



HITCHCOCK ROAD SAND EXTRACTION AND REHABILITATION PROJECT, MAROOTA



ENVIRONMENTAL ASSESSMENT Volume One

**HITCHCOCK ROAD SAND EXTRACTION
AND REHABILITATION PROJECT, MAROOTA**

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Volume One

PF Formation

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GLOSSARY



Glossary of terms and abbreviations

Term:	Definition
AHD	Australian Height Datum. The standard reference level used to express the relative elevation of various features. A height given in metres AHD is essentially the height above sea level.
Airshed	Lower atmosphere within a defined geographic area.
Ambient	The background level at a specific location, being a composite of all sources.
Anisotropic	Having some physical property that varies with direction.
Annual Average Daily Traffic	Annual average daily traffic volume representing the total traffic in both directions at a specified location calculated from mechanically obtained axle counts.
Annual Exceedance Probability (AEP)	The probability of a flood event exceeding a nominated level in a year. A one percent AEP is the probability of an event exceeding a nominated level in 100 years.
Aquiclude	A geologic formation, group of formations, or part of a formation through which virtually no water moves.
Aquifer	Geologic formation, group of formations, or part of a formation capable of transmitting and yielding economic quantities of water.
Aquifer properties	The characteristics of an aquifer that determine its hydraulic behaviour and its response to abstraction.
Aquitard	A saturated, but relatively poorly permeable formation, or group of formations that does not transmit or yield water freely.
Archaeology	The scientific study of human history, particularly the relics and cultural remains of the distant past.
ARI	Average Recurrence Interval-average or expected period between exceedance of a flood.
Background Noise Level	The ambient sound pressure noise level in the absence of the sound under investigation exceeded for 90 percent of the measurement period. Normally equated to the average minimum A-weighted sound pressure level.
Batter	The side slope of walls, embankments and cuttings or the degree of such slope, usually expressed as a ratio of horizontal distance to one vertical height.
Bore	A cylindrical drill hole sunk into the ground from which water is pumped for use or monitoring.
Boundary	A lateral discontinuity of change in the aquifer resulting in a significant change in hydraulic conductivity, storativity, or recharge.

Term:	Definition
Buffer	A physical barrier, structure or width of land which encloses, partially encloses or defines a particular environment. It serves to minimise the impacts of non-desirable external influences on the adjoining environment.
Bund Wall	A wall erected to prevent the escape of various emissions into the environment (liquids, noise or views).
Catchment	The area drained by a stream or body of water or the area of land from which water is collected.
Clay	Very fine grained sediment, often defined as having a particle size less than 2 microns (0.002mm) in diameter.
Claystone	A non-fissile rock of sedimentary origin composed primarily of clay-sized particles (less than 0.004 mm).
Compaction	The process of compressing individual grains in a soil or sediment in response to pressure.
Cone of depression	A depression of the potentiometric surface which has the shape of an inverted cone that develops around a well from which water is being withdrawn. It defines the area of influence of a well.
Confined aquifer	A completely saturated aquifer in which the upper and lower boundaries are relatively impermeable layers (aquitards or aquicludes). The groundwater is contained under sufficient pressure to cause it to rise above the aquifer if the top impermeable layer is breached.
Confining bed	A layer of relatively impermeable material underlying, overlying, or adjacent to one or more aquifers.
Conservation	The management of resources in a way that will benefit both present and future generations.
Contaminant	Any physical, chemical, biological or radiological substance or matter in water or soil that is not of natural origin.
Contamination	The degradation of the natural environment as a result of human activities.
dBA	Decibels using the A-weighted scale measured according to the frequency of the human ear.
DEC	NSW Department of Environment and Conservation
Decibel	A scale unit used in the comparison of powers and levels of sound energy. The number of decibels is ten times the logarithm to the base of ten of the ratio of the powers.
Degree of Saturation	The ratio of the traffic volume entering an intersection in a specific period to the capacity of the intersection during that period.
Department of Planning	NSW Government department responsible for planning with a role in the assessment of the proposal and making a recommendation to the Minister for Planning whether it should proceed.

Term:	Definition
Drawdown	The difference between the observed water level during pumping and the pre pumping water level.
Ecology	The relationship between living things and their environment.
Ecologically Sustainable Development	Using, conserving and enhancing the resources of the community so that ecological processes on which life depends, are maintained and the total quality of life, now and in the future, can be increased.
Ecosystem	A functional unit of energy transfer and nutrient cycling in a given place. It includes all relationships within the biotic community and between the biotic components of the system.
Emission	Discharge of a substance to the environment.
Environment	A term for all the conditions (physical, chemical, biological and social) in which an organism or group of organisms, including humans, exists.
Environmental Assessment (EA)	A formal description of a project and an assessment of its likely impact on the physical, social and economic environment. It includes an evaluation of alternatives and an overall justification of the project. The EA is used as a vehicle to facilitate public comment and as the basis for analysing the project with respect to granting approval under relevant legislation.
Environment Protection Licence	A licence that allows pollution of the environment under controlled conditions regulated by the Department of Environment and Conservation.
Eluvial deposit	A deposit formed as the result of in situ weathering of a rock located at its site of formation.
EMP	Environmental Management Plan
EPA	NSW Environment Protection Authority (now part of the Department of Environment and Conservation)
EPBC Act	Environment Protection and Biodiversity Conservation Act (Commonwealth)
Equivalent Continuous Sound Level (L _{Aeq})	The constant sound level which when operating over the same time interval as a fluctuating sound over an extended time, is equivalent to the same sound energy.
Erosion	The wearing away of the land surface by the action of water, wind and ice.
Excavate	Dig into natural material and remove using specialist machinery.
Extraction	A term referring to the removal of material from the earth synonymous with quarrying.
Evapotranspiration	Loss of water from a land mass through transpiration from plants and evaporation from the soil.
Ferricrete	A duricrust or a soil zone more or less cemented with iron oxide

Term:	Definition
Fauna	All animals including birds, reptiles, marsupials and fish.
Flora	All plants
Frequency	Similar to the pitch of a musical note in sound pressure fluctuations of cycles per second (Hertz). Most sounds comprise a composite of frequencies of varying sound pressure levels in the range of 20 Hertz to 20,000 Hertz.
Friable	Easily crumbled.
Front-end loader	Machine used to lift and place soil, earth, rocks and other materials within an extraction site or to load products into trucks.
Gradient	Rate of change of a given variable with distance, such as temperature or elevation.
g/m ² /month	grams per square metre per month
Greenhouse Effect	Changes in climate that could occur due to increases in atmospheric concentrations of certain gases.
Groundwater	Subsurface water contained within the saturated zone.
Habitat	The place where an organism lives; habitats are measurable and can be described by their flora and physical components.
Hawkesbury Sandstone	Prominent cliff-forming sandstone occurring across the Sydney basin.
Head (hydraulic head)	Energy contained in a water mass produced by elevation, pressure or velocity.
Heritage	Things of value which are inherited from the past.
Hydraulic conductivity	The rate at which water at the prevailing kinematic viscosity will move under a unit hydraulic gradient through a unit area measured perpendicular to the direction of flow, expressed in metres per day. This definition assumes a medium in which the pores are completely filled with water.
Hydraulic gradient	The change in static head per unit of distance in a given direction.
Hydrocarbon	Any organic compound, gaseous, liquid or solid, consisting only of carbon and hydrogen.
Hydrogeology	The study of subsurface water in its geological context.
Impact	The effect of human-induced action on the environment.
Infiltration	The process of surface water soaking into the soil.
Infrastructure	Supporting installations and services supplying the needs of a project.
Introduced species	Plants and animals not native to Australia and known or thought to have been brought here by humans.
Isotropic	Having the same physical properties in all directions.

Term:	Definition
Landform	A specific feature of the landscape or the general shape of the land.
Lens	Geologic deposit or body bounded by at least one curved, converging surface, giving it a lens-like appearance.
Level of Service	A qualitative measure describing operational conditions within a traffic stream and their perception by motorists and/or passengers.
Lithology	Science of the nature and composition of rock.
µg/m ³	micrograms per cubic metre
µs/cm	microsiemens per centimetre
micron	Unit of measure-one millionth of a metre.
mg/L	milligrams per litre
Mitigation measures	Measures put in place to reduce an impact.
Modelling	Use of mathematical equations to simulate and predict real events and processes.
Monitoring	Regular measurement of components of the environment to understand their condition and establish if necessary standards are being met.
Native	Local inhabitant of a defined place.
NPWS	NSW National Parks and Wildlife Service (now part of the Department of Environment and Conservation)
Observation well	A well constructed or utilised for the purpose of observing groundwater parameters such as water levels, pressure changes and water quality.
Overbank deposit	A flood plain deposit.
Palaeochannel	An ancient river bed, often filled with more recent sediments.
Perched water	Unconfined groundwater separated from an underlying body of groundwater by an unsaturated zone and supported by an aquitard or aquiclude.
Permeable material	Material that permits water to move through it at perceptible rates under the hydraulic gradients normally present.
Permeability	The property or capacity of a porous rock, sediment, clay or soil to transmit a fluid. It is a measure of the relative ease of fluid flow under unequal pressure. The hydraulic conductivity is the permeability of a material for water at the prevailing temperature.
Permian	The last period of the Palaeozoic era, finished approximately 230 millions years before present.
pH	A measure of acidity or alkalinity of a solution, numerically equal to 7 for neutral solution, increasing with increasing alkalinity and decreasing with increasing acidity. Originally stood for the words potential of hydrogen.

Term:	Definition
Piezometer	A pipe in which the elevation of the water level or potentiometric surface can be determined.
Porosity	The percentage of bulk rock, which is void space between rock particles.
Potentiometric surface	A surface, which represents the standing or total hydraulic head. In an aquifer system it represents the levels to which water will rise in tightly cased wells. The water table is the potentiometric surface of an unconfined aquifer.
Powerscreen	A mobile item of equipment used to separate material of differing size.
Process plant	Equipment used to clean and separate sand into various sizes.
Recharge	Addition of water to the zone of saturation; also the amount of water added.
Recovery	The difference between the observed water level during the recovery period after cessation of pumping and the water level measured immediately before pumping stopped.
Receptor	An environmental modelling term used to describe a map reference point where the impact is predicted. A sensitive receptor is a home, work place, school or other place where people spend some time. An elevated receptor is a point above ground level.
Rehabilitation	Preparation of a final landform following extraction and its stabilisation with vegetation.
Remnant vegetation	Native vegetation remaining after widespread clearing has taken place.
Residual drawdown	The difference between the observed water level during the recovery period following pumping and the pre- pumping water level.
Resource	Potentially usable material in a defined area that can be economically extracted.
RL	Reduced level, usually in metres to an arbitrary datum.
RTA	NSW Roads and Traffic Authority
Run-off	The proportion of precipitation discharged through surface water systems.
Sand	Sediment comprising particles ranging between 0.063mm and 2mm.
Sandstone	A fine grained rock of sedimentary origin composed primarily of sand-sized particles (0.06 to 2 mm).
Saturated zone	That part of an aquifer in which all voids are filled with water under pressure greater than atmospheric pressure.
Screen	A type of lining tube or casing of special construction, with apertures or slots designed to permit the flow of water into a well while preventing the entry of aquifer or filter pack material.

Term:	Definition
Sedimentation basin	An area where runoff is ponded to allow sediment to be deposited. The longer the period that the runoff is held, the smaller the size of the sediment deposited. Such basins have to be regularly cleaned.
Semiconfined aquifer	An aquifer confined by a layer of moderate permeability (aquitard) that allows vertical leakage of water into or out of the aquifer.
Shale	A laminated sediment in which the constituent particles are predominantly in the clay size.
Silt	Sediment comprising most particles between 0.004mm and 0.063mm.
Siltstone	A fine grained rock of sedimentary origin composed primarily of silt-sized particles (0.004 to 0.06 mm).
Species	Taxonomic grouping of organisms that are able to interbreed with each other but not with other species.
Stakeholder	An individual or group with an interest in the proposal.
Static water level	The level of groundwater standing in a well uninfluenced by pumping in that well.
Static head	The height, relative to an arbitrary reference level, of a column of water that can be supported by the static pressure of the aquifer at a given point.
Stockpile	Mound used to store material.
Storage coefficient	The volume of water an aquifer releases from or takes into storage per unit surface area per unit change in head.
Storativity	The volume of water an aquifer releases or takes into storage per unit surface area per unit change in head. In an unconfined aquifer, it is normally referred to as specific yield. In confined aquifers it may be referred to as storage coefficient.
Stormwater	Rainwater which runs off catchments following rain events. The untreated water is carried into creeks, rivers and lakes.
Terrestrial	Relating to the land as distinct from air or water.
Tertiary	Geologic time at the beginning of the Cainozoic era, 65 to 2 million years ago, after the Cretaceous and before the Quaternary.
Thalweg	The line joining the deepest points of a stream channel.
Topography	The physical relief and contours of the area.
Topsoil	The surface layer of a soil profile containing most of the organic material and viable life forms and seeds.
Total Dissolved Solids	The dissolved mineral content of groundwater, commonly expressed in milligrams/Litre.
Total Suspended Solids	A measure of suspended solids concentrations in a water body and expressed in terms of mass per unit of volume.

Term:	Definition
Transmissivity	The rate at which water at the prevailing kinematic viscosity is transmitted through a unit width of an aquifer under a unit hydraulic gradient, expressed in square metres per day. (Note: Transmissivity is equal to hydraulic conductivity times the thickness of the aquifer.)
Triassic	The earliest of the three periods that constitute the Mesozoic Era. Approximately between 230 and 180 millions years before present.
TSC Act	Threatened Species Conservation Act (NSW)
Turbidity	A measure of light penetration through a water column containing particles of matter in suspension.
Unconfined aquifer	An aquifer in which the upper boundary of the saturated zone is at atmospheric pressure.
Underflow	The volume of groundwater that flows through an aquifer through a cross sectional area. It depends on permeability and the prevailing gradient.
Unsaturated zone	That part of an aquifer between the land surface and water table.
USEPA	United States Environmental Protection Agency
Wash plant	Equipment designed to wash unwanted sized materials from the product.
Water quality	Degree or lack of contamination.
Water table	The surface of saturation in an unconfined aquifer at which the pressure of the water is equal to that of the atmosphere.
Well	A hole sunk into the ground and completed for the abstraction or injection of water or for water observation purposes. Generally synonymous with bore.
1 in 100 Year Flood Level	The flood which occurs on average once every 100 years. Also known as the 100 year Average Recurrence Interval of a flood.

SUMMARY OF THE ENVIRONMENTAL ASSESSMENT



Summary of the environmental assessment

Introduction

The Environmental Assessment has been prepared to accompany a development application by PF Formation for a change to their operations at the Hitchcock Road site in Maroota, Baulkham Hills. Although the proposal comprises a number of changes to the current approval, it is treated as a new development which would supersede it. The current approval would remain in force until it ceases to have effect when the present application is approved under Part 3A of the *Environmental Planning and Assessment Act 1979*.

The site is located approximately 50 kilometres to the north-west of the Sydney Central Business District and about eight kilometres south of Wisemans Ferry. Its location is shown on **Figure 1.1**. The site is included within the Maroota sector of *Sydney Regional Environmental Plan No 9 - Extractive Industry (Number 2)*. The objective of this plan is to protect a valuable sand resource in this and other locations.

The site is zoned Rural 1(b) under *Baulkham Hills Local Environmental Plan 2005*. Extractive industry is permitted, with Council consent, within this zone.

The existing sand mining operation is located on a site adjacent to the intersection of Old Northern Road and Wisemans Ferry Road, Maroota comprising seven separate parcels of land covering approximately 79 hectares. The proposal would include 11 parcels following the addition of five more, including the former Maroota Trigonometrical Reserve site and its access roads and the removal of one lot (Lot 2 DP555184) which is the subject of a separate application for sand extraction to Baulkham Hills Shire Council. The area subject to sand extraction would now cover an area of approximately 85 hectares which is shown on **Figure 1.2**.

The site is basically triangular in shape with an additional area located to the south east. The distance from the apex of the triangle at the intersection of Wisemans Ferry Road and Old Northern Road to its most southerly corner is approximately 1,500 metres while the base of the triangle from the junction with Hitchcock Road to its most easterly corner measures some 1,300 metres. The location of the parcels making up the site is shown on **Figure 1.2**.

The *Environmental Planning and Assessment Act 1979* (the Act) and *Environmental Planning and Assessment Regulation 2000* (the Regulation) control the use and development of land in NSW. The Act establishes the hierarchy of planning instruments that apply to the proposal.

The Act was amended in August 2005 by the inclusion of Part 3A. The Minister for Planning is responsible for determining development which has been declared to be major infrastructure under this part of the Act. The Minister may declare a development to be a major project if defined in *Schedule 1: Major Projects-Classes of Projects* in *State Environmental Planning Policy (Major Projects)*. Group 2.7 in Schedule 1 includes extractive industries and the Hitchcock Road project meets the criteria for consideration as a major project under the State Environmental Planning Policy due to its scale and significance.

The summary provides an overview of the proposal, its benefits and its impacts. It is designed to provide enough basic information to allow informed comment to be made without the need to examine the whole document and the associated technical papers.

The issues addressed in the environmental assessment and summarised here are derived from a number of sources. These include the requirements of the Director General of the Department of Planning and other relevant authorities, the previous EIS, experience of operating the site and the consent orders of the Land and Environment Court which determine the way in which the existing operations are conducted.

The authorities raised a comprehensive range of issues with an indication of those considered to be key considerations by the Department of Planning. As a result, these have been addressed in the document. Specialist consultants have provided detailed studies in relation to the following:

- geology and resource assessment;
- noise;
- air quality;
- groundwater;
- flora and fauna;
- traffic and access;
- cultural heritage; and
- visual impacts.

These studies are summarised in **Chapter 4** and included in full in Volumes Two and Three of the environmental assessment.

Existing operations

Sand extraction has been undertaken on part of the site since the mid-1980s based on a number of Council consents. Following a long series of discussions, an application covering most of the current site was determined by Baulkham Hills Shire Council by the granting of consent with conditions on 16 December 1997. The consent excluded an area located in the centre of the site, then known as the Maroota Trigonometrical Reserve, and its access roads. The resulting landform, following completion, would therefore have comprised two separate extraction zones with a major elevated area remaining in the centre of the main part of the site plus an additional area to the east.

A third party filed a Class 1 Appeal against the consent in March 1998. This was heard in the Land and Environment Court in July 1998 and the appeal dismissed.

The extraction has subsequently been operated in compliance with Consent Orders 10064 of 1998 of the Land and Environment Court dated 14 July 1998. These have been administered by Baulkham Hills Shire Council. The consent orders allow Council to amend the staging of the development and the depth to which extraction can take place following application from the proponent. Staging has been amended as a result of site related factors with the approval of Council but two applications to amend the depth of extraction in response to continuing groundwater monitoring have not been granted.

Key conditions contained in the consent orders include:

- retention of the existing Trigonometrical Reserve and hence sterilising a significant volume of extractable Tertiary sand (no land owner approval was available at the time);
- limitation of the period of extraction to 30 years from July 1998 (the endorsed date of consent);
- restriction of the maximum depth of extraction to 187 metres AHD subject to the outcome of the Maroota Groundwater Study which had only just commenced;
- limitation of annual extraction of Tertiary Sand from the site to 400,000 tonnes of processed material; and
- limitation of laden vehicle movements to a combined total of 200 movements per day via the intersection of the haulage road and Wisemans Ferry Road.

The site is operated in compliance with these and other conditions included in the consent orders administered by Baulkham Hills Shire Council.

The site is also operated in compliance with the provisions of Environment Protection Licence 3407 under the *Protection of the Environment Operations Act 1997* administered by the Department of Environment and Climate Change.

Planning context

The main planning instruments applying to the proposal are *Baulkham Hills Local Environmental Plan 2005*, *Baulkham Hills Shire Development Control Plan 16 – Extractive Industries 2004* and *Sydney Regional Environmental Plan 9 – Extractive Industry (Number 2) 1994*.

The site is within the area defined for inclusion in *Sydney Regional Environmental Plan 9* which was introduced to assist in the development of extractive resources located close to the Sydney Metropolitan area. The plan takes precedence over local planning instruments.

The site is zoned Rural 1(b) under *Baulkham Hills Local Environmental Plan 2005*. Quarrying is permissible in this zone with development consent. The proposal described in the EA generally complies with the requirements of *Baulkham Hills Shire Development Control Plan 16*.

Relationship between existing and proposed developments

The present application seeks changes of two kinds. First, these would amend the area over which the activity would be permitted and, second, would change the depth to which extraction could be undertaken and modify the resulting final landform on cessation.

The proposal would entail extraction of Tertiary Sand and other materials from all the lots included in the current consent with the addition of Lot 1 DP1013943 (formerly Maroota Trigonometrical Reserve 6739), adjacent former Crown Roads, Lot 2, DP752039 and Lot 1 DP223323 plus the removal of Lot 2 DP555184. The boundaries of the total area to be extracted would be similar to those included in the existing consent with these exceptions. The inclusion of Lot 1 DP223323 and Lot 214 DP753039 would allow the previous setbacks on the adjacent lots to be extracted where they are excluded in the present consent.

Lot 2 DP555184 is the subject of a separate application for sand extraction and associated development to Baulkham Hills Shire Council under Part 4 of the Act.

It is proposed to use the existing sand slurry transport system, central wash plant and ancillary facilities such as the workshop, weighbridge and office located on Lot 198 DP752025, in addition to the existing haul roads on site. It is not proposed to increase output above the limit set out in the existing consent (400,000 tonnes of processed material per year). As a result, the number of trucks allowed to leave the site via the weighbridge on Lot 198 each day would not increase above the approved limit (400 truck movements per day). (No trucks are allowed to convey material from the extraction site across Wisemans Ferry Road to the central wash plant except in an emergency or when routine maintenance is taking place). There would therefore be no change in the traffic impacts on the surrounding road network as a result of the proposal.

Extraction activities on the site including rehabilitation are limited to a period of 30 years from 14 July 1998 (the endorsed date of consent). It is not proposed to extend this period.

