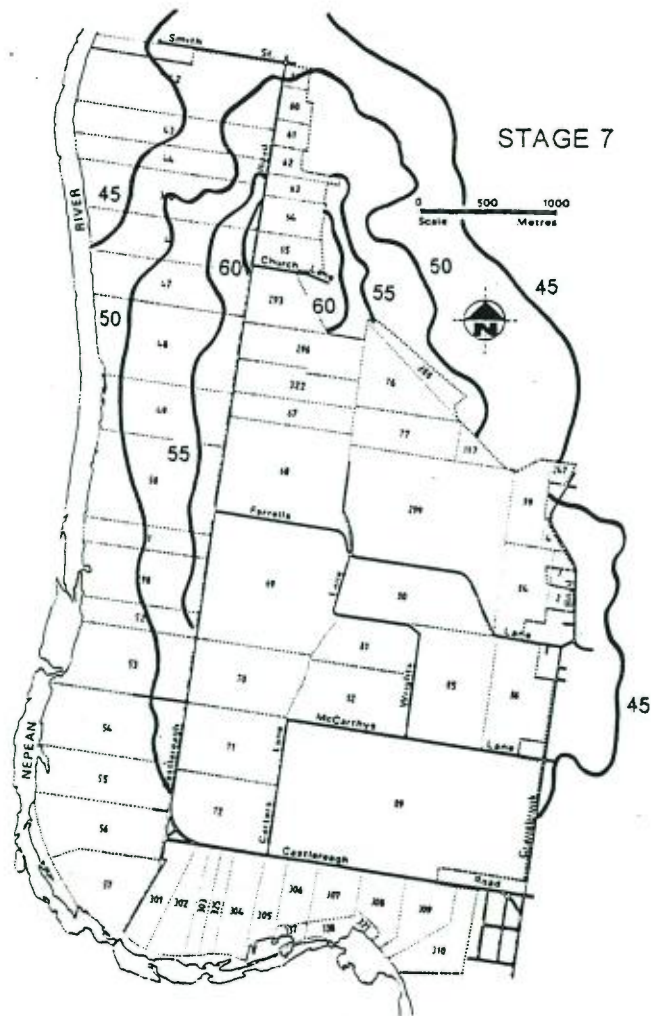
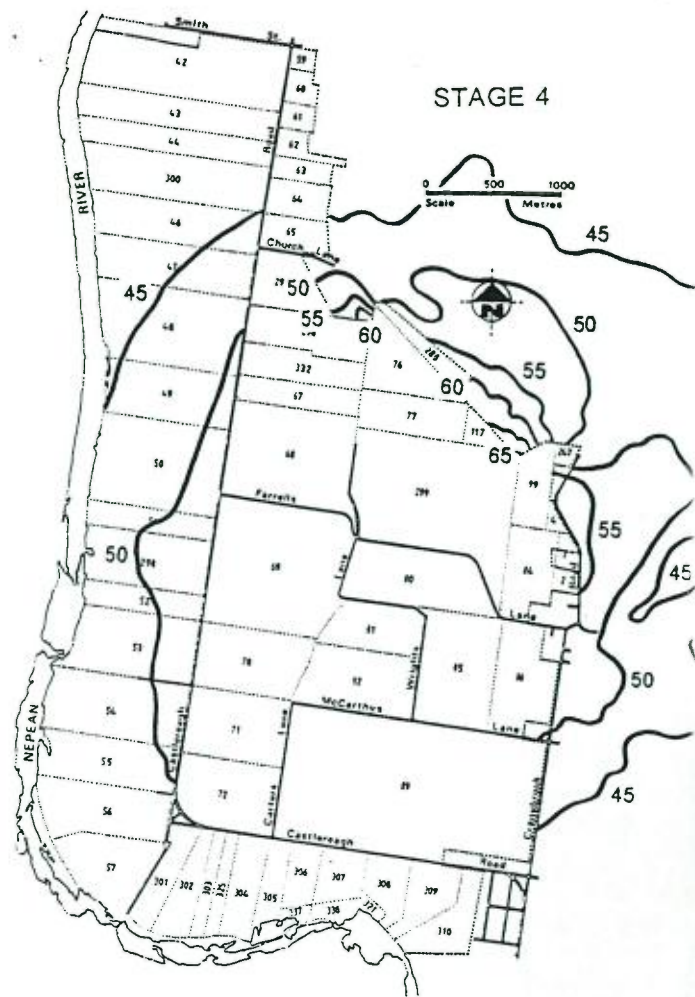
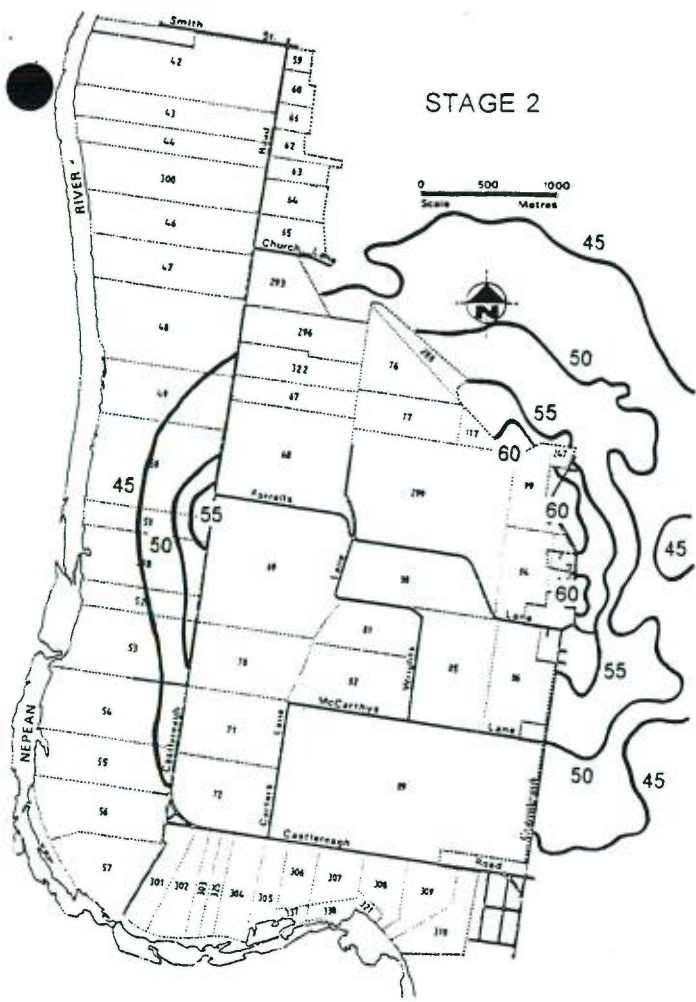
Acoustic effects such as distance attenuation, shielding, air and ground absorption and atmospheric effects are accounted for in the model. The model also accounts for the horizontal and vertical disposition of equipment in the quarry operations. The model assumed adverse atmospheric conditions which again is the worst case scenario. Under neutral conditions nearby residence might expect noise levels some 2-3 dB(A) lower than those predicted using the model. The mine strategies for each stage of development used in the model were preliminary strategies proposed by the Corporation and were not based on any detailed consideration of possible noise impacts. It is recognised that possible noise management options could involve detailed consideration of mine development strategies.

Predicted noise level contours are shown in Figure 6.2. The noise levels predicted show that:-

- \* under worst case conditions noise levels for residents in Cranebrook Village will be between 55 and 60 dB(A). The migration of the quarry and other operations will limit the period above 55dB(A) to less than two years, in accordance with criteria in section 6.1.2.
- \* noise levels between 55 and 60 dB(A), and in some instances above 60dB(A) are predicted for residents on the escarpment. The worst case levels may persist for periods in excess of two years. The criteria in section 6.1.2 is not achieved in respect of the duration of exceedence for both the 55dB(A) and 60dB(A) levels.
- \* noise levels are satisfactory for residences adjoining the northern part of DA3.

### **6.1.3 Environmental Noise Management**

The predicted noise levels indicated above suggests that an effective form of environmental noise management should be implemented. In general, noise levels at Cranebrook Village will be tolerable for a short period of time, however, it is the Corporation's intention to aim at reducing noise levels below those predicted.



PREDICTED NOISE LEVELS

FIG. 6.2

Along the Escarpment is a slightly different problem. While noise levels exceed the criteria duration, opportunities to reduce the levels are much less because of the elevated position of the receiver.

The management system proposed involves a combination of structural works, mine management and monitoring. It should be remembered that the noise levels predicted above are the most pessimistic predictions, assuming the worst cases for each of:-

- \* mine equipment distribution
- \* atmospheric conditions
- \* affected residences
- \* no noise management system

The initial decision of the Corporation to quarry noise sensitive areas as quickly as possible appears to be valid. The lake and landforms just north of Cranebrook Village will be completed within 2 years. The consequence of this is that equipment numbers are concentrated and will generate more noise, but predictions above suggests such levels will be within established criteria around the Village.

Nevertheless, it is an objective of the Corporation to manage the operation in such a manner as to keep noise impacts to a minimum.

Practical options to achieve this objective include:-

Equipment Distribution generally trying to disperse operating equipment over larger areas. This can be achieved by increasing the level of pre-stripped reserves to separate extraction and overburden stripping equipment. The provision of a long gravel face to separate extraction equipment is also possible.