The development application will seek a new approval which would supersede the existing consent and require compliance with a new set of consent conditions.

The proposed development

Development consent is sought for the proposal including:

- extraction of Tertiary Sand, friable sandstone, clay and gravel to within two metres of the wet weather high groundwater table (nominally 181 metres AHD) with no extraction within buffer zones and perimeter setbacks as defined in the environmental assessment;
- loading and transport of the extracted Tertiary Sand via articulated vehicles to the existing sand slurry plant located at the northern end of the site. Other extracted material would be stockpiled for later reuse as backfill or for transport to the central wash plant on Lot 198 prior to removal to market;
- staged clearance of vegetation within those areas designated for extraction as defined in the environmental assessment;
- transport of extracted material as a slurry via the existing pipeline to the central wash plant on Lot 198 DP752025;
- processing and stockpiling of extracted material at the existing central wash plant in accordance with the consent for this operation;
- importation and processing of clean material for recycling up to a maximum of 20 laden trucks per day;
- return of wash water via the existing pipeline and disposal of tailings from the processed Tertiary Sand into sedimentation ponds located on the site of the proposal;
- transport of the product off-site in accordance with the existing consent;
- use of the existing access from Lot 1 DP34599 to Old Northern Road for transport of friable sandstone product not requiring processing at the central wash plant on Lot 198 DP752025;

- use of the existing dam on Lot 167 DP752039 to receive and detain runoff from the extraction area and return clean water to the sand slurry transport system and the existing dam on Lot 198 to receive and detain runoff from the central wash plant area; and
- rehabilitation of extracted areas on the site of the proposal to create an integrated, continuous landform across all extracted areas as the basis for productive future use.

Extraction operations

The extraction operations are described in four general stages requiring approximately five years each to complete. In practice these would vary depending on site conditions and market demand. Extraction would continue as currently planned under the existing consent until a new approval is in operation. Some of the activities described under Phase One could be undertaken under the existing consent.

Phase One (2007 – 2011)

- continuation of extraction westward from Area B;
- extraction eastward from the haul road (overburden backfilled into Area B);
- construction of Pond 11;
- completion of Pond 9;
- partial rehabilitation of Pond 5;
- continuing extraction of the area adjacent to Old Northern Road;
- extraction on Lot 214 DP752039 and Lot 1 DP34599;
- rehabilitation (planting) in the area of former ponds 3, 4 and 6;
- completion of Pond 10 (overburden backfilled into Area B).

Phase Two (2012 – 2016)

- extraction southwards from Area A;
- construction of Pond 12;
- extraction on Lot 2 DP570966
- rehabilitation of area adjacent to Old Northern Road;
- overburden backfilled into extracted areas to the south;
- rehabilitation of Pond 11;
- extraction to the south;

Phase Three (2017 – 2021)

- continuation of extraction to the south;
- backfilling of clay overburden into extracted areas to the north and south;
- completion of Pond 13;
- continuation of extraction on Lot 2 DP570966
- rehabilitation of northern section of the northern extraction area;
- rehabilitation of the western part of the southern extraction area.

Phase Four (2022 – 2025)

- continuation of extraction southwards;
- backfilling of clay overburden into extraction to the north;
- continuation of extraction in the southern area;
- extraction on Lot 1 DP1013943, Lots 1 and 2 DP1063296 and Lot 2 DP570966;
- construction of Pond 14;
- rehabilitation of southern extraction area;
- rehabilitation of northern extraction area;
- rehabilitation of ponds leaving one to drain each catchment;

- completion of land reformation and landscape planting;
- removal of all fixed infrastructure and formation of final land form.

The existing status of the site is shown on **Figure 2.3** and those areas proposed for future extraction on **Figure 2.4**. The overall staging of the development is shown on **Figure 2.5**. Ponds 11 and above would be located in future extraction areas. Their exact location is not yet known.

Processing and product transport

All raw material requiring to be processed would be transferred to articulated dump trucks to transport the material via established on-site haul roads to the existing plant located at the northern end of the site. Here it would be mixed with water and transported as slurry by pipeline some 1.5 kilometres to the central wash plant located on Lot 198 DP752025. The wash water would be returned to the site for settlement in a series of clay lined basins prior to recirculation from the clean water pond at the lowest point on the system and subsequent reuse.

Product is currently trucked from the central plant and all sales of processed material are made from the weighbridge on Lot 198 DP752025. Trucks leave the site via the access road to Wisemans Ferry Road turning either left to the intersection with Old Northern Road and right to Dural and Castle Hill or right along Wisemans Ferry Road to Windsor, Richmond and Penrith. The proportion of trips on these routes is approximately equal.

Extracted and imported material not being processed at the central wash plant and requiring only on-site screening may be transported to market using the existing access from Lot 1 DP34599 Old Northern Road.

It is proposed that sand extracted from the Hitchcock Road site would supply the same markets as the current operation and the same transport routes would be used. The number of truck movements would remain within the currently approved limit of a total of 200 laden trucks per day (400 truck movements).

Site services

All necessary site services are available and no augmentation is required.

Workforce and hours of operation

The current workforce would remain at 20 to 22 staff. Truck drivers, either permanent staff or contracted or employed by others would pick up loads from the central process plant on Lot 198 DP752025.

The hours of operation would be in accordance with those applying to Lot 198 containing the central process plant and the weighbridge:

- 05.45 hours Monday to Saturday – gates open to allow entry of vehicles to the site;
- 06.00 to 07.00 hours Monday to Saturday (excluding public holidays) – 30 truck movements (15 loaded vehicles) may enter or leave the site;
- 07.00 to 18.00 hours Monday to Saturday (excluding public holidays) – extraction, transportation and processing or running of machinery for maintenance purposes permitted; and
- no extraction, transportation or processing on Sundays and public holidays.

Life of the proposal

Extraction rates at the Hitchcock Road site have ranged between 200,000 and 250,000 tonnes per year over the past seven years. This is not expected to change although annual rates may vary from depending on market conditions. Extraction of some 5,335,000 tonnes of material at these rates would require between 21 and 26 years to complete. This is consistent with the existing consent (30 years from November 1998).

Management of waste

The overall waste management objective is to minimise the generation of waste, maximise recycling and ensure that wastes are managed in a way that minimises impacts on the environment.

Trees, shrubs and other plants stripped during site clearing would be reused during rehabilitation to provide a source of seed, organic matter and refuge for fauna.

All overburden would be used in rehabilitation of the previously extracted area or adjacent parts of the site. Tailings, the fine clays and silts removed from the sand during washing would be disposed of in tailings ponds on the site.

General waste would be managed at the workshop and offices on Lot 198 DP752025 which provides separate receptacles for paper, aluminium, glass, plastic and general domestic waste with the recyclables (paper, aluminium, glass and plastic) collected by a licensed disposal contractor.

Sewage treatment and disposal is provided by an *enviro-cycle* type plant. It is not proposed to install any additional office facilities or amenities on the site.

Industrial waste (oil and grease) is collected and stored in a separate waste bin for weekly removal by a licensed oil recycling contractor. Building waste and putrescible material are also removed from site on a regular basis and this procedure would continue.

Rehabilitation and final land uses

The final landform of the Hitchcock Road site would be influenced by the depth of extraction, the location of commercially available resource (both Tertiary sand and friable sandstone) and the volume of overburden, mainly clay, available for re-contouring the extracted areas. Sand has been extracted from part of the site to the depth allowed in the existing consent and part of this area has been rehabilitated. These areas would only be reworked where a substantial volume of sand could be economically extracted.

A substantial part of the site would be reclaimed to Class 3 agricultural land suitable for grazing and improvement for pasture. Rehabilitation would comprise the return of the stored topsoil and the progressive revegetation of the site. Techniques to be used have been based on several sources: *Urban Erosion and Sediment Control Handbook* (Department of Conservation and Land Management 1992); *Managing Urban Stormwater* (Landcom 2007); and *Best Practice Environmental Management in Mining – Rehabilitation and Revegetation* (Environment Protection Authority 1995).

A comprehensive rehabilitation strategy including a biodiversity offset strategy would be prepared as part of the revised environmental management plan for the site.

The proposed final landform is shown on **Figure 2.7**.

Environmental impacts and safeguards

Specialist studies were undertaken to assist in the understanding of the environment of the site and its surroundings which together with the experience of operating the site over the past seven years has enabled the proposed development to be designed to avoid or minimise undesirable impacts. Potential impacts and proposed or existing safeguards are summarised in the following sections.

Land use

Land uses in the surrounding area include agriculture, extractive industries, forestry, national park, nature conservation and water reserve. Agricultural activities include orchards, market gardens and grazing undertaken mainly on the plateau along the Maroota ridge.

Sand extraction now constitutes a major land use in the Maroota area with this activity protected by designation in the *Sydney Regional Environmental Plan 9 – Extractive Industries* (Department of Urban Affairs and Planning 1994). Sand mining has been undertaken in the Maroota area since 1983 and will become a source of increasing importance as those in other parts of the metropolitan area reach the end of their active lives.

The *Agricultural Land Classification Atlas* (NSW Agriculture 1995) maps the site as Class 3 land. This is well suited to grazing and pasture improvement and may be cropped or cultivated in rotation with pasture. Soil conservation or drainage works may be required due to erosion hazard and soil structural breakdown on this class of land.

The majority of the site to be quarried would be rehabilitated with grasses on the flatter slopes and local native plants on the batters and steeper slopes.

Groundwater

Three separate aquifers can be identified, although the extent of their hydrogeological separation or, conversely, interconnection, is sometimes uncertain. These aquifer units are:

- Maroota Sand;
- eluvial/weathered profile of the underlying Hawkesbury Sandstone; and,
- Hawkesbury Sandstone.

The more significant of these are the Maroota Sand and the deeper Hawkesbury Sandstone.

The water levels in the monitoring bores have been continuously monitored using automatic data loggers since 1999 and prior to that, water level measurements were undertaken manually in some of the bores. A ten year record of groundwater levels is therefore available. Hydrographs for all bores together with all relevant rainfall data recorded at the PF Formation office site on Lot 198 DP752025 are available.

The consistent response of the water table in different locations in Maroota to groundwater extraction and recharge and the lack of an overall long term decline in levels suggest that the present extent of extraction from the Maroota Sand and Hawkesbury Sandstone in the area are in a hydrogeological balance. The sand mining operators continue the monitoring of groundwater levels and quality through the extensive network of monitoring bores and, except in a single example on an adjacent site, maintain a buffer above the water table.

The following impacts of sand extraction are possible and have been investigated:

- reduced groundwater availability to users;
- reduced flow to streams;
- increased turbidity in streams; and
- lowering of the water table.

None of these are expected to occur as a result of the proposal which should lead to an increased potential for groundwater recharge to the deep aquifer with benefit to nearby users. No mitigation measures, in addition to those in place and reported in the annual management plan, would be necessary.

Contingency plans, should they be required, cannot be limited to the sand miners, whose records show that they are careful managers of the groundwater resources and that their activities are in balance with the hydrogeological regime. In the event of a serious decline of the water table which could derive from a combination of extended drought and increased extraction, contingency measures could only be effectively developed and implemented within the overall context of agricultural and sand mining usage in the area based on an evaluation by the Water Management Act managers using accurate records of all users.

Surface water

Surface water flows are directed to a number of large detention basins which are part of the process system employed at the site. These allow the silt in the water, returned from the wash plant on Lot 198 DP752025, to settle out before progressing to the clean water basin located in the lowest part of the site. The clean water is returned from here to the slurry plant and the central process plant.

The site where sand extraction has taken place to date is inwardly draining due to a combination of topography and the effect of the peripheral bunds constructed as part of the project. No surface water is therefore discharged beyond its boundaries. The whole site can therefore be considered to be a detention basin capable of accommodating far in excess of the runoff from the 100 year ARI time of concentration event.

The site, including Lot 2 DP555184, can be divided into three catchments. Based on containing all runoff from the 100 year storm event, the following basins would be required on completion of the proposal. The basin within the eastern catchment would need to be located on Lot 2 DP555184 and is not included in the proposal.

Northern catchment (16 hectares)	5,500 cubic metres
Southern catchment (52 hectares)	39,000 cubic metres
Eastern catchment (29 hectares)	12,000 cubic metres

The impact of current operations on catchment flows is minimal and this would be expected to continue. Surface runoff would only occur during high intensity storms when the infiltration capacity of the soils is exceeded. The dams and creeks in the vicinity of the site are known to be groundwater dependent and are not expected to be influenced by any changes in catchment conditions. In addition, extraction of overburden and the underlying Tertiary sand is expected to improve groundwater recharge.

That part of the site potentially discharging to the headwaters of Little Cattai Creek (the Eastern catchment) makes up less than 0.3 percent of the total catchment and would therefore not be expected to have any impact on the quality or quantity of surface water discharged to the Hawkesbury River.

Soils

The soils on site are highly erodible under concentrated flows. Erosion and sediment controls have therefore been proposed to manage drainage and minimise the area of soil exposed to surface water flows. Controls would include:

- provision of buffers and installation of silt fences where appropriate to prevent sediment transport to adjoining land;
- minimising the area of disturbance by only clearing areas immediately prior to extraction within each stage and progressive rehabilitation of the completed area;
- diversion of upslope drainage away from disturbed areas;
- diversion of sediment laden runoff to sediment basins; and
- regular inspection and maintenance of sediment controls.

Noise

Noise would be generated on those parts of the site where extraction and subsequent rehabilitation is taking place. This would vary depending on the location of these activities at any one time. Noise levels would be similar to those currently generated and would provide the basis for the assessment of future noise levels.

The focus for the noise assessment was the nearest non-project related sensitive receptors adjacent to the site. These are mainly located on the north-eastern side of Old Northern Road. All are protected from site generated noise by acoustic mounds and one residence is at a considerable distance from current operations. Two residences are located close to the western side of the site: one at the intersection of Hitchcock Road and Wisemans Ferry Road and one close to the intersection of Old Northern Road and Wisemans Ferry Road.

The responsibility for the control of noise emissions in NSW is vested in local councils and the Department of Environment and Conservation. The Environment Protection Authority (now part of the Department of Environment and Climate Change) released an Industrial Noise Policy in January 2000. This provides a framework and process for deriving noise criteria for consents and licences that regulate premises scheduled under the *Protection of the Environment Operations Act 1997*. The Hitchcock Road site is scheduled under the Act.

All operational scenarios modelled represent worst case situations where all fixed and mobile plant and equipment likely to be used over the life of the project is operating simultaneously. This situation would not be experienced in practice and correspondingly lower received noise levels would result at the assessment locations. Noise monitoring at adjacent locations undertaken over the past ten years and reported annually to Baulkham Hills Shire Council has shown that the relevant criteria are not exceeded. As changes to operating methods or the volume of material to be extracted are not proposed, it can be concluded that the modelled Impacts are overstated.

Modelled noise emission levels at various assessment locations are below relevant criteria during the early morning period when trucks are operating along the haul road except for marginal exceedances at one location under prevailing north west winds and three locations under temperature inversion conditions. However, the use of the night time criterion for this period (06.00 to 07.00 hours) for rural areas is considered unduly stringent in the NSW Industrial Noise Policy (Department of Environment and Conservation 2000).

All locations predicted to experience noise level increases have been subject to operational noise from sand extraction and transport activities for at least seven years and the continuation of these operations can be expected to result in little overall perceived change. However, in the event of complaints concerning noise from any affected local resident, monitoring would be undertaken at the site, discussions held with the affected residents and appropriate mitigation measures agreed and implemented.

The cumulative noise assessment indicated that emissions of the proposed development at Hitchcock Road and its adjoining developments would be below the relevant acceptable amenity criteria for industrial noise during the daytime and night time periods at all nine assessment locations.

Air quality

Dust generation would be the principle air quality issue on the Hitchcock Road site. The main activities likely to generate dust during the operation of the proposed extraction areas would include:

- topsoil stripping and overburden removal;
- ripping and excavation of friable sandstone;
- vehicles travelling on unsealed surfaces;
- loading and unloading the raw feed and products to trucks and stockpiles; and
- wind erosion of stockpiles and exposed unpaved areas.

The quantity of dust generated by each activity has been established by reference to emission factors developed both locally and by the US EPA.

Dust concentrations and deposition rates due to sand extraction activities have been prepared for existing and proposed operations for predicted:

- maximum 24-hour average PM₁₀ concentrations;
- annual average PM₁₀ concentrations;
- annual average Total Suspended Particles (TSP) concentrations; and
- annual average dust deposition.

The results of the assessment indicate that:

- maximum 24-hour average PM₁₀ concentrations at the nearest dwelling are predicted to be 11.0 µg/m³. It is unlikely that the 24-hour average goal of 50 µg/m³ would be exceeded due to the proposed operations even with existing PM₁₀ concentrations;

- annual average PM₁₀ concentrations at the nearest dwelling are predicted to be a maximum of 1.6 µg/m³. It is unlikely that the annual average goal of 30 µg/m³ would be exceeded due to the proposed operations even with existing PM₁₀ concentrations;
- annual average TSP concentrations at the nearest dwelling are predicted to be a maximum of 3.4 µg/m³. It is unlikely that the 90 µg/m³ NHMRC goal would be exceeded due to the proposed operations even with existing annual average TSP concentrations; and
- annual average dust deposition levels at the nearest dwelling are predicted to be a maximum of 0.2 g/m²/month. It is unlikely that the proposal would result in any additional exceedances of the goal of 4 g/m²/month.

Results from the dispersion modelling indicated that off-site dust concentrations at all nearby dwellings would be below relevant air quality goals as a result of the proposed operations at the Hitchcock Road site. Predicted additional impacts resulting from the proposal are minimal.

Flora and fauna

Four vegetation communities occur on site, comprising Shale Sandstone Transition Forest, Sydney Sandstone Gully Forest, Sydney Sandstone Ridgetop Woodland and regrowth vegetation. Vegetation in the cleared areas is dominated by weeds and is not considered to be a native community.

The condition of the Shale Sandstone Transition Forest is poor to moderate, while the Sydney Sandstone Gully Forest and Sydney Sandstone Ridgetop Woodland are in good condition. The regrowth vegetation areas are also in poor to moderate condition. Two threatened species of plant, *Tetratheca glandulosa* and *Grevillea parviflora* subsp *parviflora* were recorded during detailed surveys of the site.

The condition of the fauna habitats in the Sydney Sandstone Gully Forest is generally good while those in the Shale Sandstone Transition Forest and Sydney Sandstone Ridgetop Woodland are in moderate condition. The regrowth vegetation areas contain fauna habitats that are in poor condition. The threatened Glossy-black Cockatoo was recorded on site. However, the species would only use the site as a marginal foraging area and would not depend on its habitat resources.

Impact assessments as required under the *Threatened Species Conservation Act 1995* and *Environment Protection and Biodiversity Conservation Act 1999* were carried out for the Shale Sandstone Transition Forest Endangered Ecological Community, five threatened species of plant, microchiropteran bats (as a group) and nocturnal birds (as a group). The assessments concluded that the proposed sand extraction and rehabilitation was unlikely to have significant impact on threatened species, population or communities.

Overall, the proposal would result in the clearing of 10.6 hectares of native vegetation with the associated loss of flora and fauna habitats. This is not considered to be a significant impact on either local or regional ecosystems. Neither would the proposed extension of sand mining activities at Hitchcock Road be expected to significantly affect any threatened species, population or community. A substantial program of replanting has started as part of the staged rehabilitation of the site and this will continue in compliance with the Rehabilitation Plan.

Cultural heritage

No Aboriginal sites were identified during the survey.

One European site was located during the site investigations. This comprised a simple farm shed which, due to its age, exhibited potential heritage significance. However, this does not meet the threshold where it would be considered significant under any of the criteria established by the NSW Heritage Office. The site does not therefore qualify for any additional assessment or listing on any local or State registers.

The Maroota Trigonometrical Station is typical of the standard design used throughout NSW and is very common. It is less than 50 years old and as such is not a heritage item under the NSW Heritage Act.

Traffic and access

Traffic growth on both Wisemans Ferry Road and Old Northern Road in the vicinity of the Hitchcock Road site has been slow over the last 15 years and has declined over the last three years on the former and remained static on the latter. Heavy vehicles, defined as articulated trucks with three to six axles and B-Doubles, make up nine percent of the total on Wisemans Ferry Road and seven percent on Old Northern Road. There is a distinct tidal flow during peak periods on both these roads with a bias towards northbound traffic in the morning with the reverse occurring in the evening.

The proposal would not generate more laden trips from the central area on Lot 198 than experienced at present and would remain within the permitted total of 200 laden trips per day for all PF Formation operations in Baulkham Hills.

The performance of the local road network and the intersections used by the site-generated traffic has been assessed using growth factors for future traffic. The assessment indicated that the traffic generated by the proposal would have no significant impacts on the road network or the performance of the intersections. No changes to these are therefore required.

Visual impacts

The proposed development would remove vegetation, topsoil, overburden and the available Tertiary Sand and friable sandstone resource from defined areas on the site. This would result in remoulding of the existing landform and, during active extraction, the exposure of substantial parts of the area. Progressive rehabilitation would return the site to a vegetated state as quickly as possible.

Visual mitigation measures such as bunds and vegetated setbacks have been implemented along the periphery of the site and parts of the site where extraction is complete have been reformed and seeded with local native species.

The proposal would lead to modification of the topography of the site with a lowering of its central and highest part. This would require removal of the remaining vegetation on the present skyline which would be replaced during rehabilitation. However, this is only visible from a small number of locations with public access. These are along Haerses Road and a short section of Old Northern Road. The former is little used (it is not a through road) and will soon become part of a recently approved major sand extraction operation resulting in the elimination of public access. Views from Wisemans Ferry Road are either at a considerable distance, fragmented or will be interrupted by future sand extraction activities in the foreground.

Views of proposed extraction areas on the Hitchcock Road site from Old Northern Road would be limited by the topography and that vegetation which will remain. These would be reinforced by new planting included in the proposal which would remove any views of the works.

Hazard

State Environmental Planning Policy 33 – Hazardous and Offensive Development requires that the safety and pollution impacts of a proposal are addressed at an early stage of the development application process. The policy provides a procedure which links the permissibility of the proposal to its safety and pollution control performance.

The application of the screening procedure set out in *Applying Safe Environmental Planning Policy 33* (Department of Urban Affairs and Planning 1994) indicated that as no hazardous materials as defined by the code were stored on site, the development is not classified as hazardous and the policy does not therefore apply.

Socio-economic effects

The Hitchcock Road development is operated within a Maroota-wide context which includes a number of other similar sand extraction projects. Together these result in cumulative impacts relating to the nuisance experienced from traffic, particularly large trucks passing through a small rural community, dust and, in some cases, noise. A small number of residents in adjacent properties may also be affected by the direct impacts of a single extraction operation. In the case of the Hitchcock Road development, this is limited as the majority of adjacent residents are separated from the site by the roads along its periphery.

Jointly and separately, sand extraction operations inject resources into the local economy in the form of royalties to the land owners, providing jobs both directly and indirectly and supporting local services. These are all benefits to the local community. The activities of the industry are controlled by a wide range of measures which aim to manage the environment so that all established criteria are met.

Cumulative impacts

There are currently three sand extraction proposals at various stages in the development process in the Maroota area which could result in cumulative impacts. These are:

- Sand extraction on Lots 1 and 2 DP 547255, Old Northern Road, Maroota using the existing process plant on Lot 196 DP 752025. This development has a life of 18 years from the date of consent and is currently underway. Production from the existing quarry and its extension is not to exceed 495,000 tonnes per year.
- Sand extraction on Lot 198 DP 752025, Wisemans Ferry Road, Maroota. The development application supported by an EIS was recently approved by Baulkham Hills Shire Council and extraction has started. Production would be expected to average 35,000 tonnes per year over a ten year life.
- Sand extraction on Lot 170 DP 664767, Lots A and B DP 407341 and Lots 176 and 177 DP 752039, Haerses Road, Maroota. The development application supported by an EA was recently approved by the Minister for Planning. The development would have a life of 25 years with an annual extraction rate of 250,000 tonnes. The proposal would use empty trucks returning to Lot 196 DP 752025 to transport the extracted material to the process plant. The annual production rate on Lot 196 would be in accordance with the approved maximum of 495,000 tonnes per year.

Each of these proposals was assessed in terms of its cumulative impact in relation to existing and future development in the Maroota area during its respective approval process. The existing operations at the Hitchcock Road site are included in these assessments. As the proposal described and assessed in the environmental assessment would result in no change to environmental impacts with the exception of changes to the final topography of the site, any additional cumulative impacts can be considered to be minimal.

Justification of the proposal

Biophysical impacts

The impacts of the proposal would be similar to those associated with existing extraction operations with the exception of visual impacts resulting from the changes to the topography of the site and the associated removal of remnants of an endangered ecological community. However, the resulting impacts would be minimal as the affected woodland community is not considered to be viable. Overall, the impacts of the proposal would be minimal with the adoption of the proposed safeguards and operational procedures.

Economic effects

High quality construction sand is a limited resource in the Sydney region especially when located relatively close to the main markets. As a number of large sources of supply become exhausted over the next ten years, a secure supply of sand will become increasingly valuable to the NSW economy. Alternative sources are at considerably greater distances from the main markets resulting in increased transport costs and environmental impacts.

The increased volume of material available for extraction as a result of the approval of the proposal would result in the continuing employment of the 20 to 22 full-time employees at Maroota. This would offer long term employment security over the next 25 years.

Continuing activity at the Hitchcock Road site would also support employment in the product transport industry in addition to equipment supply and maintenance.

The development would also make a contribution to economic development in the local community through the purchase of services and various consumables.

Social impacts

The proposed sand extraction would service the same market as previous operations undertaken by PF Formation at Maroota, would employ the same number of staff and use the same fixed and ancillary plant. Negative effects on local employment and the economy are therefore unlikely.

Socio-economic benefits of the proposal include the continuation of local employment, continuing supply of high quality sand to the Sydney market and continuing flow-on effects to the local and regional economy.

Sustainability

The precautionary principle has been applied by reliance on comprehensive scientific data throughout the planning and assessment of the proposal leading to the identification of mitigation measures and environmental safeguards. Wherever a potential impact has been identified, mitigation measures have been proposed to reduce any impacts as far as is practicable.

The proposal would provide access to a large volume of high quality sand, which would not otherwise be accessible without a major change to environmental impacts at the site and on the surrounding area. Any substitution of sand from other sources to compensate for the sterilisation of the material available at Hitchcock Road would result in additional environmental impacts. The proposal would have long term benefits for future

generations by providing a secure resource close to market with minimal environmental impacts.

The principle of conservation of biological diversity and ecological integrity has been considered throughout the assessment process. Access to a large mass of Tertiary sand close to the centre of the site will require the removal of a small remnant of Shale/Sandstone Transition Forest (Ridge Top Open Forest) which is listed as threatened. Seed has been collected from this community over the past three years and has been used in the site rehabilitation implemented to date managed by GreeningAustralia. This process will continue and a large stock of seed stored for future use. This would be used to recreate, as far as possible, a similar community to that previously established on the site to ensure that no net loss of native vegetation occurs.

The value of environmental resources on and adjacent to the site is determined by a large number of factors. These include the extent of detailed investigations and studies and planning and design of mitigation measures to prevent any irreparable damage to these resources. Regular monitoring of the existing development is undertaken on the Hitchcock Road site and this would continue for the proposed development. The cost of these activities has been included in the proponent's assessment of the proposal.

Alternatives

The only realistic alternative to the proposal is the continuation of the current consent which would result in the sterilisation of substantial volumes of extractable sand. As the proposal would result in minimal environmental impacts on the biophysical and economic environments, this approach is not considered to be effective or realistic. The proposal would lead to the removal of a small area of a protected woodland community and an adjustment to the local topography which would have limited visual impacts. The removal of the former Trigonometrical Reserve site would have no heritage impacts as the existing concrete pillar is less than 50 years old and is of a common type.

Need for the proposal

The predicted demand for medium to coarse grained sand of the type available at Hitchcock Road during the period from 2000 to 2010 is 25.4 million tonnes with a predicted supply from the region of 22.5 million tonnes over the same period. The potential shortfall of three million tonnes would need to be satisfied by increasing imports or by increasing production within the region (Department of Mineral Resources 2001).

In the medium term (2010 to 2020) the predicted demand for medium to coarse grained sand is expected to increase to 30.6 million tonnes. There will be no dominant secure supply of this material in the Sydney region following the closure of the Penrith Lakes scheme, expected in 2010. Current sand supplies from Maroota and elsewhere in the region are approximately 800,000 tonnes per year. The remainder of the annual requirement of three million tonnes would need to be derived from elsewhere, and, as a result, sand produced from sources such as Maroota will have an increasing importance in supplying the Sydney market for construction sand.

There is clearly a need for additional sources of medium to coarse grained sand within the Sydney region in both the short and medium terms. Importation would both increase its price due to the additional transport costs involved and result in additional environmental impacts as new sources are exploited. It is therefore important to enable the maximum available resource to be obtained from existing sources of sand in the Sydney region while ensuring that appropriate environmental standards are maintained. The new proposal at Hitchcock Road is seeking to achieve these principle objectives.

CHAPTER

INTRODUCTION



Chapter One Introduction

1.1 Background and objectives

1.1.1 Background

PF Formation (the proponent) currently undertakes sand extraction in Maroota, Baulkham Hills, over most of the site which is the subject of this proposal. The operation has been carried out under consent orders issued by the Land and Environment Court in July 1998. The activity is also subject to Environment Protection Licence Number 3407.

Site operations are subject to the overall management of Baulkham Hills Shire Council under the terms of the consent orders. These have required regular meetings of a Liaison and Review Committee comprising community and authority representatives and the preparation and submittal of an annual audit of site activities including the reporting of environmental monitoring undertaken over the previous 12 months.

The original application to undertake sand extraction activities covered all the area comprising the parcels listed in **Table 1.1** with the addition of Lot 1 DP1013943 (formerly Maroota Trig Reserve 6739) and Lots 1 and 2 DP1063296 (former Crown roads). A development application supported by an EIS was submitted to Baulkham Hills Shire Council on 21 March 1996. A Class 1 appeal was lodged by the applicant on 5 August 1996 on the grounds of non-determination.

Following a long series of discussions, the application was determined by Council by the granting of consent with conditions on 16 December 1997. The consent excluded the area in the centre of the site, then known as the Maroota Trigonometrical Reserve, and its approach roads at the central high point of the site as no landowner consent was available at that time. The resulting landform, following completion, would therefore have comprised two separate extraction zones with a raised area remaining in the centre of the main part of the site plus an additional area to the east.

A third party filed a Class 1 Appeal against the consent in March 1998. This was heard in the Land and Environment Court in July 1998 and the appeal dismissed.

The extraction has subsequently been undertaken in accordance with the consent orders. These have been administered by Baulkham Hills Shire Council. The consent orders allow Council to amend the staging of the development and the depth to which extraction can take place following application from the proponent. Staging has been amended as a result of site related factors with the approval of Council but two applications to amend the depth of extraction in response to continuing groundwater monitoring have not been granted.

Over the period of operation it has become increasingly clear that the restriction on extraction in the central area is seriously prejudicing the effective development of the site due to the difficulties involved in the process. This will ultimately lead to the sterilisation of a large volume of the available resource which could otherwise be extracted with little additional environmental impact. The proponent has acquired a long-term lease over the Crown land (the former Trigonometrical Reserve) for the purpose of sand extraction and has acquired the approach roads which were Crown roads. The leased land is no longer a Trigonometrical Reserve and is identified as Lot 1 DP1013943.

The consent orders also place a restriction on the depth of extraction. This was originally due to claimed uncertainties relating to the depth of the water table in the Tertiary Sand and its possible fluctuation during differing weather conditions. The *Maroota Groundwater Study Technical Status Report* (Department of Land and Water Conservation 2001) confirms the relevant depth relating to this site and together with the required buffer zone of two metres would allow a further four metres of high quality sand to be extracted with negligible additional environmental impacts.

The investigation of the environmental issues included as part of the EA focuses on the whole proposal which is the subject of the application rather than merely on the proposed changes to the existing consent. Various mitigation measures and management procedures are currently in place to achieve the requirements of the consent orders governing present activities at the site. In many cases, these will not require augmentation or change to address the issues associated with the new proposal.

The current proposal is similar to that included in the original application of March 1996 which was supported by an EIS (Collin C Donges & Associates) but with the addition of two properties and the removal of one. This covered much the same geographic area but restricted depth of extraction to an interim level of 187 metres AHD. Those impacts relating to the physical extent of land disturbance would therefore be similar to those described in that document. These are summarised in the following section where appropriate.

There are two major differences in relation to the extraction area and its subsequent rehabilitation compared to the current operation. The new proposal would revert to a landform similar to that proposed in the original application. This would comprise a large, gently sloping landform rising to the eastern and western boundaries, approximately triangular in shape compared to the currently approved final landform of two smaller hollows separated by a higher central section. There would also be a rectangular area to the east where a pit would be excavated to extract the friable sandstone. The current consent allows the complete extraction of this area to the boundary setbacks.

In practice, the final levels would be influenced by the volume and location of overburden and the extent to which the existing extracted areas are reworked. The base of the landform would be some four metres lower although this would vary in areas where backfilling has already occurred and it would not be practical to re-excavate. The final landform would however be dependent on the volume of overburden generated during the extraction process. The raised section would result from the presence of a very large volume of clay which overlies the Tertiary Sand in this location.

The current consent has a life of 30 years from July 1998. The proposal would not seek to extend this. Production rates would remain the same as allowed under the present consent. Impacts, as a result of the new proposal at Maroota, would remain essentially as now with the exception of the final landform. However, the approval process and the impacts of the proposal would need to be reconsidered in the light of new environmental legislation put in place since the original approval. Significant changes have been made to the approval process and these are discussed in **Chapter 3**.

There have also been changes in activity within the Maroota area relating to sand extraction since the start of operations on the Hitchcock Road site in late 1998 including new operations and the completion and closure of existing ones. These have been considered as part of the context for the current development application. The current application would result in negligible changes to impacts compared to the present situation.

It is not proposed to increase production above the 400,000 tonnes of processed sand allowed each year under the current consent. (Actual production rates are variable and dependent on market demand). There would therefore be no change in the generation of truck traffic on local roads as a result of this proposal. Traffic generation and movement have been assessed in relation to changes that have taken place over the last five years and suitable recommendations included in the EA as appropriate.

1.1.2 The existing quarry

The site is located immediately to the south of the intersection of Old Northern Road and Wisemans Ferry Road, Maroota, approximately 50 kilometres to the north-west of the Sydney Central Business District and about eight kilometres south of Wisemans Ferry. The location of the site is shown on **Figure 1.1**. The site is included within the Maroota sector of *Sydney Regional Environmental Plan No 9 - Extractive Industry (No 2)*. The objective of this plan is to protect a valuable resource in this and other locations.

The site is zoned Rural 1 (b) under Baulkham Hills *Local Environmental Plan 2005*. Extractive industry is permitted, with Council consent, within this zone.

The site is basically triangular in shape with an additional rectangular portion located to the south east. The distance from the apex of the triangle at the intersection of Wisemans Ferry Road and Old Northern Road to its most southerly corner is just under 1,500 metres while the base of the triangle from the junction with Hitchcock Road to its most easterly corner measures some 1,300 metres. The location of the parcels included in the current approval are shown on **Figure 1.2** and listed in **Table 1.1**.

Table 1.1: Description of the site

Description	Owner	Area (Hectares)
Lot 1 DP570966	PF Graham (No 2) Pty Ltd	6.08
Lot 2 DP570966	PF Graham (No 2) Pty Ltd	10.12
Lot 2 DP233818	PF Graham (No 2) Pty Ltd	6.89
Lot 1 DP1091018	PF Graham (No 2) Pty Ltd	15.34
Lot 167 DP752039	PF Graham (No 2) Pty Ltd	16.19
Lot 2 DP555184	Arkzeal Pty Ltd	14.01
Lot 1 DP34599	D Camilleri	10.22
Total		78.85

The former Maroota Trigonometrical Reserve and the Crown roads are excluded from the current approval and therefore do not form part of the land currently subject to extraction.

1.1.3 Existing approvals and licences

The existing development operates under Consent Orders 10064 of 1998 of the Land and Environment Court dated 14 July 1998. The principal conditions contained in the orders are:



0 30 60 90 kilometres

● Site

Figure I.1
LOCATION OF THE SITE

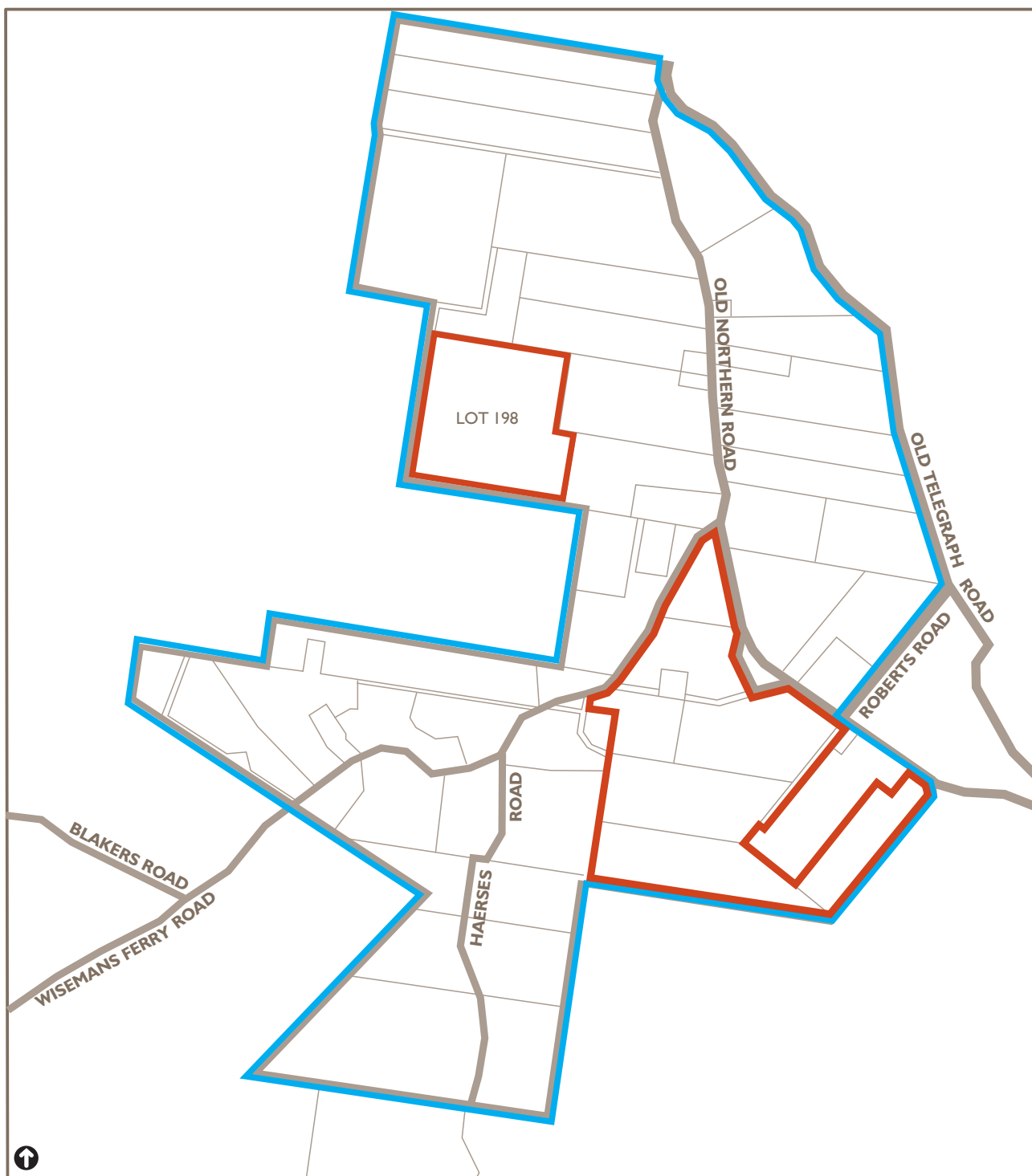


Figure 1.2
THE SITE

— Sydney Regional Environmental Plan 9 area boundary
 — Hitchcock Road site

- the development is to be substantially in accordance with that shown in Development Application 96/077 lodged with Baulkham Hills Shire Council on 21 March 1996 together with the Rehabilitation Plan dated 25 June 1998 (Order 1.2);
- the Maroota Trigonometrical Reserve and those parts of the site indicated as reserved from extraction in Revised Development Guidelines Plan LA-05B at Attachment H to the Rehabilitation Plan are excluded from development (Order 1.3);
- alterations and/or expansion to the approved extraction activities require the lodging of a separate application (Order 1.6);
- consent for the staged extraction of material and rehabilitation is limited to a period of 30 years effective from the endorsed date of the consent (14 July 1998) (Order 3.1);
- extraction shall be carried out in the sequence specified in the Staging Program at Attachment I and Paragraph 3.1 of Attachment O of the Rehabilitation Plan or such amended extraction program as approved in writing by Council's Director – Planning Services upon justification by the proponent (Order 3.4);
- the initial maximum depth of extraction shall not be lower than 187 metres Australian Height Datum (Order 3.5(a));
- if on the completion of the Maroota Groundwater Study being carried out by the Department of Land and Water Conservation, the wet weather high groundwater level is determined to be:-
 - (i) *higher than 185 metres AHD, the maximum depth of extraction shall be varied to be two metres above the wet weather high groundwater level, such maximum depth becoming effective upon written notice being given to the proponent by Council; or*
 - (ii) *lower than 185 metres AHD, the maximum depth of extraction may be varied to be not less than two metres above the wet weather high groundwater level on the written application being made to and approval being granted by the Council's Director - Planning Services Group to such varied level. (Order 3.5(b));*
- the number of laden vehicle movements is not to exceed a combined total of two hundred (200) laden movements per day via the intersection of Wisemans Ferry Road and Haulage Road, being the proponent company's total vehicle movements for their combined extractive industry operations at Maroota (Order 3.6(a));
- the maximum total annual volume of material to be extracted from the development site shall be 535,000 tonnes or 400,000 tonnes of processed material unless the prior written approval of the Council is obtained for a greater volume (Order 3.9); and
- the proponent shall convene two review meetings a year to facilitate consultation and communication between the proponent, the Council, relevant state government agencies and the community in relation to the development and any impacts the development might have on the environment.

The site is also operated in compliance with the provisions of Environment Protection Licence 3407 under the *Protection of the Environment Operations Act 1997* administered by the Department of Environment and Climate Change.

1.1.4 Objectives of the proposal

The objectives of the proposal are:

- staged clearance of vegetation within those areas designated for extraction as defined in the EA;
- extraction of sand, clay and gravel to within two metres of the wet weather high groundwater table with no extraction within buffer zones and perimeter setbacks as defined in the EA;
- loading and transport of the extracted raw material via articulated vehicles to the existing sand slurry plant located at the northern end of the site. Other extracted material would be stockpiled for later reuse as backfill or for transport to the central wash plant on Lot 198 prior to removal to market;
- transport of raw material as a slurry via the existing pipeline to the central process plant on Lot 198;
- processing and stockpiling of extracted material at the existing central process plant in accordance with the existing consent for this operation which allows such processing for the life of the extraction on the former Trigonometrical Reserve site;
- disposal of tailings from the processed extracted material into sedimentation ponds located on the site of the proposal;
- transport of the product off-site in accordance with the existing consent;
- use of the existing access from Lot 1 DP34599 to Old Northern Road for transport of friable sandstone product and imported material not requiring processing at the central wash plant on Lot 198 DP752025;
- use of the existing dam on Lot 167 DP752039 to receive and detain runoff from the extraction area and return clean water to the sand slurry transport system and the existing dam on Lot 198 to receive and detain runoff from the central wash plant area;
- rehabilitation of extracted areas on the site of the proposal to create an integrated, continuous landform across all extracted areas as the basis for productive future use; and
- importation of clean material for processing at the existing plant on the Hitchcock Road site and Lot 198 for recycling up to a total of 20 laden trucks per day.