Gravel Faces extraction equipment to be operated at the lowest level possible to maximise shielding benefits from the gravel face. The gravel face should progress towards the nearest residence along an imaginary line between the excavator and the residence. The gravel face should be perpendicular to this line. [This equipment orientation was used in the modelling works].

Haul Roads consideration in their design be given to keeping roads in noise sensitive areas along low routes, orientated directly away from dig areas and kept away from boundaries.

Noise Bunds the existing 3 metres bund near Cranebrook Village be increased to 5 metres and continued around to link to Farrells Lane. The private

property north of Cranebrook Village should have a 5 metre bund on the south, west and north boundaries. A 4 metre bund to be constructed on the DA3 north boundary (These bunds were included in the modelling works). The location of these bunds are shown in Figure 6.3.

Escarpment

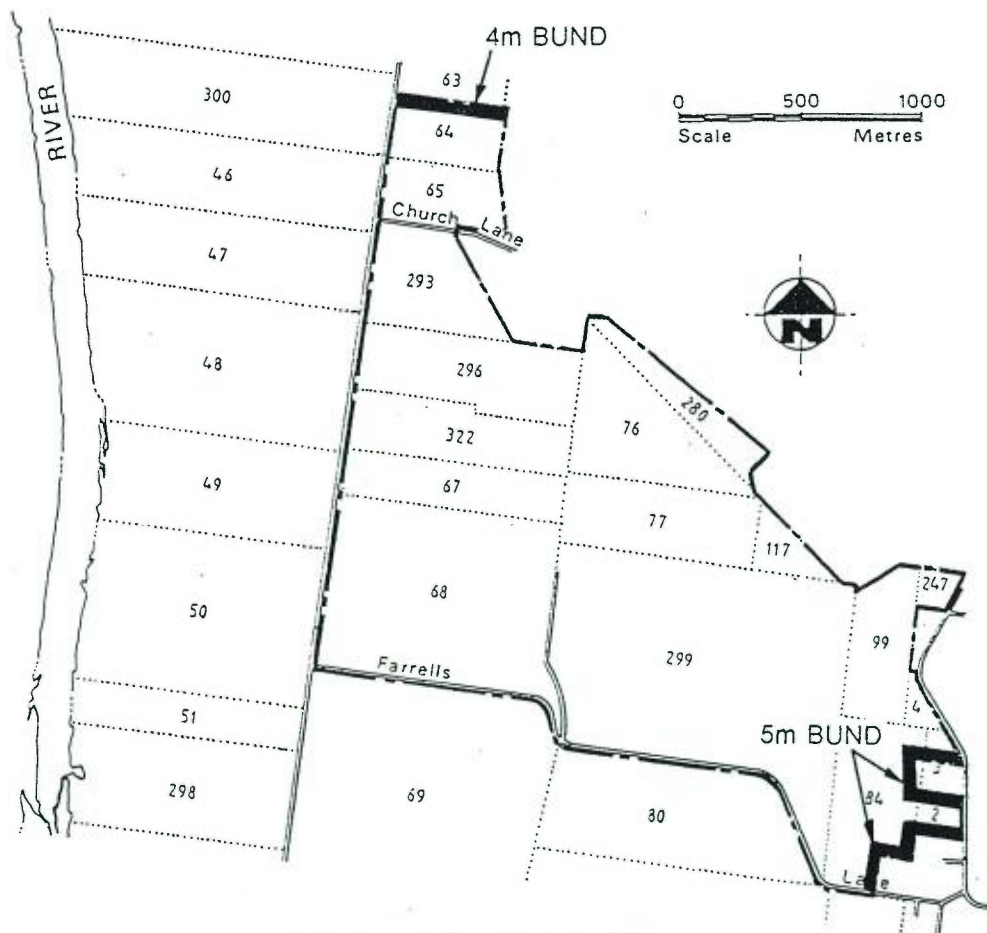
Residences along the escarpment are located at the top of it and little benefit would be gained by constructing noise bunds along its base. The residences may benefit from measures related to mine management.

Operating Hours

Proposed hours of operations (section 4.4) in noise sensitive areas will be reduced to:-

Sand and gravel extraction 7.00 a.m. to 6.00 p.m.  
Monday to Friday.  
7.00 a.m. to 1.00 p.m. Saturday.

Overburden removal 7.00 a.m. to 5.00 p.m.  
Monday to Friday.  
7.00 a.m. to 1.00 p.m. Saturday.



LOCATION OF PROPOSED NOISE BUNDS

FIG. 6.3

The mine could be configured to provide early morning/late evening working areas which are farther away from the principal working areas. If this can be arranged adverse noise impacts may be restricted to day time periods, where higher noise levels are more tolerable.

The options listed above can be implemented in one form or another. It is likely that the most effective solution would be to aim for a mix of measures and to monitor progress, implementing changes to the mix as and when necessary.

To minimise possible noise impacts, the Corporation proposes:-

- \* to construct the bunds as described above
- \* to carefully plan detailed mine development giving consideration to the options listed above.
- \* monitor the mine's progress in respect of noise levels and adjust the mining strategy as required.

A concern with the above proposal is the visual obtrusiveness of the 5 metre high bunds around Cranebrook Village and the private property to the north of the Village. The bund around Cranebrook Village has been set back 50 metres from the residential properties. A section of it was constructed in the early stages of DA2, however, it is only 3 metres high and will need to be increased by another 2 metres to be fully effective. The bund surrounding the private property to the north has not been constructed. A set back similar to Cranebrook Village is not possible given constraints on physically being able to quarry material at this location. The bund will be constructed within the 15 metre set back from the property boundary with the inside toe commencing 4 metres from the property boundary.

Given the transient nature of the quarry operations, these bunds will be removed as soon as they are no longer required to reduce noise impacts. This might occur some 18 to 24 months after their construction. (They would be required longer if it was decided to limit the amount of equipment and slow down extraction operations in the nearby areas).

## **6.2 AIR QUALITY**

This section describes the existing air quality of the Penrith Lakes Scheme area, discusses the likely impacts on air quality associated with DA3 activities and proposes control measures to keep dust emissions within prevailing criteria of acceptability. The contents of this section are a summary of a detailed study undertaken by a specialist consultant. The consultant's report has been submitted to the EPA and D o P in association with this application.

### **6.2.2 Air Quality Criteria**

The existing air quality of the Penrith Lakes area is influenced by quarrying and associated rehabilitation works being carried out in the area. The main air quality issue is the generation of dust, principally from moving machines, and

to a minor extent by wind across areas of ungrassed land. Although the impact of dust emissions is confined almost entirely to areas immediately surrounding the quarrying operations, it may include the deposition of dust particles upon or within residences nearby.

Two principal indicators are used for dust criteria. They relate to dust deposition rates and dust concentration levels.

The National Health and Medical Research Council recommends a maximum annual atmospheric particulate concentration level of  $90\mu\text{g}/\text{m}^3$  to protect public health in residential environments. This level is generally endorsed by the EPA with additional criteria for annual and daily averages for fine particles.

In respect of depositional rates, the EPA manages dust by setting receptor design goals rather than emitter absolute limits. In this manner incremental increases in dust pollution from additional development can be avoided. The EPA goals are shown in Table 6.2

**TABLE 6.2**

**NSW EPA Dust Deposition Goals**

Existing Dust Level ( $\text{g}/\text{m}^2/\text{month}$ )	Maximum Acceptable Increase Over Existing Dust Level ( $\text{g}/\text{m}^2/\text{month}$ )	
	Residential Subdivision	Other Areas
2	2	2
3	1	2
4	0	1
above 4	0	0

For example, in residential suburban areas with an annual average deposition level of between 2 and 3  $\text{g}/\text{m}^2/\text{month}$ , an increase of up to  $2\text{g}/\text{m}^2/\text{month}$  would be permitted before it is considered that a significant degradation of air quality had occurred.

**6.2.3 Existing Air Quality**

Dust monitoring specifically for studies associated with this development application commenced in July 1992. The monitoring programme involved the installation and operation of six depositional gauges, five directional gauges and one high volume sampler to measure dust concentrations. The locations of these gauges were discussed and agreed upon with the EPA.

For the depositional gauges, with the exception of one gauge, all recorded below  $4\text{g}/\text{m}^2/\text{month}$  and were generally between 2 and  $3\text{g}/\text{m}^2/\text{month}$ . These results are below the EPA's criteria. The exception to these results was one gauge located on the west side of the quarry activity near the Nepean River. It consistently had high readings and is thought to be influenced by local agricultural activities rather than quarry activities.

The directional gauges were used to identify dust sources. Gauges located south of Cranebrook Village indicated the prevalent source of dust to be from the west, which agrees with quarry locations. The gauge north of Cranebrook Village indicated the prevalent source to be located north of the gauge.

The high volume sampler was located near Cranebrook Village and indicated an annual average dust concentration of  $54.3 \text{ ug/m}^3$ , well below the criteria recommended by the NHMRC of  $90 \text{ ug/m}^3$ .

### 6.2.3 Likely Impacts

A computer based dispersion model was used to predict dust deposition rates and concentrations of total suspended particles due to quarry operations. Estimated rates of dust emissions from sources within the quarry operations were applied with meteorological data to plot contours of deposition rates and concentrations. The contours were determined for 3 stages of the quarry development, representing the stages most likely to create significant dust impacts, if any. The results were then compared to criteria shown in section 6.2.2 to determine if any significant impacts were likely.

Typical results are shown in Figure 6.4, and are described below:

The deposition figure shows the area of land expected to experience an increase in dust fallout caused by quarry and rehabilitation operations. The shape of the dust deposition contour reflect the direction of the main winds from the south and south-west.

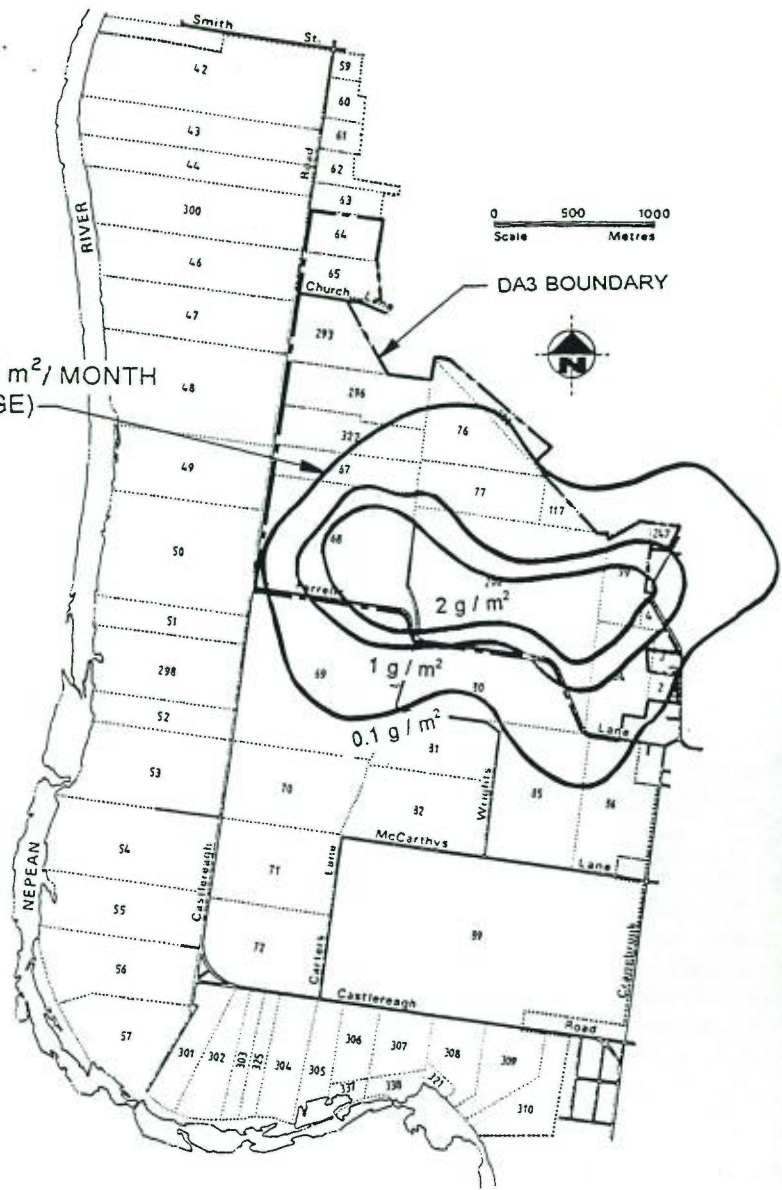
Existing air quality determined by monitoring around this location is  $2\text{--}2.5 \text{ g/m}^2/\text{month}$ . Using an acceptable design goal of limiting increases to less than  $2 \text{ g/m}^2/\text{month}$  (annual average) identifies that land outside the contour of  $2 \text{ g/m}^2/\text{month}$  on Figure 6.4 would not be affected by loss of amenity due to dust deposition. As can be noted on Figure 6.4 the relevant contour is contained within the DA3 area.

Similarly, for dust concentrations the allowable increase would be  $40 \text{ ug/m}^3$  for an existing annual average dust concentration of  $50 \text{ ug/m}^3$  if the NHMRC criteria of  $90 \text{ ug/m}^3$  is not to be exceeded. Again this contour is contained within DA3 and no loss of amenity is predicted for neighbours due to dust concentrations.

The other stages assessed yielded similar results to the above, except for predicted dust depositions related to Stage 4 of the sequence. Here the  $2 \text{ g/m}^2/\text{month}$  contour embraced a small parcel of land on the Castlereagh Escarpment. The exceedence in this area may be slight and it is not considered to be a significant loss of amenity.

Mention is made in section 2.4.4(b) of problem with episodic events related to dust mobilisation during the strong early spring westerly winds.

CONTOURS IN  $g / m^2 / MONTH$   
(ANNUAL AVERAGE)



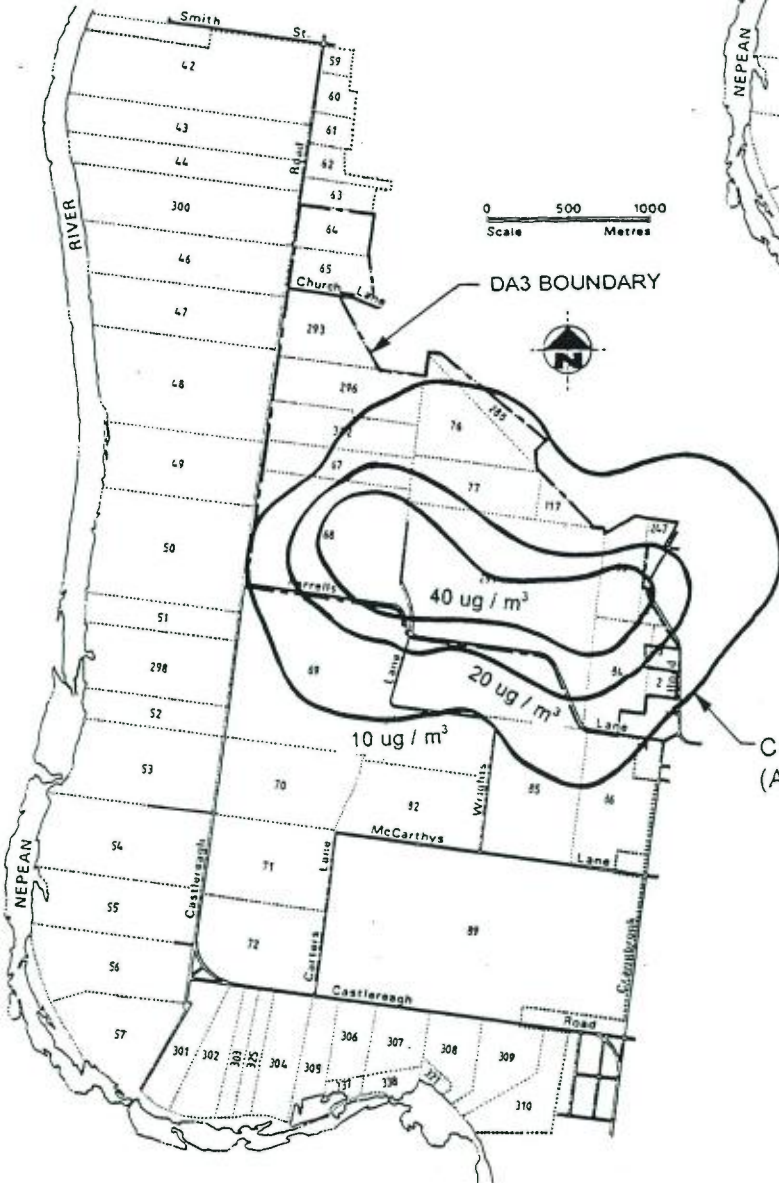
0 500 1000  
Scale Metres

DA3 BOUNDARY



PREDICTED INCREASE IN ANNUAL  
AVERAGE DUST DEPOSITION  
STAGE 2

CONTOURS IN  $\mu g / m^3$   
(ANNUAL AVERAGE)



PREDICTED INCREASE IN ANNUAL  
AVERAGE DUST CONCENTRATION  
STAGE 2

PREDICTED DUST LEVELS

FIG. 6.4

The EPA's has a new goal for these types of occurrences. It could be expected that the new goal of 150 ug/m<sup>3</sup> for dust particles less than 10um should not occur in a 24 hour period may be exceeded by this development. Such levels are from time to time exceeded in most parts of NSW and this will be true of the Penrith area. This goal would be exceeded on occasions even if the quarry were not in existence. A good extraction plan and sensible management will minimise the potential of dust generated from the quarry.

Based on the consultant's recommendations and previous experience, the Corporation will:

- \* water all working and haulage areas to surpress the emission of dust;
- \* establish grass cover on completed landforms as quickly as possible;
- \* minimise cleared land awaiting quarrying or rehabilitation but having regard to environmental noise management and safety aspects;
- \* monitor monthly dust fall out levels at the north and north-east site boundaries when dust has the potential to become a problem,
- \* cease quarry and rehabilitation works during periods of high winds which are in the direction of the north and north-east boundaries.