1.1.5 Relationship between existing and proposed developments

Development consent

The existing development operates under Consent Orders 10064 of 1998 of the Land and Environment Court dated 14 July 1998. These contain 49 conditions. Condition 1.6 of the orders requires the proponent to lodge a separate application for any alterations and/or expansion to the approved extraction activities including vehicle ingress/egress arrangements and the erection of any signs not referred to in the consent.

The consent orders required the installation of a sand slurry transport system comprising plant located on the Hitchcock Road site (Lot 1 DP570966) where the raw material is mixed with water and pumped via a pipeline to the central process plant on Lot 198

DP752025 for washing and subsequent stockpiling. Process water is returned via another pipeline to the Hitchcock Road site where the fines are allowed to settle out in a series of tailings ponds before storage in the clean water dam and subsequent reuse. The pipelines generally follow the access road to the PF Formation operations on Lot 198 across a area of unreserved Crown land. The wash plant on Lot 198 was approved by Baulkham Hills Shire Council on 2 May 1991. Sand processing and related activities can continue on the site as long as PF Formation derives material from operations in the Maroota area. This would currently expire on the 13 July 2028 with the completion of the current development on the Hitchcock Road site.

The present application seeks changes of two kinds. First, these would amend the area over which the activity would be permitted and, second would change the depth to which extraction could be undertaken and the resulting final landform on cessation.

The proposal would entail extraction of Tertiary Sand and other materials from all the lots included in the current consent with the addition of Lot 1 DP1013943 (formerly Maroota Trigonometrical Reserve 6739), adjacent Crown Roads, Lot 2, DP752039 and Lot 1 DP223323 plus the removal of Lot 2 DP555184. These are shown on **Figure 1.3**.

It is proposed to use the existing sand slurry transport system, central wash plant and ancillary facilities such as the workshop, weighbridge and office in addition to the existing haul roads on site. It is not proposed to increase output above the limit set out in the consent (400,000 tonnes of processed material per year). As a result the number of trucks allowed to leave the site via the weighbridge on Lot 198 each day would not increase over the approved limit (200 laden truck movements per day). (No trucks are allowed to convey material from the extraction site across Wisemans Ferry Road to the central wash plant except in an emergency or when routine maintenance is taking place). There would therefore be no change in the traffic impacts on the surrounding road network as a result of the proposal.

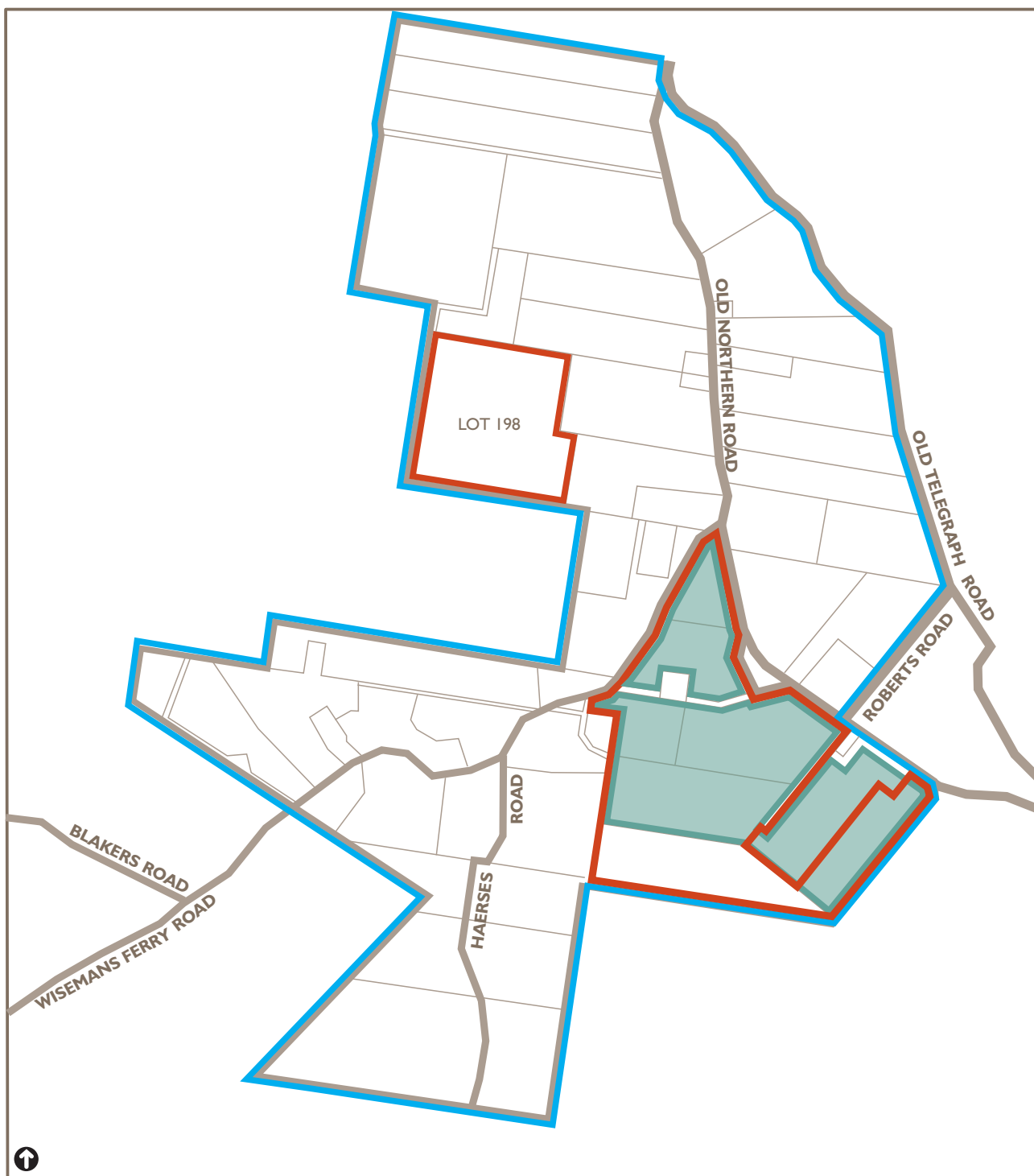
Friable sandstone and imported material not requiring processing at the central wash plant on Lot 198 DP752025 would be transported to market via the existing access on Lot 1 DP34599 onto Old Northern Road. This is a small part of the proposal and depending on the quality of the extracted material is not expected to generate any more than five laden truck movements per day. This material would be transported in trucks which would normally be returning empty to the site resulting in no net increase in total truck movements.

Extraction activities on the site including rehabilitation are limited to a period of 30 years from 14 July 1998 (the endorsed date of consent). It is not proposed to extend this period.

The development application will seek a new approval which will supercede the existing consent and require compliance with a new set of approval conditions.

Operations and landform

The extraction plan and subsequent rehabilitation would be modified from that currently approved. The current approval would result in two lowered areas with steep batters separated by a narrow ridge within the main part of the development and a single lowered area in that section of the site to the east. The proposal which is the subject of the current application would result in the partial removal of the central ridge to provide a single lowered area with a more complex topography and shallower batters. This would allow the extraction of a substantial volume of Tertiary Sand which is currently sterilised beneath a large clay lens and the creation of a more appropriate final landform avoiding steep batters and unnatural ground profiles.



Scale
 0 1.0 Kilometres

Figure 1.3
 EXISTING AND PROPOSED DEVELOPMENT AREAS

- Sydney Regional Environmental Plan 9 area boundary
- Hitchcock Road site
- Existing Development Area

The southern part of the site would also be amended as Lot 2 DP752039 and Lot 1 DP223323 have been added and Lot 2 DP555184 removed. As a result, the area subject to extraction would be changed. Extraction has recently commenced in Lot 1 DP34599 following Council approval. The resource in this part of the site mainly comprises friable sandstone which responds to the demands of a different market to that of Tertiary sand.

The rehabilitation plan would produce a sympathetic landform with a gradually sloping base suitable for productive activities with shallow batters around the periphery planted with native vegetation. This would allow the integration of the site into the surrounding area to produce an attractive landscape of natural appearance.

1.2 The determination process

In accordance with the *Environmental Planning and Assessment Act 1979*, the proposal is a Major Development under the provisions of Part 3A. Details of these are provided in **Chapter 3**.

The EA has been prepared to accompany a development application to the Department of Planning.

The Minister for Planning is the consent authority for the application. Once the adequacy of the document is determined in consultation with government agencies and Baulkham Hills Shire Council, the EA and development application will be placed on public exhibition for a minimum period of 30 days during which comments will be sought.

Copies of all responses will be sent to the proponent, the Department of Environment and Climate Change, as a licence is required, and any other public authority. The proponent may be required to respond to submissions, prepare a Preferred Project Report outlining any changes to the proposal to minimise its environmental impact and amend the Statement of Commitments. The determination process for major projects under Part 3A of the *Environmental Planning and Assessment Act 1979* is shown on **Figure 1.4**.

1.3 Consultation

1.3.1 Authority consultation

As required for State significant development under the provisions of Part 4 of the *Environmental Planning and Assessment Act*, a planning focus meeting was held at Maroota on 18 December 2002. The participants at the meeting discussed the proposal and inspected the site. The meeting was attended by representatives of the following:

- PlanningNSW (now Department of Planning);
- Baulkham Hills Shire Council;
- Environment Protection Authority (now Department of Environment and Climate Change);
- Department of Land and Water Conservation (now Department of Water and Energy);

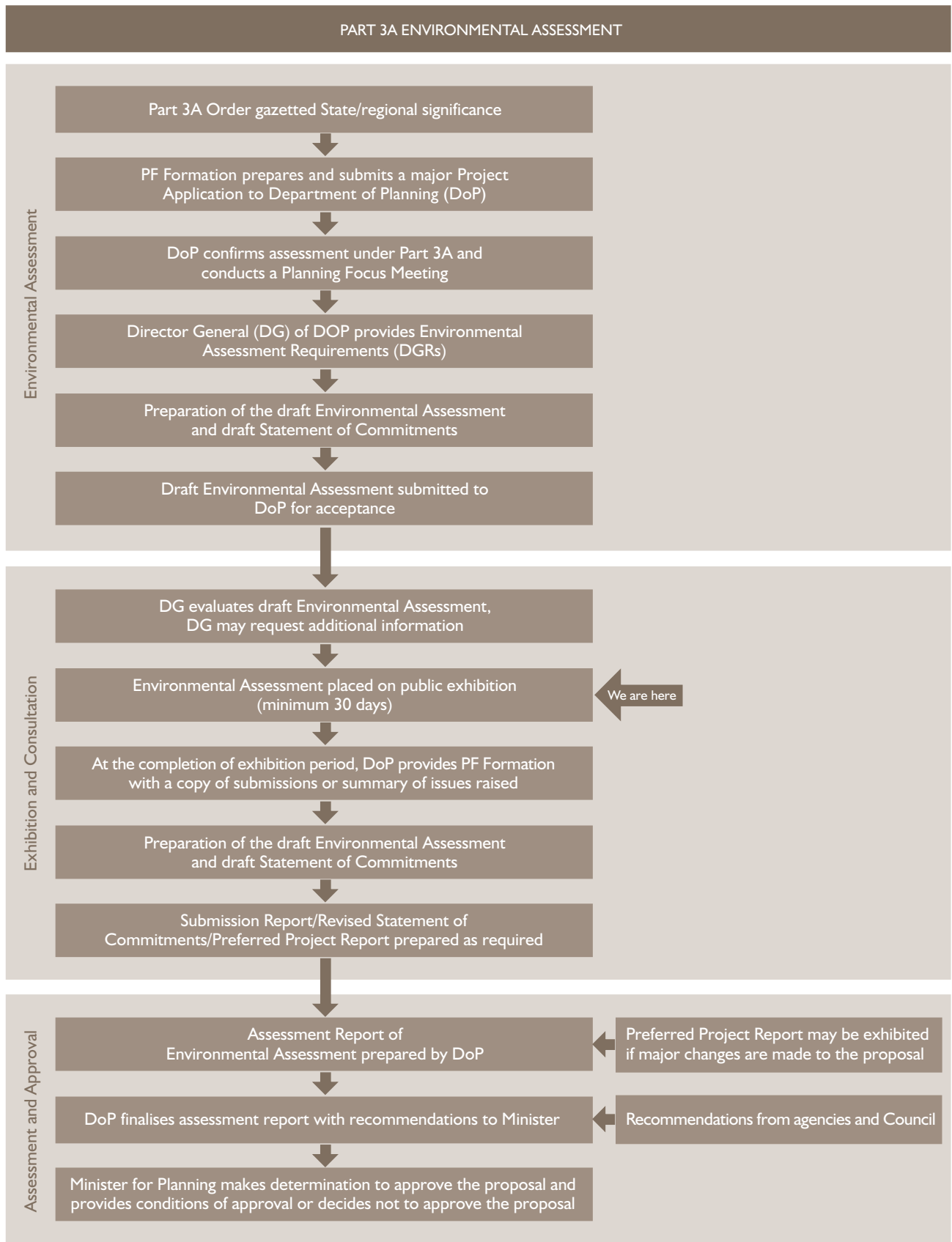


Figure 1.4

DETERMINATION PROCESS FOR MAJOR PROJECT PROPOSALS UNDER PART 3A

- NSW Agriculture;
- Department of Health;
- Department of Mineral Resources (now Department of Primary Industries); and
- The applicant (PF Formation)

All these authorities were contacted and their requirements for the EA identified. Due to the time which has elapsed since the Planning Focus Meeting and the changes to the relevant legislation, the original Director-General's requirements have been superseded. The EA has therefore been prepared in response to the requirements for assessment under the provisions of Part 3A of the *Environmental Planning and Assessment Act 1979*. These are listed in **Appendix C** together with a reference to the appropriate section within the EA where the particular issue is addressed. The relevant documentation is included in **Appendix B**.

1.3.2 Community consultation

An initial community meeting was held at the Maroota Resource Centre on 10 December 2002 to announce the intention of applying for a new consent to cover sand extraction at the Hitchcock Road site, provide a preliminary description of the proposal and seek responses from the attendees. The following issues were raised at the meeting:

- benefits to the community from Section 94 contributions;
- historic significance of the former Trigonometrical Reserve site;
- potential impacts on groundwater;
- timing of development;
- possible location of a community centre and fire tower;
- final landform;
- visual impacts;
- dust management;
- ultimate land use;
- flora and fauna impacts;
- community consultation procedures; and
- cumulative impacts.

These are addressed, where relevant to the assessment of the proposal, in the appropriate sections of the EA.

All adjacent landowners and residents were notified of the proponent's intention to proceed with the application in August 2006 and comments were sought. A similar notification was included on PF Formation's web site with a link to the application and preliminary environmental assessment on the Department of Planning site.

1.4 Issues for consideration in the EA

The issues to be addressed in the EA are defined by the Department of Planning. These are listed in the form of general requirements which apply to all environmental assessments and key requirements which reflect the potential impacts of the proposal. These are provided under a number of headings. The assessment must also take account of all appropriate State government technical and policy guidelines and consultation with relevant authorities, service providers, community groups, affected landowners and any affected Commonwealth government authorities must be undertaken.

The relative importance of the issues listed in the requirements can be determined from a number of sources, notably the Consent Orders of the Land and Environment Court which have required a specific program of site monitoring, the results of that monitoring, studies undertaken into relevant issues in Maroota, particularly the *Maroota Groundwater Study* (Department of Land and Water Conservation 2001), meetings of the Liaison and Review Committee for the site and consultation with the local community and government authorities.

The assessment process under Part 3A of the Environmental Planning and Assessment Act defines the key issues which must be examined in detail and those considered less which can be addressed via the Statement of Commitments. The key issues are typically identified using an environmental risk analysis which determines those impacts which are both expected to occur as a result of the proposal and have serious consequences if not appropriately managed.

The proposal considered in the EA is different from others in that it seeks to amend an existing development, the environmental consequences of which have been measured and reported for almost 10 years and a substantial volume of data is available to assist in identifying the issues of significance. These are therefore known and have been investigated as part of the assessment.

Issues derived from the consent orders

The consent orders (Number 10064 of 1998) require the preparation of annual reports on the results of monitoring carried out over the previous 12 months and reviews of other aspects of the development. These are:

- air quality predominantly relating to the management of dust generation;
- noise at adjacent non-mining related properties as a result of site operations;
- surface and groundwater quality particularly protection of the aquifer and management of silt-laden water;
- review of site rehabilitation;
- social impacts on the local community; and
- compliance with the principles of environmentally sustainable development.

Monitoring of each of these issues has been undertaken over the last eight years and will continue. This has resulted in the compilation of a substantial data base of information on the impacts of site activities to date. These constitute the key issues needing to be addressed in the EA which are confirmed in the Director-General's requirements.

Community consultation

The Liaison and Review Committee for the Hitchcock Road development includes three community members in addition to representatives of relevant State government authorities and Baulkham Hills Shire Council. It has met biannually for the last eight years to review activities on the site and raise various issues for consideration.

In addition to focussing on compliance of the site operations with the requirements of the consent orders, the community representatives have been mainly concerned with wider issues relating to cumulative impacts on Maroota as a result of the expansion of sand extraction over the last seven years and the benefits which should accrue to the community. Some of these are not applicable to a single development proposal but the issues of cumulative impacts are addressed in **Chapter 4**.

Community consultation specific to the present application has involved two meetings and information included in the local community newspaper. The issues raised at the meetings are comprehensive and wide-ranging. They are listed in **Section 1.3.2**.

All adjacent landowners have been visited and informed of current progress with the application. If not available at the time of the visit, a flier was left at the residence directing residents to the information on the PF Formation web site and the project application and preliminary environmental assessment on the Department of Planning web site. Residents were also encouraged to contact PF Formation with any concerns about the proposal or if further information was required.

Commonwealth approval

An EA prepared under NSW legislation has been accepted by Environment Australia as satisfying Commonwealth requirements. However it must adequately address those issues which are of concern to the Commonwealth. These are the potential impacts of the proposal on threatened species and ecological communities under sections 18 and 18A of the *Environment Protection and Biodiversity Conservation Act 1999*.

State approval

Particular State government technical and policy guidelines include:

- SEPP 11 – Traffic Generating Developments;
- SEPP 33 – Hazardous and Offensive Development;
- SEPP 44 – Koala habitat Protection;
- SEPP 55 – Remediation of Land;
- SREP 9 – Extractive Industry (Number 2);
- Baulkham Hill Local Environmental Plan 2005;
- Baulkham Hills Development Control Plan 1 – Rural Land; and
- Baulkham Hill Development control Plan 16 – Extractive Industries.

The extent to which the proposal takes account of these guidelines and policies is set out in **Chapter 3**.

Consultation

Local, State and Commonwealth government authorities, service providers and community groups need to be consulted and all issues raised, addressed in the EA. In particular, surrounding landowners and occupiers likely to be affected should be consulted. The EA must include a report describing this activity and responses to all issues raised.

The authorities raised a comprehensive range of issues with no indication of priorities. As a result, each has been addressed in the document. Specialist consultants have provided detailed studies in relation to the following:

- noise;
- air quality;
- groundwater;
- flora and fauna;
- traffic and access;
- geology and resource assessment;
- cultural heritage; and
- visual impacts.

These studies are summarised in **Chapter 4** and included in full in Volumes Two and Three of the EA.

1.5 Structure of the EA

The EA is divided into three volumes. Volume One, the Main Volume is divided into six chapters supported by four appendices.

Chapter 1 provides an introduction including a description of the background to the proposal and a definition of its objectives. The determination process is summarised and the authority and community consultation undertaken described. The issues considered in the EA are discussed and their sources summarised.

Chapter 2 provides a detailed description of the proposal including a discussion of alternatives and the implications of not proceeding with its implementation.

Chapter 3 includes a description of the statutory framework of the proposal and demonstrates its compliance with all requirements contained in the relevant planning and environmental instruments. Those approvals and licenses required for the proposal to proceed are listed.

Chapter 4 provides a detailed description of the existing environment, the anticipated impacts of the proposal on those issues defined in Chapter 1 and the management measures to be included in the proposal to mitigate any undesirable outcomes. The consideration of the principles of sustainability in the development and assessment of the proposal is also described together with an assessment of its potential cumulative effects.

Chapter 5 describes the mitigation measures proposed before, during and following the implementation of the proposal and provides an outline of the environmental management plan including a definition of objectives and the procedures required to achieve them in practice.

Chapter 6 summarises the justification of the proposal in relation to biophysical impacts, economic effects and social impacts in addition to compliance with the principles of environmentally sustainable development.

The appendices to Volume One contain a listing of the requirements of the Director-General of the Department of Planning for the EA. A checklist of the key issues raised and the location where they are addressed in the document is also provided.

Volumes Two and Three provide a series of detailed technical papers which support the assessments included in Volume One. These are:

- Technical Paper 1 Geotechnical assessment;
- Technical Paper 2 Groundwater;
- Technical Paper 3 Traffic and access;
- Technical Paper 4 Noise;
- Technical Paper 5 Air quality;
- Technical Paper 6 Flora and fauna;
- Technical Paper 7 Cultural heritage assessment; and
- Technical Paper 8 Visual impacts.

Where any discrepancies arise between the descriptions and conclusions in the Main Volume and the Technical Papers in Volumes Two and Three, those in the main Volume prevail. One part of the site, which is included in the current approval, has been omitted from this application following discussions with the landowner. Where this could be expected to lead to changes in impacts, the technical papers (Flora and fauna) have been updated to reflect this. Where changes are expected to be minimal or where there would be a minor reduction in impacts, the technical papers (Groundwater, Traffic and access, Noise, Air quality, Cultural heritage and Visual impacts) have not been amended.