### **6.3 WATER RESOURCES**

This section describes the existing water resources and discusses the likely impacts of the proposed development in relation to dewatering, flood management, surface drainage and the water supply and quality of the interim lakes. The assessment of the Nepean River as a source of supply to the Scheme was exhaustively examined during the preparation of the Regional Environmental Study. That assessment considered the impacts on the Nepean Hawkesbury River system. Thus no assessment of impacts on the Scheme water supply proposal has been included in this statement.

#### **6.3.1 Existing Water Resources**

The existing water resources of the Scheme area in general and the DA3 area in particular encompass both the groundwater and the surface drainage systems.

Below the 6 to 8 metre thick overburden layer, a groundwater table 4 to 6 metres in depth, generally lying in the sand and gravel deposit immediately above the impermeable shale bedrock, carries water across the Scheme area to the west. Groundwater is depleted by natural aquifer drainage to the Nepean River and, to a lesser extent, by evaporation losses associated with lakes in

previously extracted areas. Monitored water surface levels in these lakes indicate little variation, even in periods of low rainfall, which is evidence of the system's capacity to maintain groundwater levels in these areas. Groundwater quality is generally very good, but salinity tends to increase with increasing aquifer depth.

Monitoring of groundwater levels indicates a relatively responsive aquifer which is very much influenced by almost immediate prevailing weather conditions.

The Scheme area is located within a relatively small and well defined catchment which is subject to flooding from the Nepean River and from its own catchment. In general, the catchment drains in a northerly direction by way of three main creeks: Cranebrook, McCarthys and Farrells Creeks. No formal stormwater drainage system exists within the Scheme area. Works associated with DA1/DA2 and DA Rowing Lake have introduced some form of drainage to the area utilising lakes and quarry operations as features in the system.

### **6.3.2 Likely Impacts and Proposed Ameliorative Measures**

The principal water management and water quality issues associated with the DA3 development would be essentially similar to those associated with the current activities and with future development of the lakes. These issues are discussed below.

#### **Dewatering**

Removal of excess water from extraction pits and fill areas is essential for operational requirements. The proposed management system described in section 4.7 will be directed toward using dewatering volumes as an additional source of make up water for DA1/DA2/DA Rowing Lake water bodies.

Dewatering has an immediate effect on the surrounding aquifer. Experience in DA2 works showed surrounding wells being reduced by 1-2 metres as exposed aquifers were draining into adjacent dewatering areas. These wells recovered relatively quickly after the aquifer was sealed with placed overburden.

If any existing licensed groundwater users within the Scheme area are affected by dewatering operations, the Corporation would undertake to provide an alternative supply.

While it is the general intent to utilise local resources to meet Scheme needs, there may be circumstances where surplus water stored on site will interfere with operations/commitments. In these circumstances it will be necessary to discharge this surplus water from the site.

As proposed in section 4.7 these discharges will be made to Cranebrook Creek and undertaken in accordance with provisions contained in EPA licensing requirements. Other sites might also be required from time to time, to meet immediate operational requirements. Again these will be subject of EPA licensing requirements.

## **Tailings**

The existing tailings management system described in Section 4.7 operates satisfactorily. It will not require any amendment to the system after the Rowing Course has been completed. DA3 works will utilise this existing system.

## **Completed Scheme Flood Management**

The Scheme area is subject to flooding from the Nepean River. In the south of the Scheme area, a 1 in 100 year flood would generally be contained within the Nepean River banks, but floods of greater magnitude would overtop the banks and inundate most of the Scheme area. However, a study of flood gradients and bank slopes in the downstream sections of the river adjacent to the Scheme area showed that overbank flow into the Scheme area approximately between the midway point and the northern end could occur during smaller floods. In addition to overbank flow from the river, lands in the north of the Scheme area are subject to flooding from back-up water from the Nepean River and from stormwaters draining the local catchment.

In the completed Scheme, if floodwaters were permitted to overtop the Nepean River bank and flood the lakes and their environs, and if proper protection had not been provided for the river bank, failure of the bank could occur through scouring of the internal sides of the bank. A system of flood protection has therefore been formulated and incorporated into the proposed design of the Scheme.

The objective of the flood protection plan is to fill the lakes with water during the early stages of a flood. Should there then be any overtopping of the river banks, the water level in the lakes would almost equal the water level in the river, thus minimising the area of bank that would be exposed to scouring flows. Control weirs connecting the lakes with the river and to each other would be required.

The overall concept of the proposed flood protection plan has been refined by further investigation, and it is considered that the proposed arrangements of spillways and levees should protect the lakes system from scour damage by floods. Final design studies have been completed and an application has been made to modify the Structure Plan of SREP No. 11 to accommodate design implications arising from these studies.

No specific Scheme flood protection works are required to be undertaken within the DA3 area. It should be noted that the possible future urban area has been modified within the DA3 area to suit findings of the flood studies.

## **Interim Flood Management**

There is a risk that Nepean River floodwaters could enter the quarry and rehabilitation areas during the life of DA3, either by overbank flow from the Nepean River or via back up water from Cranebrook and Farrells Creeks.

Small bunds adjacent to Castlereagh Road (section 4.7) will diminish this risk.

If floodwaters do enter the quarry and rehabilitation area, the pits and lakes would be dewatered using pumps, in order to resume normal operations as soon as practicable. Emergency extraction areas may need to be provided outside the DA3 area to maintain sand and gravel supplies until such time that the flooded operations areas are returned to normal.

### **Surface Drainage**

The sections of Cranebrook and Farrells Creeks contained within the DA3 area will be progressively removed by proposed quarry and rehabilitation works.

The upper catchment of Cranebrook Creek has already been removed by works under previous consents in areas south of Farrells Lane. Its removal during DA3 will cause no additional impacts.

Provision has been made to divert Farrells Creek into the detention basin system as a source of supply to the Rowing Lake. This will facilitate operations in the DA3 area.

In respect of downstream water supply, the Corporation has control over all lands along these two creeks other than Nepean Park. During both DA1 and DA2 supplies to Nepean Park have been maintained using informal arrangements. On occasions there has been times when the Corporation has had insufficient water on site to discharge downstream. This only happens during extended drought periods. Supplies to Nepean Park will continue as and when required.

### **Rowing Lake Water Supply and Quality**

Section 4.7 details water management arrangements during DA3. Included in this description is provisions for water supply to the Rowing Lake. Its average annual requirement has been assessed as 300 megalitres per year. The diversion of Farrells Creek should supply in the order of 900 megalitres per year on average. However, Farrells Creek is a relatively small catchment and a high degree of variability of flows could be expected. For this reason, provision has been made to return water from the Main Recreation Lake A storage area to supplement creek flows during dry periods.

Water quality performance of the Rowing Lake is expected to be slightly better than experienced in the 1988 Lake (see section 2.4.4(g)). The response of the 1988 Lake was fairly predictable given that the lake was biologically sterile at the completion of quarry operations. It was then filled with relatively enriched waters over a very short period. Two or three heavy storms provided sufficient water to fill the lake. While four algae blooms were recorded in as many years in this lake, the severity and duration of the blooms was decreasing as the lake aged. This strongly suggests that as the aquatic biological structure in the lake developed with age, so did its influence on quality performance.

Desirable water quality goals could be achieved by reducing nutrient loadings and promoting the early development of the aquatic biological structure.

To this end, the detention basin system has been designed to reduce nutrient loadings entering the Rowing Lake. Monitoring of Farrells Creek nutrient levels indicates a moderate level of nutrients, generally in the order of 50 to 100 ug/l of total phosphorus. This loading will be reduced by the detention provided. The McCarthys Creek and Lugard Street drainage system will contribute loadings and developments in their catchment needs to be resolved with Council. It is important that water quality management works be undertaken in these catchments as soon as practicable to minimise potential nutrient loading in the Rowing Lake.

In regard to the aquatic biological structure, the Corporation has already constructed cultivation ponds to provide sufficient stock of appropriate aquatic plants. Already some 15000 aquatic plants have been introduced to the western end of the Rowing Course and Warm Up Lake area.

The water quality of the Rowing Lake cannot be guaranteed to meet the recommended water quality criteria for the main lakes. It could be expected that algae blooms will be experienced in the first few years of development but the system should settle down as the aquatic biological structure matures. The blooms could be expected to occur around late March early April and last from 1 week to 3 weeks, diminishing as the lake ages.

The Corporation will continue to monitor the lakes to take appropriate management actions as and when required.

## **6.4 FLORA AND FAUNA**

This section describes the existing conditions relating to flora and fauna in the Scheme area, and discusses the likely impacts and proposed mitigation measures.