The property omitted from this assessment (Lot 2 DP555184) is subject to a separate application for sand extraction and related activities for consideration by Baulkham Hills Shire Council under Part 4 of the *Environmental Planning and Assessment Act 1979*.

CHAPTER

2

DESCRIPTION OF THE PROPOSAL



Chapter Two Description of the proposal

2.1 Overview

The proposal includes extraction of sand to a maximum depth of two metres above the wet weather high water table (defined as 181 mAHD) over the whole of the site with the exception of the setbacks from the property boundaries as defined in Baulkham Hills Shire Council *Development Control Plan 16-Extractive Industries*. Extraction is proposed to the boundaries of Lot 2 DP555184 as development approval is currently being sought for sand extraction on this site and setbacks would not be appropriate. Batters would be cut at one vertical to two horizontal and restored to a maximum of one vertical to three or four horizontal depending on orientation, on completion of the development. These would also comply with the requirements of the development control plan.

Most of the raw material would be extracted using an excavator and transferred to articulated dump trucks to transport the material to the existing slurry plant located at the northern end of the site. Here it would be mixed with water and pumped via pipeline some 1.5 kilometres to the central process plant located on Lot 198. The wash water would be returned to the site for settlement in a series of clay lined basins prior to recirculation from the clean water pond at the lowest point in the system and subsequent reuse. A small amount of the extracted material not requiring further processing would be exported directly from the site via an existing access onto Old Northern Road.

The sand would be processed at the central plant. It would then be sent to market following checking at the weighbridge. There would be no transport of raw material by truck from the site to the central wash plant except during periods of routine maintenance or as a result of plant breakdown.

The proposal, which is the subject of the development application, includes a more extensive area of extraction within similar site boundaries than allowed at present and an extension of approximately six hectares to the south. An estimate of the volume of material available for extraction is summarised in **Section 2.2**.

A maximum of 400,000 tonnes of processed raw material would be exported from the site each year for a maximum period of 30 years from July 1998 (until June 2028). This would represent no change from the current consent.

The final landform would largely comprise a gently sloping bowl with shallow slopes rising to the peripheral bunds which slope down to the surrounding roads. Steeper slopes would define the periphery. The topography would also be varied in relation to the depth of overburden available for reforming the contours. Where slopes are too steep for subsequent agricultural use they would be planted with local native species and allowed to regenerate. The flatter areas would be returned to agricultural or horticultural use which was the predominant activity prior to the start of sand extraction.

Extraction in the eastern part of the site would result in separate lowered areas extending over the accessible resource. These would be rehabilitated to blend, as far as possible, into the existing land form with batter slopes complying with the requirements of Development Control Plan 16. These would be seeded and planted with local native forest species.

It is also proposed to import clean material to the site for processing and recycling. This would use the existing plant on both the Hitchcock Road site and Lot 198.

Rehabilitation would take place in a number of stages phased over the life of the project. These would include the construction of peripheral mounds (mostly complete), the drying and capping of the sediment ponds (this can take a number of years), the formation of the final batter slopes and the planting and maintenance of native species on the batters and along drainage lines. The presence of large volumes of clay overburden provides the potential for future modelling of the final ground profile including the creation of shallower batters than required in Development Control Plan 16.

2.2 Estimate of the resource

2.2.1 Introduction

The estimate of the resource available on site relates to three components: Tertiary Sand including gravel; friable sandstone and clay and is derived from several previous investigations. These focus not only on the three different products but relate to different parts of the site. The data available in the relevant reports has been assessed and where feasible has been subjected to computer modelling. In some cases this has not been possible and the conclusions of the reports have been critically assessed and used where appropriate. A major consideration has been the determination of the feasibility of extraction and the final landform once the material has been removed.

The assessment was based on the following documents:

- Stenhouse I (2002), *Geological Assessment of the PF Formation Sand Deposit*, Report for CSR Readymix (unpublished);
- Earth Data Pty Ltd (1997), *Maroota Clay Assessment*, Report for CSR Building Materials Pty Ltd.
- Minpro Pty Ltd (1990), *Report on the Maroota Project*, New South Wales (unpublished);
- Dames & Moore (1988), *Investigation of Sandstone Resource at Lot 3, Maroota*, Report for Glen Hill Enterprises Pty Ltd;
- Longworth & McKenzie Pty Ltd (1979), *An Assessment of the Minerals Present on Portion 214, Hitchcock Road, Maroota*, Report for the Flora Shelf Company Pty Ltd; and
- Sargeant FJ (1978), *Report on Filtration Media and Associated Sand and Gravel with Additional Notes on Sandstone and Clay Volumes occurring on The CR Property*, Report for T Essington Breen.

The following sections focus initially on estimates of the Tertiary Sand resources followed by consideration of the friable sandstone and clay. The full assessment is included in **Technical Paper 1** in Volume Two. Those parts of the site where data is available are shown on **Figure 2.1**.

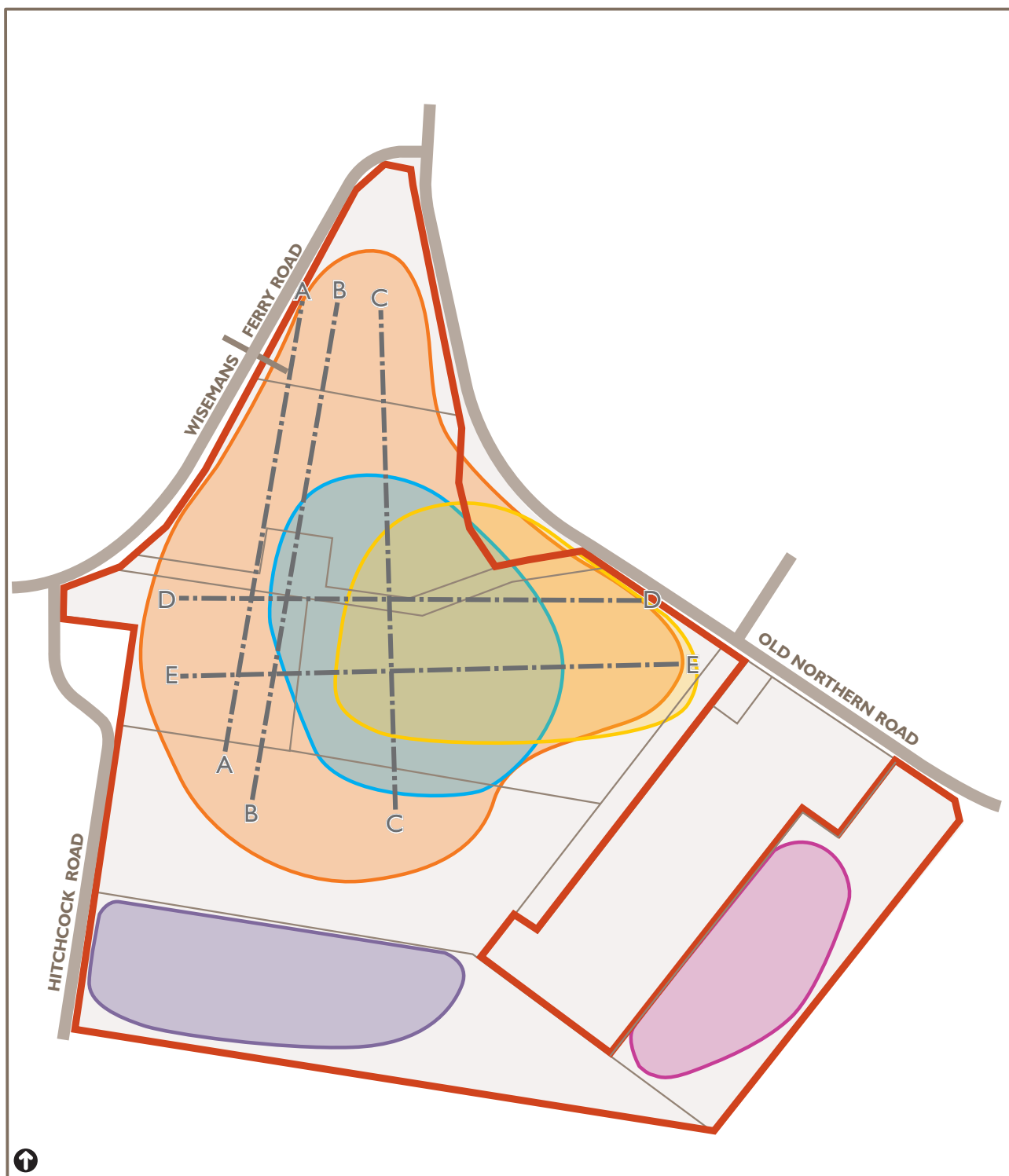


Figure 2.1

AREAS FOR WHICH SUB-SURFACE DATA IS AVAILABLE

- Earth Data 1997
- Stenhouse for CSR 2002
- Dames & Moore 1988
- Longwall & McKenzie 1979
- Minpro 1990

--- Cross sections shown in Figures 2.2a to 2.2c

2.2.2 Sand units at Maroota

There are two distinct sand units present on the site – the Maroota Sand of Tertiary age (up to 65 million years old) overlying the Hawkesbury Sandstone of Triassic age (195 to 225 million years old). The Tertiary Sands are largely confined within two ancient river channels. These alluvial sediments overlie a highly irregular basement mainly comprising quartzosed sandstone and shale lenses belonging to the Hawkesbury Sandstone.

The Maroota Sand comprises a Tertiary sequence of interbedded fluvial (river origin) sediments ranging from cobble conglomerate to clay, the bulk of the material being composed of clayey sand, sand and gravelly sand.

The Tertiary Sand has characteristics making it particularly suitable for the production of fine aggregate. The deposits are capable of producing a range of products including mortar sand, concrete sand, high specification drainage sand, filter sand, ceramic clay, decorative gravel and pebbles. Some clay lenses within the fluvial sediments exhibit firing characteristics suitable for the manufacture of cream bricks.

Irregularities in the basement show no direct relationship with the present topography of the site and the thickness of the Tertiary Sand is not directly related to the ground contours. The thickness of the sand unit is highly variable attaining a maximum thickness of approximately 40 metres in the vicinity of the centre of the site.

Drilling at the site has identified four distinct mappable geological units. In order from oldest to youngest these are as follows:

Hawkesbury Sandstone: This unit underlies the whole area. The sandstone can be described as medium to fine grained ranging in hardness from friable to strong.

Tertiary Sand: This overlies the Hawkesbury Sandstone but is not continuous over the whole area. The Tertiary Sand ranges from conglomerate to clay, the bulk of the material being composed of clayey sand, sand and gravelly sand. Rapid lateral and vertical facies changes are evident throughout the deposit. Gravel commonly occurs as lenses and stringers within sand units and clay lenses of various sizes are widely and randomly distributed throughout the Maroota Sand. The bulk of the Maroota Sand consists of sand sized material (Etheridge 1980).

Clay: An extensive clay unit overlies the Tertiary Sand. The base of this unit is at approximately 205 metres AHD. Drilling has identified a maximum thickness of some 25 metres with an average thickness of 13.8 metres.

Upper Tertiary Sand: This material overlies the clay layer and is part of the Maroota Tertiary Sand depositional system. It comprises a fatty sand some of which is suitable for washing and some suitable for use as brickie sand. Its maximum thickness of 12 metres is found within the vicinity of the previous Maroota Trigonometrical Station site decreasing to zero in all directions from this location.

The drilling program used a 100 metre square grid across the site comprising 37 reverse circulation holes, two auger holes and two reverse circulation hammer holes. It covered approximately 60 percent of the area included in the development application excluding those areas to the east and south where extraction has not yet occurred. Sand samples were taken every metre. These were then tested to determine the anticipated losses from the resource resulting from the presence of fine material which would be removed during the washing process. The average yield from the Tertiary Sand is shown in **Table 2.1**

2.2.3 Investigation of the resource

The approach involved the assessment of existing information on the site, formulation of a geological model, preparation of spatial and volumetric analyses and fieldwork and laboratory testing to determine the bulking factor of the clay to be used for site rehabilitation. The process is explained in more detail in **Technical Paper 1** in Volume Two.

Existing subsurface information on the site comprised a geological investigation report (Stenhouse, 2002) supplemented by summary borehole logs obtained from the author of the report, a digital version of the site plan (Bell Cochrane and Associates) and borehole levels (William Backhouse Surveyor).

Table 2.1 Components of Tertiary Sand

Component	Average percentage
Gravel content	5
Medium Coarse sand	46
Medium Fine sand	16
Fine sand	8
Waste	0.2
Washing loss	25
Total	100

Existing information comprised the following:

- a site plan dated 23 September 2002, showing the locations of the boreholes and contours of the site;
- summary borehole logs for 27 boreholes drilled on a grid approximately 100 metres square;
- survey data positioning the boreholes within the site with respect to AMG and AHD;
- results of particle size distribution tests carried out on samples collected during the drilling;
- hand drawn geological cross sections; and
- an analysis and estimate of the resource.

Further information regarding the Tertiary Sand deposit was collected from three sources: two reports commissioned by the Department of Mineral Resources (Etheridge, 1980, and Pienmunne and Whitehouse, 2001) and a paper on friable sandstone deposits within the Sydney region (Whitehouse and Roy, 2000).

The area investigated, and for which data are available, comprises approximately 85 percent of the surface area included in the development application. Estimates of resource volumes contained in the remaining area are inferred from previous, but limited information.

The Tertiary Sand deposit is of variable thickness and an irregular basement consisting predominantly of Triassic Hawkesbury sandstone. Based on the information contained in the summary borehole logs and using the particle size distribution analyses, geological cross sections were constructed with north-south and east-west trends depicting the stratigraphy within the deposit. Individual descriptions of each of the units are provided in the following section.

Upper sand unit

The Upper sand unit overlies the clay unit, and generally comprises fine to coarse grained silty sand and clayey sand with some gravel sized particles. Some of this unit is mined and used as construction sand.

The fines component (silt and clay) generally ranges from between 22 percent and 30 percent, with one sample testing as sandy clay with 53 percent fines. The coarse component (gravel) generally ranges between one percent and 15 percent.

The thickness of this unit is greatest beneath the centre of the site, where it reaches about 17 metres. Further to the south, the Upper sand diminishes rapidly over a distance of between 50 metres and 150 metres, while to the north and east, the unit diminishes over a distances of about 400 metres.

The base of the Upper sand gently undulates between levels of about 220 metres AHD to 225 metres AHD in the western and northern part of the site, and rises slowly to about 230 metres AHD as it lenses out towards the east.

Clay unit

An extensive layer of clay underlies the Upper sand and overlies the Lower sand. The materials within the clay unit generally comprise clay, silty clay, and sandy clay with trace gravel. This unit is generally stripped and stockpiled for later reuse as a liner or capping for the tailings ponds. A small proportion has economic value for brick making where the colour is appropriate and consistent.

The fines component ranged between 53 percent and 85 percent, while the coarse component was between one percent and six percent, leaving a sand component of between nine percent and 45 percent.

The thickness of this unit is highly variable across the site as its base undergoes significant undulations. For example, in one area the clay thickness encountered decreases from 24 metres to 13 metres over a length of about 80 metres, and then increases to a thickness of 18 metres over a distance of 120 metres.

Elsewhere on the site, the clay layer is generally between 10 metres and 15 metres thick and occurs between elevations of about 205 metres AHD and 215 metres AHD, except in the north eastern end of the site, where it occurs at about 220 metres AHD.

Lower sand unit

The Lower sand is an extensive unit encountered underlying the clay and overlying the basement sandstone. Generally, the Lower sand comprises fine to coarse grained, well graded silty sand and clayey sand with some gravel sized particles. This unit represents the main economic resource and is targeted for extraction for construction sand products.

The fines component (silt and clay) generally ranges from about 17 percent to 31 percent, with outlier samples ranging between 10 percent and 55 percent. The coarse component (gravel) generally ranges from between one percent and 14 percent. Particle sizes up to about 13 millimetres were detected in the analysis.

The thickness of the unit is variable across the site, as it is sandwiched between two undulating surfaces comprising the base of the clay, and the top of the basement sandstone. Lower sand is thickest in the south eastern portion of the site. Reasonable thicknesses are also present to the north and south. However, to the north east a low

point in the undulating base of the clay layer almost meets a high point in the basement sandstone, causing the Lower sand unit to pinch out at this location. This will mean that extraction of the Lower sand in this location may not be feasible as the overburden is highly variable and up to 25 metres thick.

Over the south western and northern portions of the site, the base of the Lower sand exists over varying reduced levels ranging from 195 metres AHD up to 205 metres AHD. In the south eastern corner of the site, the base of the Lower sand falls quickly from about 195 metres AHD to around 175 metres AHD. Sand extraction would however be limited to a level of 183 metres AHD to provide a buffer to the aquifer.

A feature of the Lower sand is the presence of silty and clayey layers and lenses located wholly within the unit, or at its base, between the base of the Lower sand and the top of the basement sandstone. Subsurface correlation of these silty and clayey layers/lenses has been carried out.

Basement rock

Basement rock generally comprising Hawkesbury sandstone is encountered underlying the entire study area and is overlain by the Lower sand. The sandstone is fine to medium grained and fine to coarse grained. The surface of the sandstone is the same as that described for the Lower sand unit.

Cross sections of the resource are shown on **Figures 2.2a to 2.2c**.

2.2.4 Assessment of the resource

An estimate of the insitu material volume for each of the geological units has been prepared using the 3D surface modelling package MX. The estimate was prepared using subsurface information collected by others, including:

- summary borehole logs recording the results of a drilling investigation;
- results of particle size distribution analyses carried out on soil samples collected during the drilling; and
- a digitised site plan.

In order to estimate the reserve, the model was programmed to construct the following surfaces:

- Topographic Surface – based on the digitised contoured site plan.
- Base of the Upper sand.
- Base of the clay unit.
- Base of the Lower sand.
- A horizontal layer at 183 metres AHD, where the sediments dipped below the assumed lower extraction limit.

A pit batter sloping at two horizontal to one vertical down from the assumed pit limits was formed in order to define the base of extraction. The volumes between each of the layers were calculated, including those above the pit batter slopes, over the area shown in **Figure 2.1**. These volumes were converted to tonnages and summarised in **Table 2.2**.

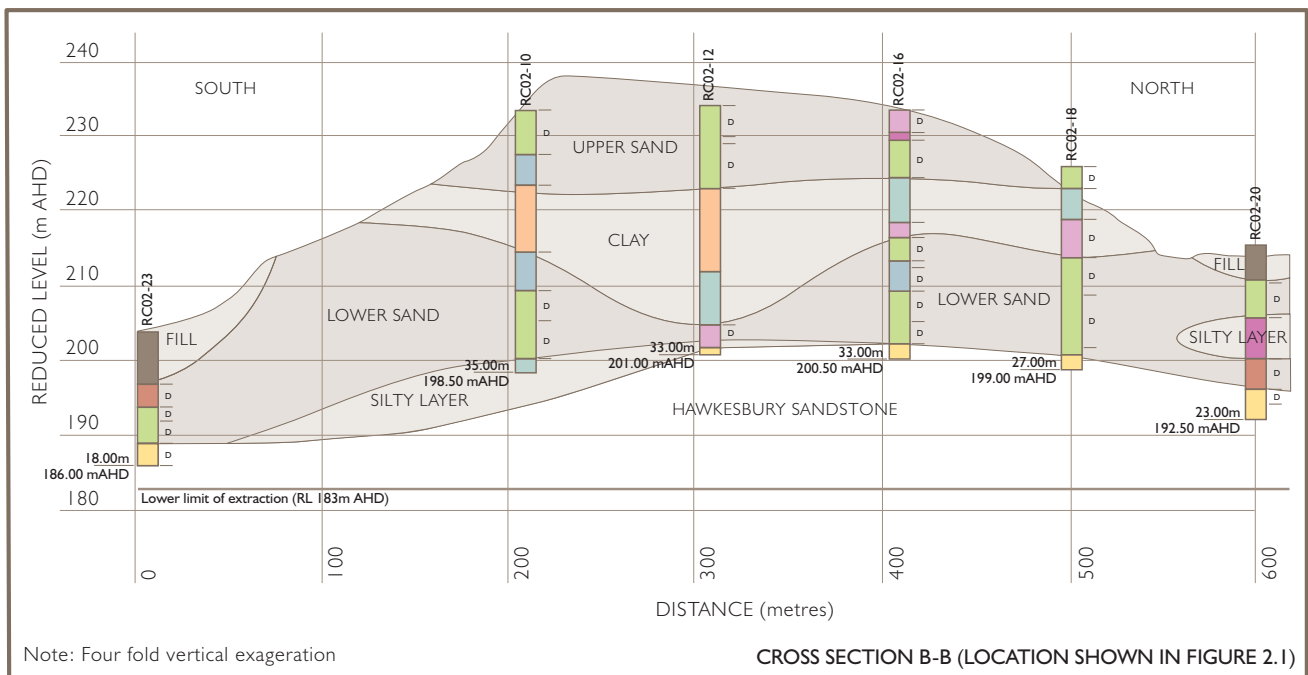
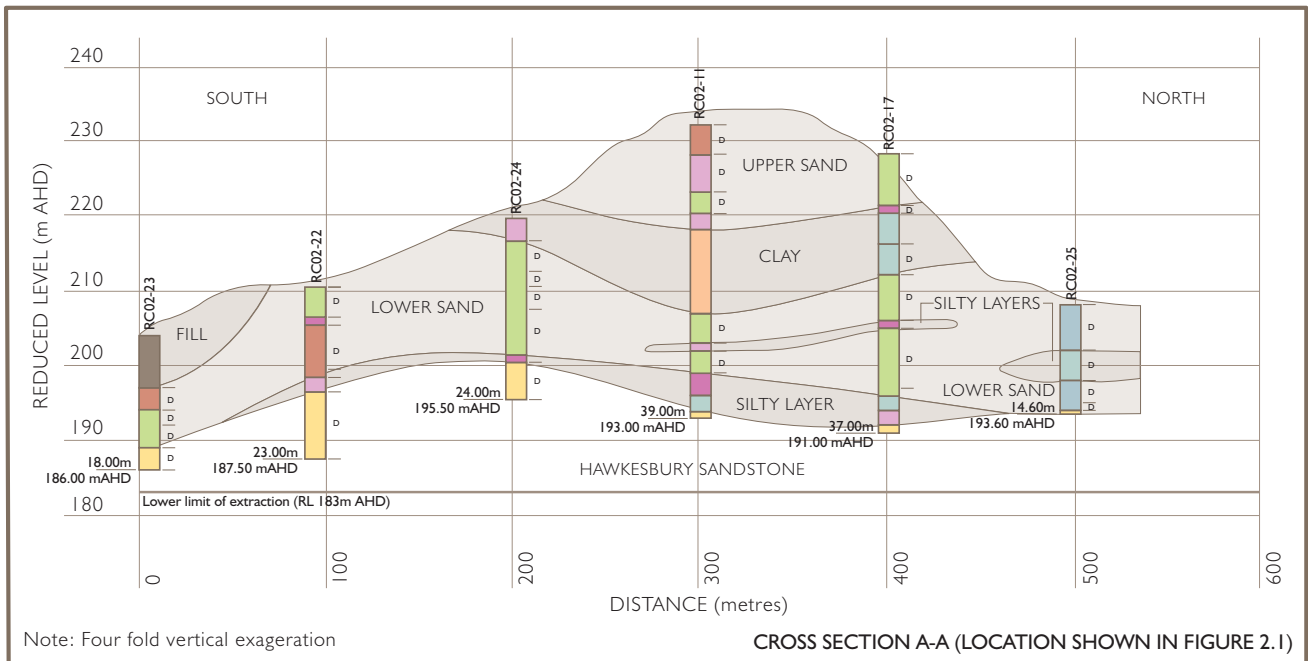
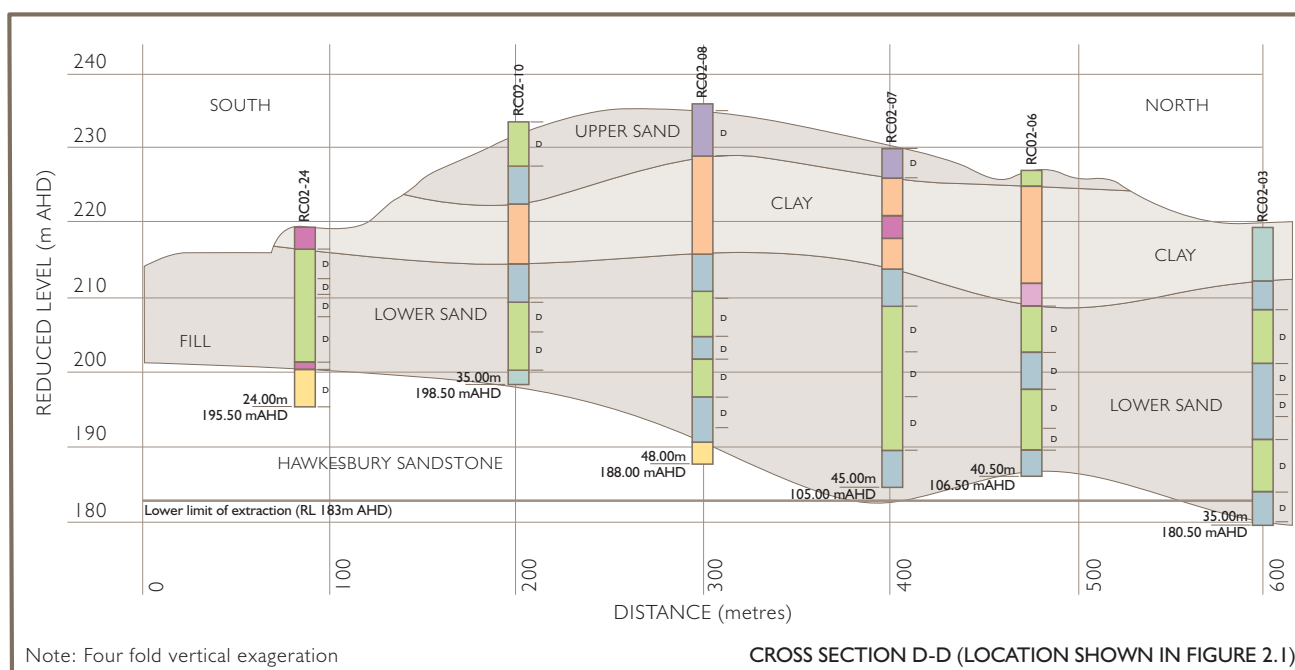
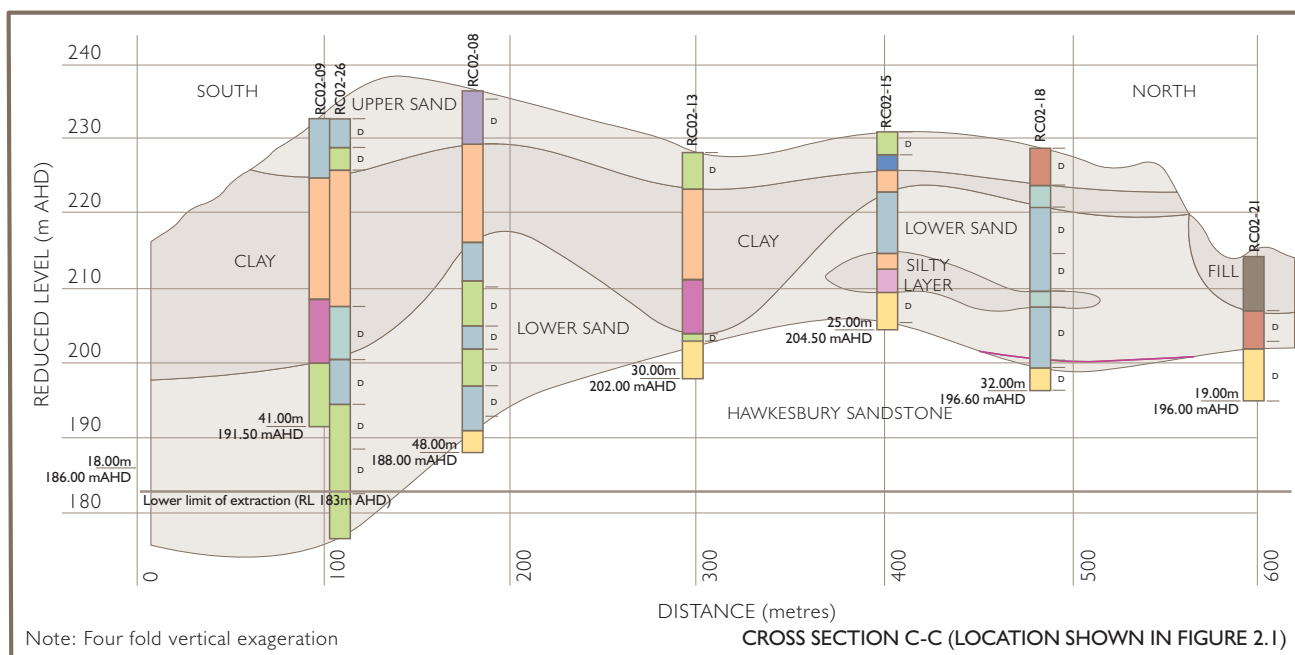


Figure 2.2a

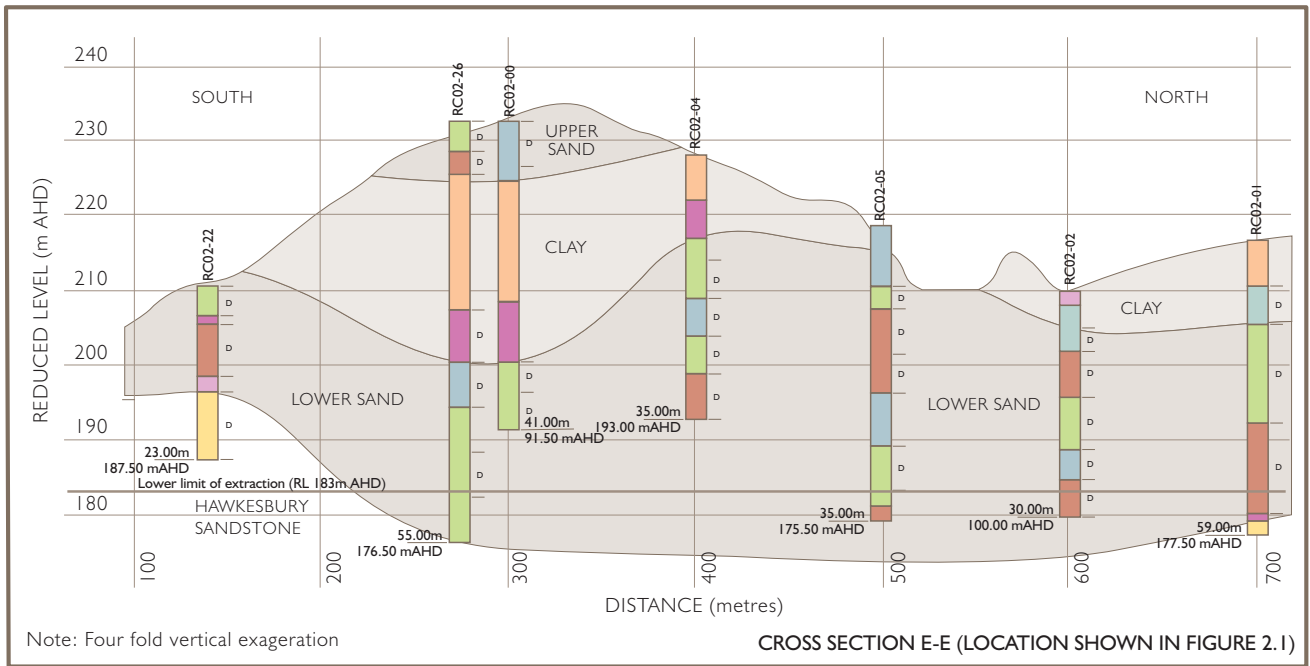
GEOLOGICAL SITE CROSS SECTIONS

- Gravelly Sand
- Sand
- Silty Sand
- Clayey Sand
- Sandstone
- Clay
- Sandy clay
- Sandy silt
- Silt
- Silty clay
- Fill (man made ground)
- ?--- Inferred Geotechnical Boundary



- Gravelly Sand
- Sand
- Silty Sand
- Clayey Sand
- Sandstone
- Clay
- Sandy clay
- Sandy silt
- Silt
- Silty clay
- Fill (man made ground)
- Inferred Geotechnical Boundary

Figure 2.2b
GEOLOGICAL SITE CROSS SECTIONS



- Gravelly Sand
- Sand
- Silty Sand
- Clayey Sand
- Sandstone
- Clay
- Sandy clay
- Sandy silt
- Silt
- Silty clay
- Fill (man made ground)
- ?-- Inferred Geotechnical Boundary

Figure 2.2c
GEOLOGICAL SITE CROSS SECTIONS

Table 2.2: Summary of reserve assessment¹

Material	Calculated volume (m ³)	Calculated tonnage (t)
Upper sand	732,000	1,354,000
Clay unit	1,684,000	3,368,000
Lower sand	2,619,000	4,845,000

Note 1: Volume of material available for extraction in 2004 within the area subject to the assessment. This does not include areas to the south and east which are included in the development application.

Once the overall resource volumes and tonnages were calculated, the deposit was divided into 32 blocks measuring 100 metres square. The volumes and tonnages of each layer within each block were also estimated using MX in order to cross check the overall volume calculations.

An estimate of the stripping ratio for each block and an overall stripping ratio for the entire deposit mined from within the pit boundary were also calculated. This ratio is the amount of over burden that has to be mined in order to reach the resource compared to the amount of resource available beneath the overburden. The ratio for each block varies considerably, from 0.07 to 16.94. However the overall stripping ratio for the whole area is 0.97.

Friable sandstone

The friable sandstone resource is located predominantly on Lot 1 DP 34599. This is located at the north eastern end of the area which is subject to the development application. It covers an area of approximately 10 hectares bounded by Old Northern Road to the north and Marramara National Park to the east. The resource area consists of a wide flat-topped sandstone ridge which slopes gently to the south west. This comprises about half the lot and is thickly vegetated. Fine grained sandstone is exposed over much of the area. It is capped in parts by laterite.

A drilling program was undertaken at the site in May 1988 (Dames & Moore 1988). Three drill locations were determined across the site with a fourth to provide correlation with previously dug backhoe pits.

Penetration depths were variable ranging from 3.8 metres to 13 metres with ironstone bands limiting drill depth. A representative sample from a depth of seven metres indicated three typical features:

- general grading of fine to medium for the crushed sandstone;
- coarse fraction due to incomplete crushing of sandstone either by the drill or in the laboratory; and
- high (30%) fines content, typical of fresh, fine grained sandstone.

Gradings from around seven metres and 10 metres to 14 metres depth were all fine to medium sand size with 27 percent to 40 percent fines. A small percentage of fines will result from grinding by the drill bit resulting in an estimate of 25 percent to 30 percent fines in situ.

The ridge of weathered sandstone appears to be consistently fine to medium grained with a high fines content and minimal coarse grain size.

The resource estimate was based on the more accessible western portion of the site in an area of approximately 100 metres by 250 metres. Assuming an average depth of 12 metres and allowing for batters, this results in an estimate of 700,000 tonnes of fine to medium grained sandstone. The sandstone could be extracted for the most part by ripping and excavation. It may require treatment in a simple crusher to achieve a consistently sized product.

The clay resource

In addition to the recent investigations described in **Section 2.2**, two other assessments of the clay resource on the site have been undertaken. Both only relate to parts of the site which is subject to the development application and were based on limited programs of drilling and laboratory testing. The first (Minpro 1990) focussed on Lot 1 DP 1091018 which has now been substantially extracted and the clay either stockpiled or used for rehabilitation or lining of the silt ponds and the second (Earth Data 1997) assessed the resource located in the central part of the site to the east of the former Trigonometrical Reserve.

The basement of the clay in the area investigated appears to be consistent with the lowest level of 204 metres AHD with an average level of 210 metres AHD. The south eastern portion of the site contains the largest volume of clay with an average depth of 16.4 metres. The total volume of clay on that part of the site investigated by Stenhouse is substantial, amounting to a total of some 1.7 million cubic metres (3.4 million tonnes).

The commercial value of clay in relation to its ceramic qualities is determined by its fired colour, the lighter the better. A total of 14 fired colours was identified from two resource areas containing approximately 464,000 cubic metres at an average thickness of 8.7 metres.

Clay bulking

Materials excavated from the ground experience an increase in volume due to a reduction of the material density. This is referred to as bulking. If the materials are then engineered into place, their density increases and the volume is therefore reduced. Bulking Factors for the clay material have been calculated in its loose state and for circumstances when it is engineered to form controlled fill.

The bulking factor assessment was carried out to assess the amount of bulking that the clay layer is likely to be subject to during excavation and to assess its likely final bulking following placement on the ground as engineered fill. The results of the assessment indicate that the soils from the clay unit have a calculated bulking factor of between 1.3 and 1.7.

The high plasticity soils had the greatest bulking factor at 1.7. A bulking factor of about 1.5 is considered normal for high plasticity clay. However, given that high plasticity soils generally form blocky soil pods upon excavation, this result is considered reasonable and likely to be on the high end of the scale.

The sandy clay had the lowest bulking factor at 1.3. Low and medium plasticity clays normally bulk up to about 1.3 times their insitu volume. This result is therefore considered normal for such a material. However, given that the soil within the sand deposit generally displays a high variation both laterally and vertically, it would be reasonable to expect a total bulking factor for the clay unit of about 1.5.

The results of the insitu and laboratory tests carried out on in the field and on the samples collected are presented in full in **Technical Paper 1** in Volume Two.

The compacted bulking factor ranges from 0.96 to 1.1. The low values (1.0 and 0.96) were returned from samples comprising sandy clay of medium plasticity. It is reasonable to expect that the soils within the Clay unit are likely to be more clayey than those encountered elsewhere. On this basis, the Compacted Bulking Factor is more likely to be between 1.05 and 1.1, as the remainder of the results suggest.

Summary of the resource available for extraction

A summary of those components of the resource at the Maroota site which are considered to be capable of economic extraction are listed in **Table 2.3**.

Table 2.3: Summary of extractable resource

Material	Calculated volume (m³)	Calculated tonnage (t)
Upper Sand	146,000	270,000
Clay	92,500	185,000
Friable Sandstone	280,000	560,000
Tertiary Sand	2,335,000	4,320,000

The resource estimates were prepared in 2005. Material extracted since then would reduce the tonnage available by some 300,000 to 400,000 tonnes.

2.3 Proposed life of the operation

Extraction rates at the Hitchcock Road site have ranged between 200,000 and 250,000 tonnes per year over the past five years. This is not expected to change although annual rates may vary depending on market conditions. Extraction of some 5,335,000 tonnes of material at these rates would require between 21 and 26 years to complete. This is consistent with the existing consent (30 years from November 1998).

2.4 Extraction, processing and haulage

2.4.1 Overview

The resource available on the site comprises both Tertiary Sand and friable sandstone, although the former is present in much larger volumes.

The extraction and processing of Tertiary Sand is determined by its relatively high clay content which requires removal by washing, producing as a result, large volumes of silt laden water which requires appropriate management both to enable the process water to be reused and to minimise the possibility of contaminating downstream water courses with silt. The process is therefore different from that used in the extraction of friable sandstone and involves a number of progressive stages:

- removal and storage of top soil and overburden – as progressive stages are undertaken it is possible to move newly extracted overburden, mainly clay, to its final location and reduce the handling of this material;
- extraction of raw material;

- development of tailings ponds – these require large areas of land and are preferably located to minimise the need to pump the silt laden water through a series of ponds culminating in the clean water supply dam. The ponds, once filled to capacity with fines, need to dry ready for capping. This process can take up to two years; and
- rehabilitation of the extracted areas by the reformation of final ground contours using overburden, stockpiled top soil and seeding as appropriate.

This is a complex process which requires large areas of land and cannot be easily reconciled with a geographic staging plan. Extraction must occur prior to the construction of tailings dams and these cannot be confined to a particular phase of an extracted area due to locational and timing constraints.

In practice, these stages are undertaken in parallel resulting inevitably in large areas of the site being exposed with the potential for erosion and sedimentation. The inward draining nature of the site and the large pits, which result from the extraction process, ensure that no contaminated surface water can affect adjacent water courses and potential impacts are minimised.

The process employed in the extraction of friable sandstone would also be undertaken in a number of stages.

- a bulldozer would rip the easily worked component of the exposed sand resource and move it into a number of large mounds. This process results in the crushing of lumps of sandstone allowing easier working of the softer material.
- crude crushed sandstone would be transported by dump truck to the slurry plant where it is fed into a portable dry screening plant or transported via the existing pipeline to the central process plant. The wash plant screens over-coarse particles from the product sand to reduce the fines content to a level appropriate to its intended final use.
- the product would be distributed via a series of conveyors and slurry pumps to various stockpiles according to the grade and colour of the sand produced. The silt laden water from this plant would be pumped to the tailings dams where suspended sediment is removed before being discharged to the clean water storage dam from where it is recycled to the wash plant.
- the dry screening plant uses vibrating wire screens to separate over-coarse particles from the product. No removal of fines takes place. A mobile screen could be located on the extraction site if there was sufficient space for the associated stockpiles and working area during the various phases of development.
- specific grades of processed sand would be separately stockpiled on the floor of the pit or at the central process plant depending on the need to wash the product of its clay content. In some cases these can contain large volumes (up to 5,000 tonnes) in order to guarantee continuity of supply for large construction projects.

Improvements at the central wash plant have been undertaken to reduce the volume of fines in the process water returned to the site and hence reduce the capacity of the sedimentation basins required. Two clusters of cyclones added to the plant reduce fines by approximately 20 percent and a dewatering screen produces a drier product for stockpiling resulting in a reduction in sediment and water loss due to evaporation. These modifications have been undertaken as part of normal plant maintenance and upgrade and are not part of the application.

However, they have resulted in a significant reduction in the use of groundwater in the extraction and washing process even over a period of extended drought. Extraction of water from the dam on the Hitchcock Road site (PF167DAM), which has a licensed limit of 50 ML/year, has declined from a marginal exceedance of the limit in 2004/2005 to 21.3 ML in the year ending in June 2007. This reduction has been repeated for the two water supply bores on Lot 198 which service the wash plant. Total extraction for the year ending in June 2007 was 27.7 ML from a combined licensed allocation of 60 ML/year. Following the plant modifications, these bores are no longer required to operate continuously.

2.4.2 Influences on extraction

The main influences on future extraction activities at the Hitchcock Road site are:

- compliance with requirements of *Baulkham Hills Development Control Plan 16– Extractive Industries* including setbacks and the maintenance of a two metre buffer above the wet weather high water table;
- accommodating previous extraction activities on the site;
- maintaining sufficient area for tailings ponds without seriously inhibiting the staging of extraction or requiring multiple handling of overburden;
- managing the clay overburden, which in the central part of the site is up to 25 metres deep, overlying the Tertiary Sand resource; and
- achieving a final landform retaining as far as possible the visual and ecological characteristics of the area.

Existing conditions at the site are shown in **Figure 2.3**.

The extraction plan is based on:

- area available for extraction determined by the set backs required in Baulkham Hills Development Control Plan 16;
- achievement of an acceptable final land form which appears natural and avoids abrupt transitions and steep slopes;
- limitation on depth of extraction to two metres above the wet weather high groundwater level;
- phasing of activity to minimise double handling of the significant volume of clay overburden to be used to reshape the site following extraction; and
- minimising the area required for settlement ponds which restricts operational flexibility and requires an excessive time to dry out and stabilise prior to final rehabilitation.

Experience to date has indicated that the division of the site into stages does not meet the requirements of the extraction process and has resulted in a number of applications to Baulkham Hills Shire Council to vary the previous staging plan. This was prepared prior to detailed knowledge of the site and the resource which is now available.