### **6.4.1 Existing Conditions**

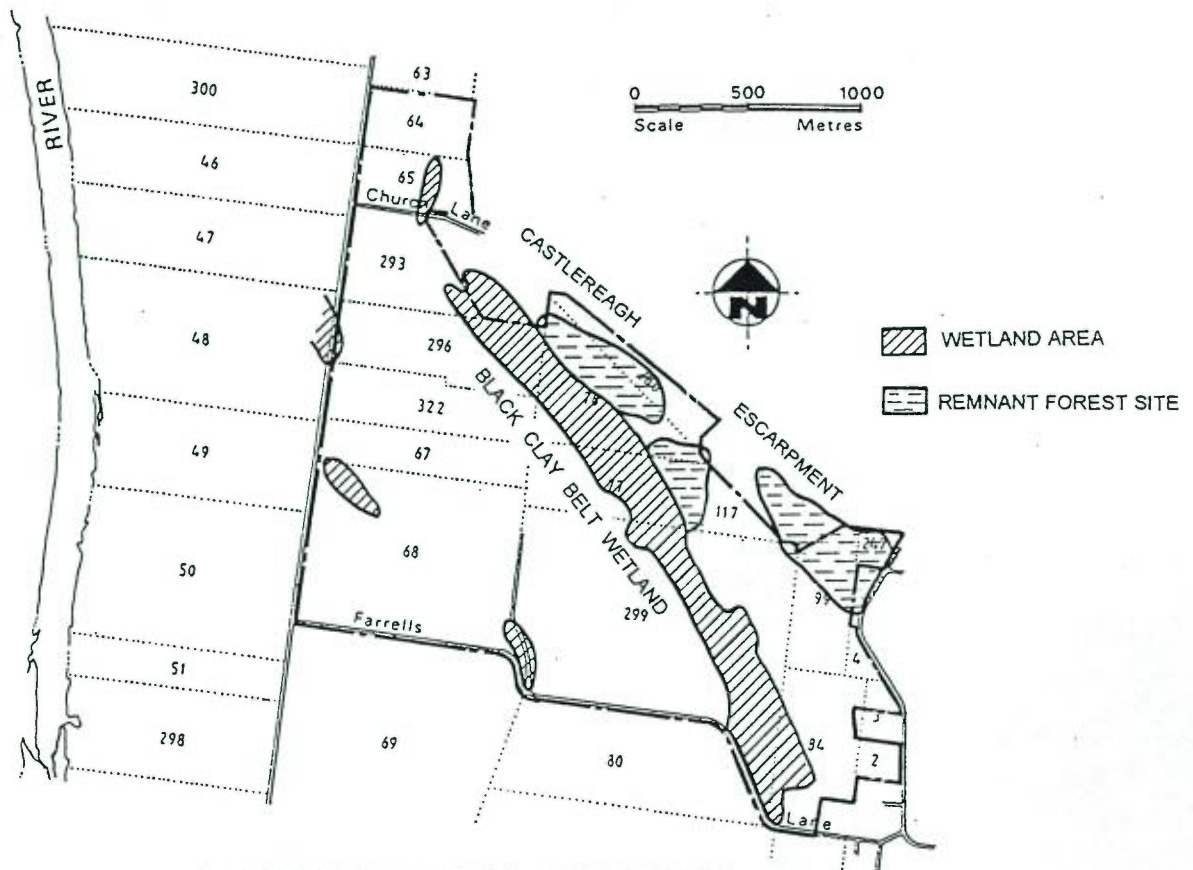
#### **Flora**

The land included in the DA3 proposal has long been almost totally cleared for agricultural purposes. The native plant cover has thus been almost completely eradicated and replaced by pasture, turf cultivation and row crops. In the Regional Environmental Study three remnant plant community types were identified in the overall scheme area:

- \* wetland areas
- \* riparian areas
- \* remnant forest sites

These small areas contain remnants of the scheme area's former vegetation, although their biological importance has been much diminished a result of land clearance, grazing and other activities.

Four wetland areas and three remnant forest sites are included in the DA3 areas (as shown on Figure 6.5).



PLANT COMMUNITIES AND HABITAT TYPES IN DA3

FIG. 6.5

The principal wetland area is the "Black Clay Belt Wetland" associated with Farrells Creek. It is described in the Regional Environmental Study as:-

"At other locations (including the black clay belt wetlands), some flooding occurs periodically, but is unlikely that standing water persists for long after heavy rains. Here Carex appressa dominates a wetland community which includes such introduced and native species as Alternanthera denticulata, Cyperus eragrostis, Juncus usitatus, Ludwigia peploides and Polygonum hydropiper".

The smaller associated wetlands within DA3 are deep enough and sufficiently well watered to retain some standing water even during prolonged dry periods. The RES described these wetlands as being floristically diverse with common species being Juncus usitatus, Polygonum hydropiper, Paspalum paspaloides, Ludwigia peploides and Eleocharis sphacelata.

The remnant forest along the escarpment are generally above the RL30m AHD mark. The three sites carry an open forest dominated by species commonly found on Tertiary alluvium, Recent alluvium and Wianamatta Shale. Dominant species are Eucalyptus fibrosa, E. amplifolia, E. eugenoides, E. crebra and Syncarpia glomulifera.

## Fauna

The surveys undertaken for the Regional Environmental Study concluded that it was most unlikely that any rare or endangered species of fauna existed within the Scheme area.

### Significant biological areas

Within the context of a site that has had its biological value diminished as a result of land clearance and agriculture, three remnant sites were identified as having particular biological significance. One of these sites was contained within the DA2 area, the other two are in the proposed DA3 area.

The sites within DA3 are described in the RES as:-

Black clay belt and adjacent forested lands: The black clay belt is of high biological value. For much of its length, it supports an unusual plant association dominated by Carex appressa, an association which is uncommon in the Nepean-Hawkesbury system and possibly in the lowlands of eastern Australia generally. In turn, this plant association provides habitat for several bird species of limited distribution and relatively specific life needs, and supports a large and diverse frog population.

The adjacent forested lands support several bird, frog and particularly reptile species, and possibly also support three species of native arboreal mammals. In terms of fauna, these forested areas should be considered part of a broader assemblage that includes the black clay belt vegetation because the interface between the wetlands and forest is important to some fauna (for example, frog and reptiles).

Castlereagh swamp and adjoining escarpment: The wetland areas, which can be considered as a northern extension of the black clay belt, are floristically among the most diverse in the Scheme area. They were also rated highly for their value to waterbirds and frogs. The adjoining escarpment has the potential to provide a corridor for the movement of native fauna between the scheme lands and the large tracts of natural vegetation running north to Agnes Banks.

The RES also identified that the value of these sites could be diminished in changes in land uses outside the Scheme and in agricultural land management practices.

The studies undertaken for the RES were undertaken during 1981/82. Since that time significant land use changes have happened outside the Scheme area. The upper catchment of Farrells Creek has become urbanised with the consequential result of changing downstream hydrology. The significant biological areas now are wetter for much longer and more frequent periods. The associations which dominated during the RES period has now given away to an invasion of Typha orientalis. The new hydrological conditions favour Typha and it now covers most of the area. Associated with the changed conditions has been the decline of Carex appressa and Melaleuca linariifolia which are not suited to the wetter environment.

#### **6.4.2 Likely Impacts**

The process of quarrying would have a severe impact on both the flora and fauna of the affected lands. However, as has been demonstrated in the DA1/DA2/DA Rowing Lake areas, new habitat formed by the rehabilitation process would be colonised quickly both by elements of the original flora and fauna and by immigrant species. Careful rehabilitation of the quarried lands would create considerably more diverse and enriched natural environment than now exists particularly in view of the already severe impacts of agriculture and changed land uses on the flora and fauna of the subject area.

##### **Flora**

Quarrying of the land covered by DA3 would destroy all existing plant cover, except in areas on the escarpment. The remnant forest sites along the escarpment will remain in tact.

##### **Fauna**

The proposed DA3 would have minimal impact on fauna since the value of these lands as habitat has been much diminished through past agricultural practices. Birdlife existing in the wetlands areas will quickly re-establish to similar sites in previously rehabilitated areas. Water birds will continue to benefit by the creation of more and expansive areas of water. Birds associated with cleared lands will be initially disadvantaged as their existing habitat will be destroyed by quarry operations. However, new habitats would be created during the rehabilitation process, the value of which will be enhanced as vegetation matures. Frog and reptile populations will suffer a similar fate, however, their presence in the DA2 area suggest that such populations will re-colonise the DA3 area after its rehabilitation is completed.

#### **6.4.3 Mitigation of Impacts**

The largely cleared nature of the lands affected by the DA3 proposal, as in the rest of the Scheme area, has much diminished their value in terms of flora and fauna. External land use changes has also impacted on the habitat value of these lands. The overall Scheme is unusual in that it provides an opportunity to enhance this flora and faunal value substantially. Continued Scheme development would continue to enhance habitat value.

## 7. THE EXISTING CULTURAL ENVIRONMENT AND IMPACT OF DA3 DEVELOPMENT

This chapter contains a description of the existing cultural environment, the likely effects of the DA3 works, and the proposed environmental management measures for the areas subject to this development application. The aspects discussed in this chapter embrace the visual environment, heritage sites, agriculture, traffic, urban development, employment and energy use.

### 7.1 VISUAL ENVIRONMENT

The existing visual environment of the Scheme area is discussed in this section, together with the likely visual impacts of the DA3 extraction and rehabilitation activities and the measures proposed to ameliorate these impacts.

#### 7.1.1 Existing Impacts

The existing visual environment of the DA3 area, and of the Scheme area as a whole, is the result of a combination of farming and quarrying activities on the floodplain, set against a backdrop of predominantly unaltered natural escarpment features.

A detailed visual assessment of the Scheme area was presented in the RES. As noted in that document, the Blue Mountains escarpment, rising 200 metres or more from the general level of the Scheme area land, forms a strong profile to the west which is visible from anywhere within the Scheme area. To the north-east and east, the low ridge of the Castlereagh escarpment is also apparent, it rises 30 to 50 metres above the general level of the land within the Scheme area. While the bush vegetation of the Blue Mountains escarpment is generally unbroken, it is possible to see a scatter of houses within the lighter vegetation of the Castlereagh escarpment.

The Scheme area consists essentially of a flat alluvial terrace divided visually by vegetation associated with the creek beds that run north and north-west through the Scheme and by the planting, structures and roads associated with agricultural activities. In the DA3 area the views are generally of open farmland in the west and north, previous quarry/rehabilitation areas in the centre and open areas reinforced with boundary trees transitioning to the escarpment around Cranebrook Village. The Farrells Creek vegetation provides a contrasting variation between the open space/woodland to the east and the lakes/foreshores in the central area. To the south, views on the plain are dominated with the as yet unfinished DA2 works. The tall trees associated with the Salmond property provide some vertical dimension to an otherwise flat terrain.

### **7.2.1 Likely Visual Impacts**

There would be a difference between the visual impacts associated with the extraction and the rehabilitation phases of the DA3 programme. The visual impacts of the extraction phase would be relatively short lived, being limited to extraction periods of one or two years in localised areas. Visual impacts of the rehabilitation phase would change over time as the long term landscaping and rehabilitation measures were implemented.

#### **Impacts of Extraction Activities**

Probably the most significant visual impact associated with the extraction phase would be the intrusion of the noise bunds. These bunds, as described in section 6.1 and their location shown on Figure 6.3 will be to the north and west of Cranebrook Village and also on the north, west and southern boundary of the private property just north of the Village. Another bund will be established along the northern boundary of DA3.

Views from the Village and from the private property will be interrupted. These bunds must be 5 metres high to mitigate noise from extraction and rehabilitation operations. While they will be required for only 18 to 24 months, they will totally dominate views from the Village and the private property. Passing motorists will also observe these visually obtrusive structures.

A substantial portion of the bund north and west of the Village has already been constructed, and has been in place for several years. Trees have been planted between the Village and the bund and are now of sufficient height to reduce the visual dominance of the bund.

The bund around the private property to the north of the Village will be new construction works. It will not be there long enough to benefit from tree screening. The visual impact can be reduced by reducing the time that it is required to be in place. To this end the Corporation will monitor noise levels and when levels commence to be a problem the bund will be constructed. When monitoring indicates that noise levels have reduced to acceptable levels the bund will be removed. It is expected that the bund may be in place for 18 to 24 months. The bund on the northern DA3 boundary will be treated in a similar manner.

In longer distance views of the area, quarry activities would appear as just one visual element in a panorama embracing a number of natural and man-made visual elements.

#### **Impacts of Rehabilitation Activities**

Detailed rehabilitation plans prepared by the Corporation are based on principles and guidelines documented in the Landscape Manual. The two year plans for the first section of the DA3 area will be submitted for approval in November 1994 (see section 4.3).

In general, landscaping principles associated with the development of the Scheme are to maintain the integrity and consistency of the floodplain. This implies that landforms and landscaping works in rehabilitated areas be directed toward re-creating a fluvial structure which could be expected to be found in such a riverine system. This dictates landform profile, tree selection and the like. Quality viewing features such as the Nepean River gorge, Blue Mountains and Castlereagh escarpments are considered in determining landscape plans for rehabilitation works.

The resultant landforms surrounding Cranebrook Village will form part of the possible future urban area. There may be several years between the time the land is constructed and when it is marketed for urban development. Interim and final land uses will need to be considered in the preparation of landscape plans. Tree planting would be undertaken at the completion of rehabilitation works, such planting being compatible with both interim and final land uses.

The visual quality of the area will be enhanced by the rehabilitation works for both views from within the Scheme and views to the Scheme.

## **7.2 HERITAGE SITES**

This section describes the occurrence and nature of archaeological or historical interest within the DA3 activities.

### **7.2.1 Items of Archaeological or Historical Interest**

#### **Archaeological Sites**

The Scheme area and adjacent lands were extensively surveyed by an archaeologist during preparation of the RES. All sites that were identified were recorded and then registered with the National Parks and Wildlife Service. To comply with the Service's policy of protecting Aboriginal archaeological sites, the details of the sites will not be made public.

The results of the 1982 survey indicated that four areas had been extensively used by Aborigines:-

- \* the eastern banks of the Nepean River
- \* the northern high ground around Smith Street
- \* Cranebrook escarpment and adjacent plains
- \* Cranebrook Creek

The last two of the above areas are contained within the DA3 area. In respect of these sites the RES stated:-

### Escarpment:

The eastern ridge was a popular location for camping and contains several potentially significant sites. As most of these sites are outside the proposed development, they should be preserved. Two sites have potential for further investigation. The sites on the low ground below the ridge are minor, but are still of interest. As they are disturbed sites, surface collections should be undertaken to characterise the stone assemblages.

### Cranebrook Creek:

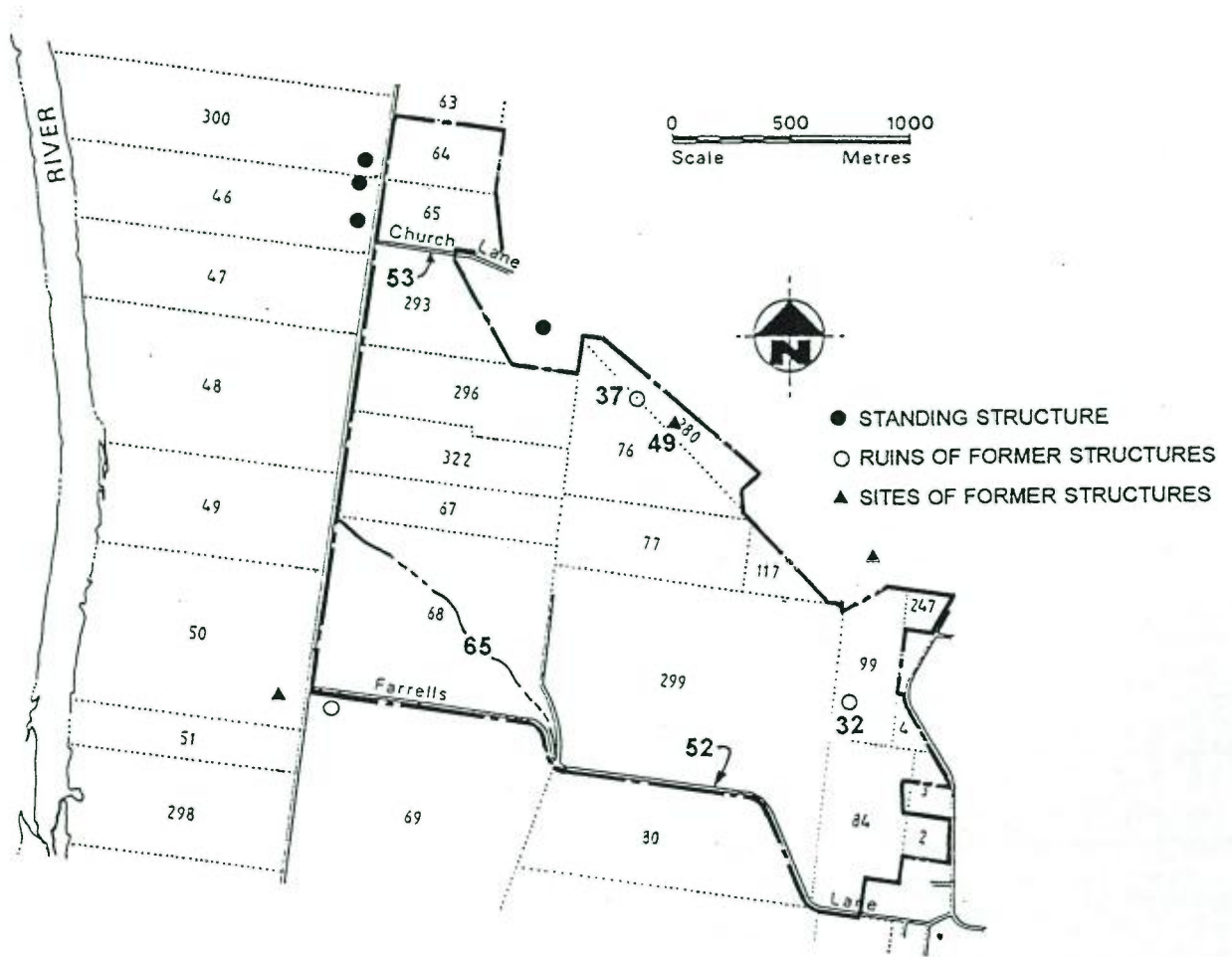
Small numbers of artefacts have been found scattered along the length of this creek. However, extensive cultivation and disturbance of the land which has taken place over the past 200 years in addition to the surface artefact collections already undertaken, make it unlikely that a major undisturbed site would be found. Further artefacts might come to light, but it is doubtful if any significant information could be obtained unless any early sites were exposed during quarrying.

In order to confirm these findings, a further archaeological investigation was conducted of the DA3 area in early 1994. The National Parks and Wildlife Services' Site Register was inspected to determine if any additional sites had been recorded since the time of the original survey. Field inspections were undertaken in association with a representative from Daruk Local Aboriginal Land Council. Findings of the investigations have been forwarded to the NPWS and Daruk Land Council.