2.4.3 Extraction plan

The proposal would comprise the extraction of both Tertiary Sand and friable, crushed sandstone from the site. The processes required for the removal of these materials is different as described in the following section. Other materials derived from the site

during extraction which have commercial value are clay for brick making, if this is of a consistent and desirable colour, and gravel.

The processing of recycled material, imported to the site, using the fixed and portable equipment to produce marketable sand is expected to increase over the next few years and is included in the proposal.

The extraction of Tertiary Sand and its subsequent processing is relatively simple although large areas of land are required for stockpiles and, in particular, for the sedimentation ponds which allow the residual fines to settle out of the wash/transport water.

The Tertiary sand is located in areas with a varying thickness of overburden comprising top soil, upper sand and clay. A small proportion of the upper sand is of value and can be extracted. Removal and stockpiling of the clay overburden is required to facilitate access to the Tertiary Sand below. This is removed using a tracked excavator and articulated dump trucks. The sand is soft and requires no additional processing to remove it.

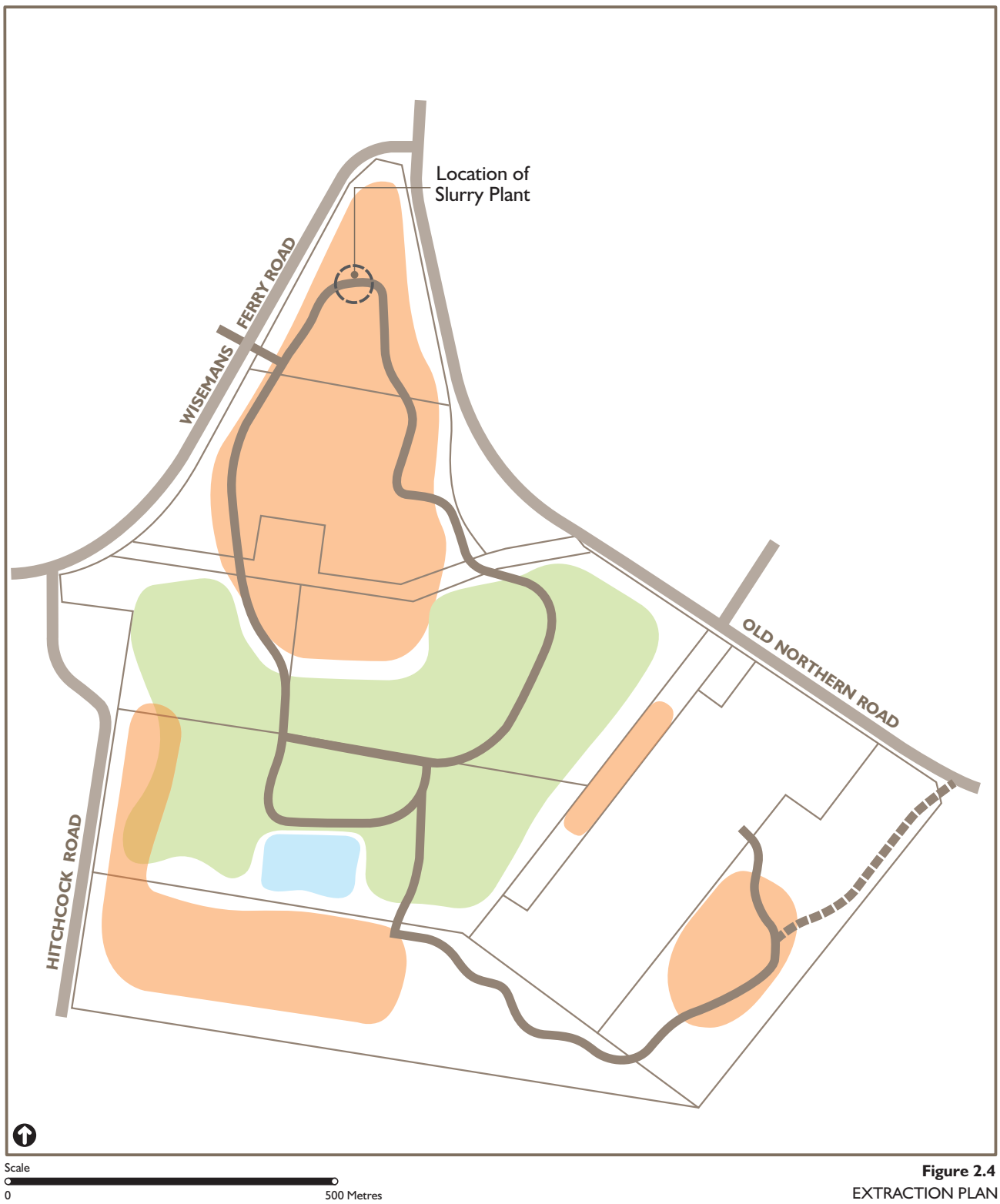
Extraction results in the development of a series of pits which can be reconfigured and lined with clay for use as sedimentation ponds or progressively backfilled as part of the final landform.

Once the sedimentation ponds reach their capacity they are disconnected from the water circulation system, allowed to dry out and are capped using the stockpiled overburden and top soil. Drying out sufficiently to allow the placement of the capping layer takes some time (approximately two years). The provision of sufficient capacity to accommodate the returned fines laden water and the location of the ponds to provide continuous flow to the clean water pond at the low point on the site are important considerations in the management and phasing of extraction.

Improvements to the central process plant on Lot 198 allow approximately 20 percent reduction in the volume of tailings returned to the ponds on the Hitchcock Road site. This has resulted in a corresponding reduction in the volume required in the ponds for settlement. The water content of the tailings has also been reduced allowing a further reduction in the capacity of the ponds and an improvement in the rate of drying. These improvements have also led to a reduction in the requirement for top-up water for the central process plant on Lot 198.

The Tertiary Sand would be transported in articulated trucks to the existing slurry plant located in the northern part of the site. Here it would be transformed into slurry for transport via a pipeline to the wash plant on Lot 198. The sand would be washed and stockpiled for market while the wash water would be collected and returned to the ponds on the Hitchcock Road site for settlement and ultimate reuse.

The proposed extraction plan is shown on **Figure 2.4**. Those parts of the site where sand has been extracted and the land rehabilitated (land reformed following capping of the silt ponds and, in part seeded with native species) are shown. These would not normally be disturbed further except where good quality sand can be derived as a result of the increase in depth. The boundaries of the total area to be extracted are similar to those included in the current consent with the addition of Lot 1 DP223323 and Lot 214 DP753039



- Area already extracted and partially rehabilitated
- Area for future extraction
- Clean water dam
- Internal haul road

2.4.3 Extraction plan

The proposal would comprise the extraction of both Tertiary Sand and friable, crushed sandstone from the site. The processes required for the removal of these materials is different as described in the following section. Other materials derived from the site during extraction which have commercial value are clay for brick making, if this is of a consistent and desirable colour, and gravel.

The processing of recycled material, imported to the site, using the fixed and portable equipment to produce marketable sand is expected to increase over the next few years and is included in the proposal.

The extraction of Tertiary Sand and its subsequent processing is relatively simple although large areas of land are required for stockpiles and, in particular, for the sedimentation ponds which allow the residual fines to settle out of the wash/transport water.

The Tertiary sand is located in areas with a varying thickness of overburden comprising top soil, upper sand and clay. A small proportion of the upper sand is of value and can be extracted. Removal and stockpiling of the clay overburden is required to facilitate access to the Tertiary Sand below. This is removed using a tracked excavator and articulated dump trucks. The sand is soft and requires no additional processing to remove it.

Extraction results in the development of a series of pits which can be reconfigured and lined with clay for use as sedimentation ponds or progressively backfilled as part of the final landform.

Once the sedimentation ponds reach their capacity they are disconnected from the water circulation system, allowed to dry out and are capped using the stockpiled overburden and top soil. Drying out sufficiently to allow the placement of the capping layer takes some time (approximately two years). The provision of sufficient capacity to accommodate the returned fines laden water and the location of the ponds to provide continuous flow to the clean water pond at the low point on the site are important considerations in the management and phasing of extraction.

Improvements to the central process plant on Lot 198 allow approximately 20 percent reduction in the volume of tailings returned to the ponds on the Hitchcock Road site. This has resulted in a corresponding reduction in the volume required in the ponds for settlement. The water content of the tailings has also been reduced allowing a further reduction in the capacity of the ponds and an improvement in the rate of drying. These improvements have also led to a reduction in the requirement for top-up water for the central process plant on Lot 198.

The Tertiary Sand would be transported in articulated trucks to the existing slurry plant located in the northern part of the site. Here it would be transformed into slurry for transport via a pipeline to the wash plant on Lot 198. The sand would be washed and stockpiled for market while the wash water would be collected and returned to the ponds on the Hitchcock Road site for settlement and ultimate reuse.

The proposed extraction plan is shown on **Figure 2.4**. Those parts of the site where sand has been extracted and the land rehabilitated (land reformed following capping of the silt ponds and, in part seeded with native species) are shown. These would not normally be disturbed further except where good quality sand can be derived as a result of the increase in depth. The boundaries of the total area to be extracted are similar to those included in the current consent with the addition of Lot 1 DP223323 and Lot 214 DP753039

and the removal of Lot 2 DP555184. In addition, their inclusion will allow the setbacks on the adjacent lots to be extracted where they were previously excluded.

Current activities have created a large extraction pit in the south eastern part of the site. Extraction would continue to the west from this area and from the west adjacent to the haul road towards the east. Overburden from these new extraction areas would be used as fill for previously extracted pits. Extraction would also continue adjacent to Old Northern Road, the overburden used as fill in the previously extracted pits. A new silt pond would also be formed in the extracted area.

The development would be undertaken in four main stages requiring approximately five years each to complete. Extraction would continue as currently planned under the existing consent until a new approval is received.

Phase One (2007 – 2011)

- continuation of extraction westward from Area B;
- extraction eastward from the haul road (overburden backfilled into Area B);
- construction of Pond 11;
- completion of Pond 9;
- partial rehabilitation of Pond 5;
- continuing extraction of the area adjacent to Old Northern Road;
- extraction on Lot 214 DP752039 and Lot1 DP34599;
- rehabilitation (planting) in the area of former ponds 3, 4 and 6;

Phase Two (2012 – 2016)

- extraction southwards from Area A;
- construction of Pond 12;
- extraction on Lot 2 DP570966
- rehabilitation of area adjacent to Old Northern Road;
- overburden backfilled into extracted areas to the south;
- rehabilitation of Pond 11;
- extraction to the south;

Phase Three (2017 – 2021)

- continuation of extraction to the south;
- backfilling of clay overburden into extracted areas to the north and south;
- completion of Pond 13;
- continuation of extraction on Lot 2 DP570966
- rehabilitation of northern section of the northern extraction area;
- rehabilitation of the western part of the southern extraction area.

Phase Four (2022 – 2025)

- continuation of extraction southwards;
- backfilling of clay overburden into extraction to the north;
- continuation of extraction in the southern area;
- extraction on Lot 1 DP1013943, Lots 1 and 2 DP1063296 and Lot 2 DP570966;
- construction of Pond 14;
- rehabilitation of southern extraction area;
- rehabilitation of northern extraction area;
- rehabilitation of ponds leaving one to drain each catchment;
- completion of land reformation and landscape planting;
- removal of all fixed infrastructure and formation of final land form.

The overall phasing of the development is shown on **Figure 2.5**. Ponds 11 and above would be located in future extraction areas. Their exact location is not yet known.

2.4.4 Plant and equipment

The following plant and equipment would be used:

- D9/D10 Bulldozer – CAT D9L and CAT D10N;
- 633 Scraper – CAT 633;
- Two wheel loaders – CAT 962G/966F/966G;
- Mobile power screen-8 feet by 4 feet Commander powered by F4L912 Deutz;
- Mobile crusher – APK1010 Hazemag Crusher powered by 250HP Cummins;
- Excavator – CAT 330CL;
- Dump trucks – CAT 730;
- Water truck – LTD18 Euclid powered by 350 Cummins; and
- Wash plant – electric approximately 500KVA.

The existing slurry plant located on Lot 1 DP570966, at the northern end of the site would continue to be used.

2.4.5 On-site haulage and processing

All Tertiary Sand would be extracted using an excavator and transferred to articulated dump trucks which would transport the material via established on-site haul roads to the existing plant located at the northern end of the site. Here it would be mixed with water and transported as slurry by pipeline some 1.5 kilometres to the central wash plant located on Lot 198. The wash water would be returned to the site for settlement in a series of clay lined basins prior to recirculation from the clean water pond at the lowest point on the system and reuse.

Friable sandstone and imported material which does not require washing at the central plant would be processed within the extraction area on Lot 1 DP34599 and transported to market via the existing access onto Old Northern Road. This is a properly formed access located where Old Northern Road has been widened to provide a climbing lane. It was originally intended to be the southern access to the haul road intended to serve all the sand extraction operations in Maroota, but the rest of the proposal was not implemented.

2.4.6 Existing slurry plant and pipelines

The sand slurry plant occupies a site of approximately one hectare at the northern end of the Hitchcock Road site. It performs the following functions:

- receipt of raw sand from the quarry;
- removal of plus 100 millimetre material from the raw sand feed and screening of the raw sand to remove plus 14 millimetre particles;
- pre-washing of the sand to remove fine silt and clay to tailings; and
- preparation of a constant density feed for pumping to the central wash plant via the main slurry pipeline.

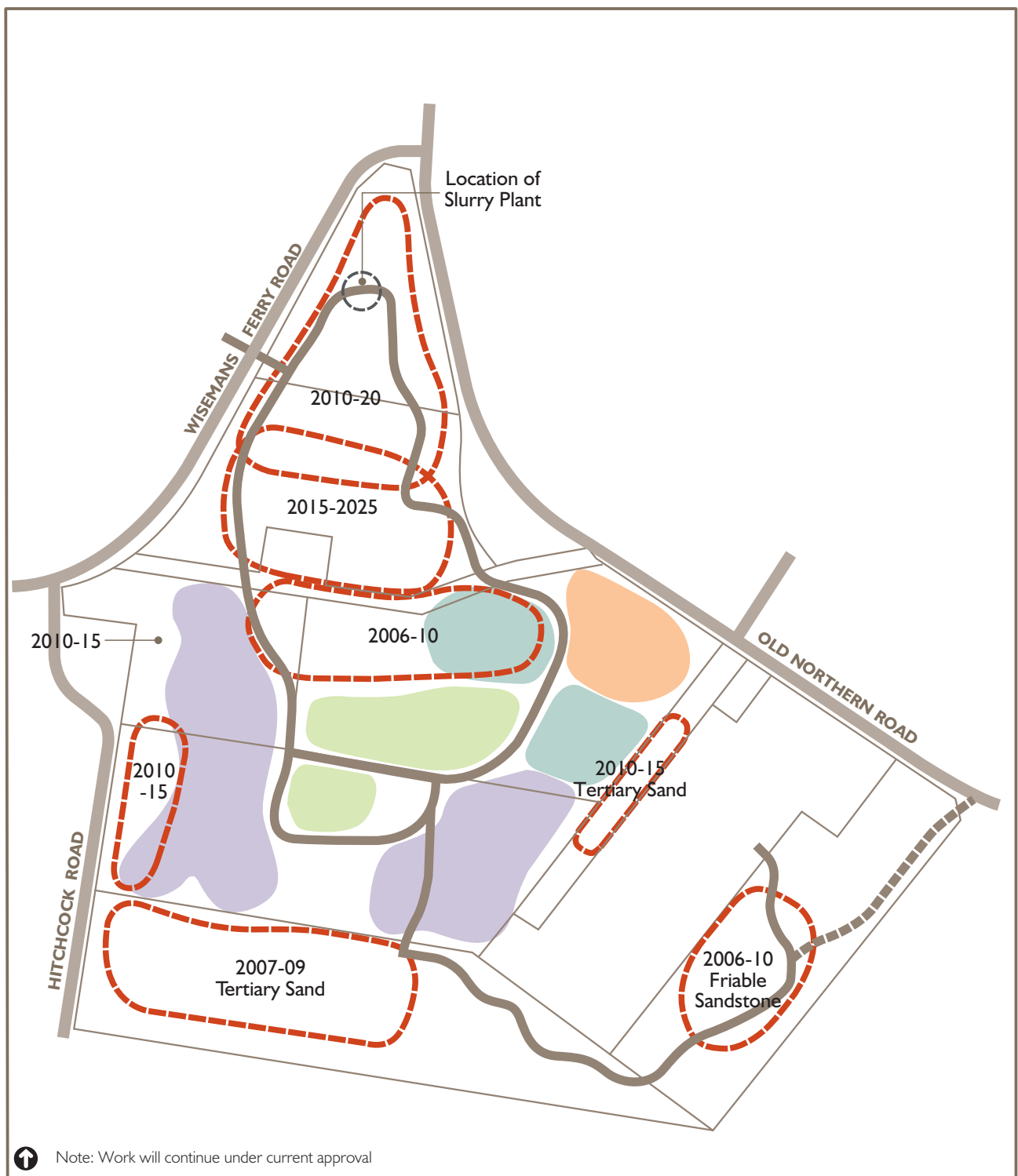


Figure 2.5

OVERALL PHASING OF DEVELOPMENT

Scale
0 500 Metres

- | | |
|--|--|
| Extraction completed - rehabilitation underway | Areas for future extraction and rehabilitation |
| Areas to be capped and rehabilitated - currently ponds | Areas currently working / almost completed |
| Area extracted - to be used as detention basin | Internal haul road |
| | Temporary access |

Raw sand from the quarry is tipped by rear dump trucks over a 100 millimetre spacing bar grizzly mounted at 45 degrees above the plant feed hopper. Grizzly oversize is temporarily held in a ground hopper to await disposal. The raw sand is withdrawn from the hopper by the belt feeder at 200 tonnes per hour and elevated by the plant feed conveyor to the scalping screen feed box. The raw sand is added to water in the feedbox and flows onto the scalping screen where it is sized at 14 millimetres. High volume sprays mounted above the screen assist in breaking down cemented particles and in producing a cleaner oversize reject. The reject is temporarily held in a second ground hopper until removed by loader and trucks together with the oversize from the 100 millimetre grizzly.

The pipelines are grouped into two main routes:

- Hitchcock Road slurry plant to the main process plant on Lot 198 comprising the main slurry line, the main tailings line and the return water line. Due to the presence of the main slurry line this route is bunded between the Hitchcock Road site and the main process plant.
- Hitchcock Road slurry plant to the tailings and water supply dams comprising the main tailings line, the Hitchcock Road plant tailings line and the main water supply line. As none of these pipelines is subject to severe wear or possibility of blockage, the provision of bunding is not necessary.

Bunding of the pipeline route from the Hitchcock Road site to the main process plant takes the form of clay lined earth embankments along the northern and eastern edges of the present access road. On the northern section of the route the pipeline diverges from the haul road to pass through an area of open forest and scrub land. The embankments provide an effective bund height of 800 millimetres and a bottom width of 1,500 millimetres. The bunds are graded from the north and east toward a containment dam with a capacity of 100 cubic metres located at the low point of the pipeline route so that any leakage is effectively controlled and collected.

The main slurry pipeline has a dump valve at the containment dam to facilitate line clearing in the event of a blockage. The containment dam also incorporates a ramp entry to facilitate cleanout. Total volume of the slurry pipeline and Hitchcock Road plant sand sump is 77 cubic metres which is the maximum volume of spillage which could flow to the containment dam in the event of a line failure.

2.4.7 Product haulage

Product is currently trucked from the central plant and all sales are made from the weighbridge on Lot 198. Trucks leave the site via the access road to Wisemans Ferry Road turning either left to the intersection with Old Northern Road then right to Dural and Castle Hill or right along Wisemans Ferry Road to Windsor, Richmond and Penrith. The proportion of trips on these routes is approximately equal. This would not change with the following exception.

Material (friable sandstone) and imported material not requiring processing (except on-site screening) would be transported to market via the existing access onto Old Northern Road. The volume of this material is small and would be expected to generate few laden truck trips.

It is proposed that sand extracted from the Hitchcock Road site would supply the same markets as the current operation and the same transport routes would be used. The number of truck movements would remain within the currently approved limit of a total of 200 laden trucks per day (400 truck movements).

2.4.8 Workforce and hours of operation

The current workforce would remain at 20 to 22 staff. Truck drivers, either permanent staff or contracted or employed by others would pick up loads from the central process plant on Lot 198.

The hours of operation would be in accordance with those of the existing site.

- 05.45 hours Monday to Saturday – gates open to allow entry of vehicles to the site;
- 06.00 to 07.00 hours Monday to Saturday (excluding public holidays) – 30 truck movements (15 loaded vehicles) may enter or leave the site;
- 07.00 to 18.00 hours Monday to Saturday (excluding public holidays) – extraction, transportation and processing or running of machinery for maintenance purposes permitted; and
- no extraction, transportation or processing on Sundays and public holidays.

2.5 Surface water management

2.5.1 Existing catchments

Site topography has been modified as a result of ongoing extraction activities. Surface water flows are directed into a number of large detention basins which are part of the process system employed at the site. These allow the silt in the water returned from the wash plant on Lot 198 to settle out before progressing to the clean water basin located in the lowest part of the site. The clean water is returned from here to the slurry plant and the central process plant.

A total of nine tailings ponds has now been constructed and commissioned for the dewatering of the tailings in the main extraction area. One additional pond (Number 10) has been lined but has not yet been introduced into the tailings stream. Ponds Number 5 and 9 are currently in use; Pond 7 is currently drying prior to reintroduction and Ponds 1, 2, 3, 4 and 6 have been fully capped and partially rehabilitated.

The site where sand extraction has taken place to date is inwardly draining due to a combination of topography and the effect of the peripheral bunds constructed as part of the project. No surface water is therefore discharged beyond its boundaries. Most of the site can therefore be considered to be a detention basin capable of accommodating far in excess of the runoff from the 100 year ARI time of concentration event.