The investigation confirmed the findings of the original RES studies. No new sites of significance were identified, but there may be potential minor sites along the Cranebrook Creek worthy of further investigations. Poor visibility at these sites restricts their assessment and they should be considered as potential sites until such time that further detailed assessments are undertaken. This is similar to the situation in DA2 where potential sites were identified, the topsoil was stripped and the archaeologist was then able to make a full assessment of the site. Once assessed actions were taken to recover artefacts and consent sought to destroy the site by way of application to the NPWS and consultation with the Daruk Land Council.

### **European Heritage Sites**

A comprehensive heritage survey of the Scheme area and surrounding lands was undertaken during the preparation of the RES. Of the seventy five items of historical interest recorded by that survey, six are contained within the DA3 area. These items, their nature and suggested conservation policy are presented in Table 7.1 and location shown on Figure 7.1



ITEMS OF HISTORIC INTEREST

FIG. 7.1

TABLE 7.1

Heritage Items in DA3 Area

RES Ref. No.	Item	Type	Suggested Conservation Policy
37	Pise House	Ruins	Retention not required
49	Frasers House	Site	Retention not required
32	Rev.Fulton's parsonage	Ruins	Retention not required
52	Farrells Lane	Road	Partial retention
53	Church Lane (part)	Road	Preferred or partial retention
65	Cranebrook Creek	Landscape	Retention not required

## 7.2.2 Likely Impacts and Proposed Ameliorative Measures

### Archaeological Sites

All Aboriginal sites in New South Wales are protected by the National Parks and Wildlife Act, 1974, and come under the jurisdiction of the National Parks and Wildlife Service. Before any site can be destroyed, permission must be obtained from the Director of the Service. National Parks and Wildlife Services' policy also requires that developers consult with the local Aboriginal people to ascertain whether a site that may be destroyed is of significance to them. A representative of the Daruk Land Council accompanied the consultant archaeologist on the 1994 field investigation. A copy of the consultant's report has been forwarded to both the Daruk Land Council and NPWS.

As noted above, there has already been considerable destruction of archaeological records in the DA3 area as a result of over 200 years of European settlement. Removal of topsoil and overburden as proposed in the DA3 extraction programme would remove any remaining physical trace of Aboriginal occupation. However, it is not considered that this would constitute a serious loss to local, State or national heritage.

Actions which would be taken by the Corporation in relation to archaeological heritage items during the DA3 work are set out below:-

- \* Before any development occurred adjacent to Cranebrook Creek or near the Escarpment, an application would be sought for consent to destroy those sites identified in the area. Negotiations would be undertaken with the Daruk Local Aboriginal Land Council and the National Parks and Wildlife Service regarding any requirement to have the artefacts collected.
- \* If additional sites were uncovered during development, the Regional Archaeologist of the National Parks and Wildlife Service and the Daruk Land Council would be notified, and appropriate action taken to evaluate the sites.
- \* In view of the almost total lack of archaeological visibility at the potential sites that may be located beneath the surface, periodic examination of the area by an archaeologist would be undertaken during the quarrying operations. This would take the same format as works undertaken in the DA2 area.

It is the intention of the Corporation to establish a visual display at its Site Office for education and research purposes. Although still at a conceptual level, a significant component of the display will relate to archaeological issues of the Scheme area. The Daruk Land Council and NPWS will be consulted in establishing this display.

## **European Heritage**

By comparison to other areas in the Scheme, the DA3 area has very few items of historical interest. The RES identified several significant heritage sites to be retained within the Scheme, none of which are present in DA3.

DA2 conditions of consent require the Corporation to investigate and record identified items of historical interest prior to their removal. Only one item exists in DA3 lands which will be affected by quarry and rehabilitation works. This is the Rev. Fulton's parsonage which is the foundations of a former structure.

Current arrangements with the Nepean District Historical and Archaeological Group will continue into the DA3 area. The Corporation will make arrangements for NDHAG to investigate and report on this item before it is affected by quarry operations.

In regard to the visual display mentioned above, it is the Corporation's intention to select and salvage various heritage components within the Scheme for use in the display. Arrangements will be made with NDHAG to assist in the establishment of this display.

### **7.3 AGRICULTURE**

This section describes the existing agricultural activities in the DA3 area and discusses the likely impacts of the DA3 development on these activities.

#### **7.3.1 Existing Conditions**

Agricultural activities within the DA3 area involve mainly dryland grazing (beef and dairy cattle). Land owned by the Corporation and its shareholders that has not already been quarried is leased out for grazing. These activities have proved to be a rational use of the land, as well as being appropriate to the available managerial resources and to the maintenance of the attractiveness of the area at a fairly low cost.

#### **7.3.2 Agricultural Impacts**

The proposed development would result initially in the loss of an area presently used for grazing. Cessation of these agricultural activities would have an insignificant impact either on total production from the area or on supplies to the metropolitan area, as this production could be easily replaced by intensified production within the Scheme area or in other areas.

Although the end use of the DA3 area would not be for agriculture, it is possible that there could be some agriculturally related uses, such as grass hay production or grazing, in the interim on rehabilitated land. However, it is unlikely that rehabilitated land could be used for more intensive agriculture uses because of the need to establish and conserve landforms.

If quarrying were not a prospect for the DA3 area, it is likely that the agricultural activities in the area would continue to decline in importance,

although the rates of change would be different. In the absence of Corporation ownership of the land, it is likely that dairying and grazing would decline at a faster rate and that there would be a greater proportion of the area devoted to other land uses.

In summary, the DA3 area is of minor importance in terms of agricultural production on a State basis, and all production could be replaced economically by intensifying production in other areas where land is cheaper.

## **7.4 TRAFFIC**

This section describes the existing traffic conditions in and round the DA3 area and discusses the likely traffic and transport impacts associated with the DA3 activities.

### **7.4.1 Existing Conditions**

There are three major elements contributing to the existing transport situation in the scheme area:-

- \* the general movement of cars and trucks to, through, and around the area;
- \* the movement of raw feed from quarries to crushing plants;
- \* the movement of crushed gravel and concrete from the crushing and concrete plants to destinations outside the Scheme area.

The third of these elements, the movement of finished products from crushing and concrete plants, is not considered in this SEE, as the crushing plants are not included in this development application. However, the output of existing crushing plants would not alter significantly.

Most of the Scheme area is served only by road, with no bus or rail services being available for either passengers or goods. South of the river, there is a rail spur to the Boral crushing plant, although only 20% of the finished product from this plant is transported by rail, the remainder being moved by road.

### **General Vehicular Movement**

Access to the DA3 area, as for the Scheme area in general, is via three major routes.

- \* Castlereagh Road, a State arterial road, providing access from the south and north-west;
- \* Andrews Road, a Regional arterial road, providing access from the east and south-east;
- \* Cranebrook Road, a State arterial road, running north-east from the Scheme area.

A number of lesser roads provide cross-connections through the DA3 area. These include:-

- \* Farrells Lane, which runs east-west across the southern boundary

of the DA3 area between Castlereagh Road and Cranebrook Road, at Cranebrook;

- \* Church Lane, which runs north-west from Cranebrook Road to Castlereagh Road. Most of this road is outside the Scheme boundary except for the very western section at its intersection with Castlereagh Road.

Castlereagh Road west of Cranebrook Road carries more than 4500 vehicles per day. Cranebrook Road carries a slightly less volume of traffic but is becoming increasingly more important as a regional link between Penrith and areas to the north.

Farrells and Church Lanes are important local roads linking Cranebrook Road to Castlereagh Road. The volume of traffic on these roads is small, generally less than 200 vehicles per day but are important for local requirements. Thornleys Lane maintains access to lands leased from the Corporation or its Shareholders.

#### **Transport of Raw Feed**

All raw feed is transported from the quarry faces to the crushing plants by off-road haulage (Figure 4.4). Vehicular and pedestrian access to the quarry areas, haul roads, crushing plants and areas undergoing rehabilitation is strictly controlled, with no unauthorised personnel or vehicles being permitted in these areas.

#### **7.4.2 Likely Traffic and Transport Impacts**

The traffic and transport impacts associated with the proposed extraction programme would be the closure of Farrells Lane and the relocation of the western end of Church Lane.

It is proposed to close Farrells Lane at a point near Cranebrook Village and at its intersection with Castlereagh Road. The closure point at Cranebrook Village will be varied during the life of DA3 to permit rehabilitation works on the road alignment but at the same time maintain access to the private property in the DA2 area (Salmond). Pioneer haul road trucks will cross the existing lane, at grade, about 500 metres west of the Village. The section of lane between the Village and its intersection with Thornleys Lane will not be quarried, but will have its profile adjusted in accord with rehabilitation works within the DA2 areas to the south and DA3 areas to the north. West of Thornleys Lane, the road will be stripped of overburden down to approximately RL15m AHD. A 20 metre wide berm will be retained on this road alignment for access and water management purposes.

The closure of Farrells Lane would be an inconvenience to residents of Cranebrook Village as it is a useful route for access to Richmond. Additionally, it is common to see residents using the lane for walking/cycling. Alternative access to Richmond would be available via Church Lane, while not quite as direct as Farrells Lane, it will nevertheless maintain access to Richmond for Cranebrook residents up until Castlereagh Road is re-located.

Alternative opportunities are available for walking/cycling, principally Boundary Road to the east, however, as the Scheme proceeds the residents will be able to access rehabilitated lands dedicated for public use.

The closure of Thornleys Lane would not cause inconvenience to the public.

At the western end of Church Lane, it is intended to quarry the existing road alignment and properties just to its north. The lane will be relocated to the northern boundary of DA3 during Stage 6 of the DA3 works. The additional traffic expected from the closure of Farrells Lane will increase traffic volumes on Church Lane but the increase is not expected to be significant.

## **7.5 URBAN DEVELOPMENT**

This section describes existing urban development in the vicinity of DA3 and discusses likely impacts associated with the DA3 development.

### **7.5.1 Existing Urban Development**

The areas subject to extraction and rehabilitation under the DA3 approval are located between 5km and 7 km north-west of the central area of Penrith. With the exception of the village of Cranebrook which is immediately to the east, the DA3 area is adjoined largely by rural land. There are approximately eighty houses in the village of Cranebrook, most of which have been constructed since 1978.

### **7.5.2 Likely Impacts**

There would be no quarrying activities within 30m of roads or urban development, and the impacts of operations undertaken close to Cranebrook would be kept within acceptable limits (see Sections 6.1 and 6.2 in particular). Most of the lands south of the village would have had rehabilitation works completed by the time DA3 works are scheduled to commence in the north (Stage 2). No sand or gravel extraction works will be undertaken within the area between the existing noise bund and the Village. Some minor rehabilitation works may be undertaken in this area, probably toward the end of DA3.

Section 6.1 describes the approach taken to co-ordinate works to the immediate west and north of the Village. Basic options were to undertake the works as quickly as possible keeping the period of inconvenience short as possible or to undertake the works over a longer period of time using less machinery and causing less noise. On the basis that noise and dust studies indicated that the level of inconvenience would be acceptable, the works were scheduled to extract and rehabilitate the area as quickly as possible. This approach has the attraction of nearby rehabilitated lands being completed earlier than would have normally been possible.

Given the proximity of the eastern section of the DA3 area to the regional road system, the higher existing ground levels, and the present level of urban and rural residential development, some form of urban development would appear

to be an attractive end use for this section of the Scheme area (Figure 5.1). Thus in the medium to long term, Cranebrook is likely to be adjacent to the area of urban development established on nearby rehabilitated land.

## 7.6 EMPLOYMENT

There are sixty six people whose employment currently relates directly to the extraction of sand and gravel from the Penrith Lakes Scheme (Table 7.2). The numbers and distribution given in this table are not expected to change as a result of DA3 activities.

TABLE 7.2

Existing Employment in Extraction and Rehabilitation  
Penrith Lakes Scheme

Category	Pioneer	Boral	CSR	Contract	PLDC	Total
Pit operators	2	2	1	-	-	5
Workshop staff (pit related) and haulage	2	4	4	3	-	13
Raw feed haulage	3	6	5	11	-	25
Rehab./Maintenance	-	-	-	10	3	13
Staff	1	2	2	2	3	10
<b>Total</b>	<b>8</b>	<b>14</b>	<b>12</b>	<b>26</b>	<b>6</b>	<b>66</b>

## 7.7 ENERGY STATEMENT

During the DA3 period, it is proposed to continue using the existing methods of extraction and rehabilitation as described in section 4.4. All equipment use diesel fuel. The fleet of equipment described in section 4.4 and other equipment uses in operations and maintenance works would consume on an annual basis the following approximate quantities

* Raw Feed Winning, Loading and Hauling	2,400,000 litres
* Stripping and Rehabilitation	2,100,000litres
* Haul road maintenance	300,000 litres
* Miscellaneous-slashing/minor works/dewatering	200,000 litres
<b>Total</b>	<b>5,000,000 litres</b>

Actual annual consumption of diesel will vary depending on raw feed extraction levels, haul distances and mine sequencing.

## 7.8 SERVICES

As noted in the RES, the Corporation would be required to pay all costs associated with the relocation of any services affected by the Scheme. Within the DA3 area any low voltage electricity and telephone services would be relocated as and when necessary. Liaison would be maintained respectively with the Prospect County Council and Telecom Australia. There are no sewers that would be affected by the DA3 extraction and rehabilitation programme.

## APPENDIX A

### MATTERS TO BE INCLUDED IN THE STATEMENT OF ENVIRONMENTAL EFFECTS

Matters to be included in the SEE are prescribed under SREP No. 11. The Corporation sought the advice of the Department of Planning of any other matters for consideration. The Department advised of the recent establishment of the Hawkesbury Nepean Catchment Management Trust and requested the Corporation to consult with the Trust during the preparation of the SEE.

The Corporation consulted the Trust and were advised that issues and matters of concern to the Trust were covered by the requirements of SREP No. 11. It also required consideration of:-

- \* current EPA licence conditions for discharges from site
- \* implications arising from revised flood levels and proposals to raise Warragamba Dam
- \* scope for using treated effluent in the DA3 area

Requirements of SREP No. 11 are:-

1. The following matters:-

- (a) justification of the proposed development in the context of Sydney Regional Environmental Plan No. 11 - Penrith Lakes Scheme;
- (b) a full description of the proposed development;
- (c) a statement of the objectives of the proposed development;
- (d) a full description of the existing environment likely to be affected by the proposed development if carried out;
- (e) identification and analysis of the likely environmental interactions between the proposed development and the environment;
- (f) analysis of the likely environmental impacts or consequences of carrying out the proposed development (including implications for use and conservation of energy);
- (g) justification of the proposed development in terms of environmental, economic and social considerations;
- (h) measures to be taken in conjunction with the proposed development to protect the environment and an assessment of the likely effectiveness of those measures;
- (i) energy requirements of the proposed development;
- (j) any feasible alternatives to the carrying out of the proposed development and

the reasons for choosing the latter; and

(k) the consequences of not carrying out the proposed development.

2. In addition to the matters listed in paragraph 1, particular regard must be given to the following matters:

- (a) relationship and extent of the proposed development to the completed scheme;
- (b) where appropriate, the integration of the proposed development with development previously carried out;
- (c) the sequence of extraction where the proposed development is for, or includes, an extractive industry;
- (d) unless the land is to be dedicated to the Crown, the proposed control and management of the land;
- (e) the management and control of water resources including:
  - (i) the source of water in order of fill any lake (including the quality and quantity of water from that source).
  - (ii) water reticulation systems from the Nepean River to any lake, from lake to lake and from any lake to the Nepean River;
  - (iii) the water quality of any lake (including the aquatic ecosystem);
  - (iv) water treatment facilities;
  - (v) water depth of any lake;
  - (vi) flood control;
  - (vii) storm water control;
  - (viii) the effect that development would have upon the quantity and quality of the existing groundwater as well as the level of the existing groundwater table;
  - (ix) lake usage;
  - (x) staged development of the lakes and their usage during staged development;
  - (xi) the need to monitor the water quality of the lakes having regard to their intended use; and
  - (xii) the effect upon the Hawkesbury/Nepean River system;

- (f) the rehabilitation and reconstruction of the land including:
- (i) landscape design;
  - (ii) the structural stability and soil compaction of landforms (including, where appropriate, the land shown on the structure plans as future urban);
  - (iii) the stability and impermeability of the Nepean River embankment;
  - (iv) soil conservation; and
  - (v) revegetation;
- (g) any effect upon a locality, place or building not listed in Schedule 3 having aesthetic, anthropological, archaeological, architectural, cultural, historical, scientific or social significance or other special value for present or future generations; and
- (h) measures to be taken to conserve and preserve items of environmental heritage listed in Schedule 3, including, where appropriate, a conservation plan; and
- (i) access to, the supply of water from any existing service to, and the supply of and access to municipal and utility services to, land to which this plan applies other than that part of that land the subject of the application.

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## APPENDIX C

### ABBREVIATIONS

#### Measurements

Technical units of measurement in this report are based on the International System of Units (SI) wherever possible. These technical units may be broadly grouped as prefixes and measurements. A solidus is used to indicate 'per'(for example megalitres per annum - ML/a).

The prefixes used are as follows:

M	mega	1,000,000
k	kilo	1,000
m	milli	0.001
u	micro	0.000001

Units of measurement that have been use are:

a	annum	L <sub>90</sub>	sound power level exceeded 90% of the time (background noise level)
dBA	decibel, frequency weighting network A	L <sub>10</sub>	general noise level
g	gram	m <sup>2</sup>	square metre
h	hour	m <sup>3</sup>	cubic metre
ha	hectare	km	kilometre
L	litre	%	percent
t	tonne		

#### Miscellaneous

AHD	Australian height datum
DA1	Development Application No. 1
DA2	Development Application No. 2
DA3	Development Application
DA ROWING LAKE	Development Application for construction of Rowing Lake
D o P	Department of Planning
DSRR	Department of Sport, Recreation and Racing
EIS	Environmental Impact Statement
EPA	Environment Protection Authority
NPWS	National Parks and Wildlife Service
PLDC	Penrith Lakes Development Corporation
REP	Regional Environmental Plan
RES	Regional Environmental Study
RL	Reduced Level
SEE	Statement of Environmental Effects