The eastern catchment currently drains to a large farm dam which discharges to an intermittent creek. This is a tributary of Little Cattai Creek which has a large catchment (approximately 10,000 hectares) draining eventually to the Hawkesbury River, some 12 kilometres to the south west of the site,

The site, including Lot 2 DP555184, can be divided into three catchments:

Northern catchment	16 hectares
Southern catchment	52 hectares
Eastern catchment	29 hectares

The northern and southern catchments drain to existing detention basins as part of the on-site surface water management system while the eastern catchment discharges to the natural drainage system forming the headwaters of Little Cattai Creek.

2.5.2 Surface water management during extraction

The site experiences high levels of infiltration. Surface runoff, except during major storms, is not therefore generated in significant quantities and the high permeability of the quarry floor would maintain current infiltration and groundwater recharge rates. Any surplus flows would be directed to existing and new detention basins forming part of the process water management system. The water management system is shown on **Figure 2.6**. Clean water would be diverted around the extraction areas where these form pits and directed to the natural surface water drainage system. There has been no discharge of surface water beyond the boundary of the site to date and this is not expected to change.

Containment of surface water within the extraction area, subsequent infiltration and capture of surplus flows within the detention basins would ensure that any sediment is not transported off-site. New basins would be constructed as the extraction areas extend beyond their present boundaries. Surface water management is therefore not fixed and would be amended to accommodate the needs of the extraction plan. This would be reflected in the Environmental Management Plan and its subsequent amendments.

The impact of current operations on catchment flows is minimal and this would be expected to continue. Surface runoff would only occur during high intensity storms when the infiltration capacity of the soils is exceeded. The dams and creeks in the vicinity of the site are known to be groundwater dependent and are not expected to be influenced by any changes in catchment conditions. In addition, extraction of overburden and the underlying Tertiary Sand is expected to improve groundwater recharge.

That part of the site potentially discharging to the headwaters of Little Cattai Creek makes a very small part of the total catchment (less than 0.2 percent) and would therefore not be expected to have any impact on the quality or quantity of surface water discharged to the Hawkesbury River. The large dam which discharges to the headwaters of Little Cattai Creek is located on Lot 2 DP555184 and is not included in the proposal.

2.5.3 Surface water management on completion

The proposed final landform would comprise a large bowl gently sloping towards the south east with steeper slopes along the northern side towards Old Northern Road. The floor of this area would vary between two metres and six metres above the high wet weather groundwater level. Batters would be formed as shallow as possible depending on the volume of overburden (mainly clay) available for reformation of the profile of the site. This would be aimed at achieving a natural overall profile and avoiding, as far as possible, steep slopes. The quarry floors of the remaining extraction areas located in the eastern part of the site would be graded to a level approximately two metres above the high wet weather groundwater level with batters formed in accordance with the requirements of Development Control Plan 16.

The final retention basins would be sized to ensure that no discharge occurs for storm events up to and including the 100 year ARI event. These would be constructed towards the end of the development as part of the completion of the final landform. Rainfall intensity frequency data for the site were generated using the procedures in *Australian Rainfall and Runoff (1998)*. These are summarised in **Table 2.4**

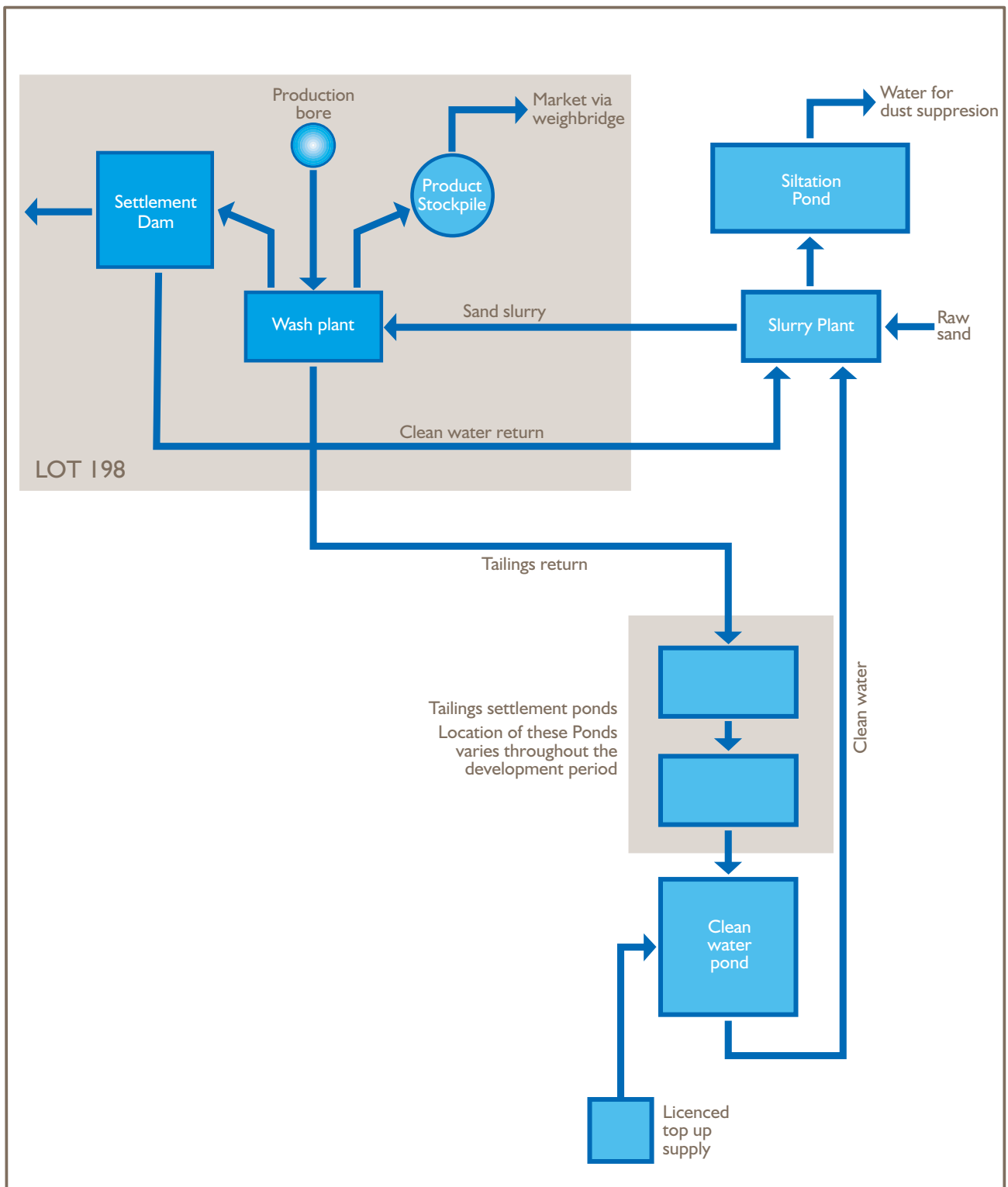


Figure 2.6
WATER MANAGEMENT SYSTEM

Catchment areas were calculated using available maps and design 100 year ARI flows estimated using the probabilistic rational method. Required pond storage volumes were estimated using a triangular hydrograph approximation. A further 30 percent additional storage volume was added to allow for sedimentation.

Table 2.4 Design rainfall (millimetres per hour)

Duration (minutes)	Average Storm Recurrence Interval (years)						
	1	2	5	10	20	50	100
5	75.79	98.02	128.32	144.95	167.67	197.52	220.31
10	58.00	74.99	98.10	110.78	128.10	150.85	168.22
30	34.19	44.19	57.73	65.15	75.29	88.61	98.77
60	23.22	30.00	39.15	44.16	51.02	60.01	66.87
120	15.51	20.06	26.22	29.59	34.21	40.28	44.90

Three main sediment ponds would be required as part of the final landform:

- one in the northern part of the site to the south of the intersection between Old Northern Road and Wisemans Ferry Road-the northern catchment;
- one within the southern catchment; and
- one located in the eastern part of the site. This would need to be located on Lot 2 DP555184 and is not included in the proposal.

Estimated storage volumes required for containment of the 100 year ARI storm for the three catchment areas are shown in **Table 2.5**.

Ponds with volumes of at least 10,000 cubic metres and 38,000 cubic metres have been included in the northern and southern catchments respectively. The necessary storage volume for the eastern pond would need to be provided within the development proposed for Lot 2 DP555184 which is subject to a separate development application to Baulkham Hills Shire Council under Part 4 of the *Environmental Planning and Assessment Act 1979*.

Table 2.5 Retention basins (minimum storage volume)

Catchment	Area (hectares)	Volume (cubic metres) ¹
Northern	16	10,000
Southern	52	38,000
Eastern	29	19,500 ²

Note 1: Including 30 percent allowance for sedimentation

2: Located on Lot 2 DP555184 and not included in the proposal

Surface water runoff from the surrounding areas would be prevented from entering the extraction areas by diversion drains around the perimeter and internal drainage would be directed towards suitably sized detention basins.

2.6 Soil management

Topsoil would be stripped immediately prior to extraction and used in rehabilitation. If it cannot then be spread over areas to be rehabilitated, it would be stockpiled temporarily at a location away from drainage lines. Silt fences would be placed around the base of the stockpiles to prevent soil loss. Height of the stockpiles would be limited to three metres to maintain the organic properties of the soil.

2.7 Erosion and sediment control

The soils on site are highly erodible under concentrated flows. Erosion and sediment controls have therefore been proposed to manage drainage on the site and minimise the area of soil exposed to surface water flows. Controls would include:

- provision of buffers and installation of silt fences where appropriate to prevent sediment transport to adjoining land;
- minimising the area of disturbance by only clearing areas immediately prior to extraction within each stage and progressive rehabilitation of the completed area;
- diversion of upslope drainage away from disturbed areas;
- diversion of sediment laden runoff to sediment basins; and
- regular inspection and maintenance of sediment controls.

These controls would be described in more detail, including type, location and inspection and monitoring protocols in the environmental management plan covering the works. These would comply with the procedures and recommendations in *Managing Urban Stormwater: Soils and Construction* (Landcom 2006).

Existing surface water controls are inspected on a regular basis in accordance with the requirements of the current environmental management plan and their performance reported annually in the environmental audit. All controls are maintained in good working order.

2.8 Rehabilitation and final land use

2.8.1 Rehabilitation plan

The final landform of the Hitchcock Road site would be influenced by the depth of extraction, the location of commercially available resource (both Tertiary Sand and friable sandstone) and the volume of overburden, mainly clay, available for re-contouring the extracted areas. Sand has been extracted from part of the site to the depth allowed in the existing consent and part of this area has been rehabilitated. These areas would not be reworked unless substantial volumes of sand can be economically extracted.

The main Tertiary Sand resource is located in the centre of the main part of the site with smaller volumes of friable sandstone in the eastern part. The larger area provides opportunities for reformation of the contours using the large volume of overburden above the Tertiary Sand to create an integrated, continuous landform. There is less scope to achieve such a landform where smaller areas of resource would be extracted from individual pits. Here, rehabilitation would comprise the reduction of any steep batters to better integrate the lowered area into its surroundings. The base of the extracted and

rehabilitated area would be generally level with a gentle slope sufficient to achieve good local drainage and minimise erosion.

Most of the area is expected to be reclaimed to Class 3 agricultural land suitable for grazing and improvement for pasture. Rehabilitation would comprise the return of the stored topsoil and the progressive revegetation of the site. Techniques to be used have been based on several sources: *Urban Erosion and Sediment Control Handbook* (Department of Conservation and Land Management 1992); *Managing Urban Stormwater* (Landcom 2006); and *Best Practice Environmental Management in Mining – Rehabilitation and Revegetation* (Environment Protection Authority 1995).

A comprehensive rehabilitation strategy would be prepared as part of the revised environmental management plan for the site. This would include a biodiversity offset strategy.

The proposed final landform for the Hitchcock Road site is shown in **Figure 2.7**. The objectives of the rehabilitation plan are to:

- achieve a final landform that blends into the surrounding ground profile and natural landscape;
- ensure that rehabilitation is undertaken progressively;
- maintain the scenic and environmental quality of the site; and
- return the site to its previous dominant land use, horticulture/agriculture.

2.8.2 Rehabilitation process

Extraction and rehabilitation would be undertaken in a series of pits which are gradually extended and progressively backfilled with the overburden removed from above the extraction face. This process is necessary due to the depth of the clay overburden above the Tertiary Sand and the necessity to minimise double handling of the material. Other excavated areas would be lined with compacted clay for use as sedimentation basins once the previous tailings ponds have reached the end of their lives and require drying out and capping. This process is different from that employed where extraction takes place in strips where clearance, extraction and rehabilitation is undertaken concurrently.

This is not feasible where the overburden to be removed is many metres thick and large areas of the site are required for tailings management.

Once the final site contours have been achieved in an appropriately sized part of the site, its revegetation would be initiated. This would take place in a number of stages requiring differing approaches for those areas to be returned to agricultural uses and those where habitat restoration would take place.

There are two forms of habitat restoration: revegetation and natural regeneration. Revegetation is an excellent tool for linking areas of remnant native vegetation. However, its ecological and genetic value is limited in restoring areas which have the potential to regenerate naturally.

Revegetation measures are appropriate when the regeneration potential of the site has been wholly or severely depleted or where key missing species cannot be naturally recruited to the site. Revegetation aims to use the minimum intervention necessary to re-establish the natural regeneration process. The potential to oversimplify the ecosystem via the process of revegetation needs to be avoided. In the circumstances prevailing at

Hitchcock Road, a combination of these approaches is appropriate in order to achieve successful large-scale restoration of a specific vegetation community in areas which have been subject to sand extraction and significant land reformation.

Seed Collection

Material for propagation is available on-site. The use of site-adapted local seed for propagation is best for restoring pre-existing plant communities and conserving local biodiversity. It is also more likely to lead to a successful self-perpetuating plant community as local provident seed is adapted to local soils, climatic conditions and ecological processes. The rate of change in many endangered communities is very slow, particularly for understorey species, remaining highly localised with very limited dispersal.

Seed collection would be carried out within the framework of a formal collection policy or code of practice such as *The Model Code of Practice for Community based Collectors and Suppliers of Native Plant Seed* (Florabank 1999) and collectors would be required to meet the requirements of the *Threatened Species Conservation Act 1995* including a Section 91 licence from the Department of Environment and Conservation when seed is collected from a plant community listed under the Act. The proportion of seed taken from any site would not exceed 10 percent of the species total annual seed crop from that site per year.

However, seed collection can be time consuming and specialised skills and knowledge are required. In some cases the seed drops immediately it ripens or is located high in the tree canopy. Some species have dormancy mechanisms which inhibit immediate seed germination. It would therefore be undertaken by an organisation skilled in these procedures such as Greening Australia.

Site Preparation

Revegetation requires the mitigation or treatment of any degrading influences. The presence of environmental weeds and problems such as erosion needs to be addressed. Any efforts that can be included in site preparation would benefit the restoration results. These would include, where necessary:

- stabilisation of the soil using fast growing native grasses such as *Chloris ventricosa*, *Austrodanthonia racemosa* or *Capillipedium spicigerum*;
- ripping of any severely compacted soil following the contours of the site;
- mulching of areas or around individual plants to conserve moisture and suppress weed growth taking care not to equally suppress native plant growth;
- weed and rabbit control undertaken during the site preparation phase using methods appropriate to the area and the degree of infestation;
- pre-watering of holes and plants; and
- restriction of access to the rehabilitated site to protect and delineate the planted areas.

Direct Seeding

Direct seeding would also be considered as an approach following experience gained in the earlier stages of rehabilitation. This has a number of advantages. It is quick, little labour is required, the cost per plant is low and plants grow quickly as their roots have not been disturbed. It is also believed that directly seeded trees, once established, are more resistant to drought and better able to recover from insect defoliation. However, total failure can result if the seed is not viable, the ground is not sufficiently moist or the

temperature not conducive to germination. Drought can also be disastrous and heavy rains can wash away the seed if the site is poorly prepared.

Site preparation and the climatic conditions experienced after planting are the two major factors in determining the success of seedling establishment. Good site preparation would maximise the chances of a successful project. This aims to provide ideal conditions for seed germination and seed establishment. Basic requirements are:

- soft soil so that air, water and roots can penetrate; and
- bare soil, free of leaf litter and especially weeds as weeds will compete with the native plants for water and nutrients.

Bare soil would be achieved by:

- scraping off debris and leaf litter;
- fire alone, or in combination with prior weed control using herbicides;
- spraying weeds with herbicides three times in the 12 months before seeding;
- scraping off the top soil to remove weed seeds – the top 2-10 centimetres, depending on soil type, contains the highest concentration of these; or
- spot preparation where small areas are prepared by removing the weeds by hand before being sown (Buchanan 1989).

Associated weed control would be undertaken over the period needed to allow good establishment and growth of seedlings in the first year.

Various sowing techniques are available including hydro-seeding, mechanical seeding and hand sowing. Mechanical seeding would be necessary for large areas.

The re-establishment of the top soil previously removed is important for rehabilitation as it contains seeds, vegetative reproductive organs and most of the organic matter from the site.

Planting

Planting of seedling tubestock would also be included in the rehabilitation program. While seedlings are better than seeds in a number of ways, they require substantial labour to establish, the process is slow and the cost per plant is higher. Plant selection would focus on local species adapted to the prevailing conditions and providing the right resources for local wildlife. Planting would take place at the most opportune time of year, generally in the early autumn.

Agricultural crops to be established on the site would include those grown throughout Maroota including pastures such as oats and sorghum. A typical pasture mix would be sown at a rate of 50 kilograms per hectare during the autumn or greater where conditions dictate.

Grasses and cover crops are the most effective for initial erosion control in most areas (Department of Conservation and Land Management 1992). A cover crop of oats would be sown with superphosphate to establish ground cover, stabilise and increase the organic content of the soils within the site. Legume species such as lucerne could also be established to encourage nitrogen accumulation and improve soil fertility for future agricultural uses.

Stands of local native vegetation would be re-established around the perimeter and on the highest points of the site and on all batters too steep to accommodate agricultural uses. Existing stands of native vegetation and the perimeter planting would be reinforced to improve the screening of site operations. Disturbance of existing screen planting would be minimised. The area to be seeded and planted with native vegetation would be approximately twice that removed to allow the present proposal to be implemented.

A farm management plan would be included in the revised environmental management plan. This would outline crop management and monitoring practices for the site. Revegetation would be regularly monitored and supplemented by reseeded where this is necessary. Cover crops would either be slashed or left on the ground surface to provide a mulch (Department of Conservation and Land Management 1992). Pasture less than five years old would receive annual maintenance fertiliser in spring and autumn while more established pasture would receive supplements in autumn only.

Weeds would be controlled as required until pasture/ground cover is established.

2.9 Alternatives

2.9.1 Introduction

Schedule 2 of the *Environmental Planning and Assessment Regulation 2000* requires an analysis of any feasible alternatives to the carrying out of the development having regard to its objectives, including the consequences of not carrying out the development.

The Department of Environment and Conservation has also requested that consideration is given to alternatives and the justification of the proposal, including alternative sites and layouts, access modes and routes, materials handling and production processes, waste and water management, impact mitigation measures and energy sources.

The Sydney Construction Material Industry Strategy is currently being prepared by the Department of Planning in conjunction with the Department of Mineral Resources. This is intended to provide a framework for the management of existing construction material operations in the region and the consideration of new proposals of strategic importance. As an input to the development of the strategy, the Geological Survey has prepared a number of position papers on supply and demand for construction materials including construction sand. The following section is derived from that paper (Department of Mineral Resources 2001).

2.9.2 Alternative sources and materials

Construction sand is a low value resource which is used in large quantities. Transport costs are a significant proportion of the total cost of the resource. Location within the consuming region is therefore an important factor and the material should preferably be obtained from sources close to the markets both to minimise the costs of transport and the environmental impacts of transportation.

Some seven million tonnes of construction sand are consumed annually within the Sydney Region. Approximately half (48%) is fine to medium-grained sand, just over one third (36%) medium to coarse-grained and 15 percent clayey mortar sand.

About 85 percent of demand is satisfied from deposits along the Hawkesbury-Nepean River, Georges River (medium to coarse-grained sand), coastal dunes at Kurnell (fine to medium-grained sand) and from the friable sandstone deposits (clayey mortar sand) at

Maroota and on the Somersby Plateau. In addition, approximately 900,000 tonnes of sand is obtained each year from outside the region.

In the short term (up to 2010), predicted demand for construction sand can be accommodated by continuing extraction from current sources and from imports at their present or slightly increased levels. However, a large shortfall will occur in the supply of fine to medium-grained sand with the cessation of extraction at Kurnell. This shortfall will have to be made up by either a substantial increase in imports and/or obtaining more fine to medium-grained sand from friable sandstone deposits within the region or opening new deposits for extraction.

The closure of the Penrith Lakes Development Scheme in 2010 will result in the need to derive some 2.2 million tonnes of medium to coarse-grained sand annually from alternative sources either within or outside the region. There are large identified sources of construction sand within the region at Richmond Lowlands, Somersby and Maroota and offshore which have the potential to become long term suppliers. However, various constraints apply to these locations.

There are substantial sand deposits located off-shore between Sydney Heads and the southern end of the Royal national Park. These are at least 60 metres thick over an area some three kilometres wide and 35 kilometres long. However, the off-shore sand is relatively homogeneous and free of clay, restricting its use for a number of construction purposes. There would also be environmental impacts related to the areas along the coast necessary for the stockpiles and some of the ecological and hydraulic effects of removing these large bodies of sand are not known. Two proposals have been put forward to extract this resource, the most recent in the mid-1990s. Both were rejected by the State government.

If these deposits are not used, the importation of increasing quantities of construction sand from external sources will be required, increasing costs and environmental impacts. Large deposits of friable sandstone occur at Newnes Plateau near Lithgow and at Wingello and Penrose in Wingecaribee Shire. These have the potential to become major sources in the long term. In the short term, moderate amounts of fine to medium-grained sand can be imported from the Stockton Bight and the Illawarra.

Alternative materials such as slag sand, quarry sand (crusher fines), manufactured sand, recycled building and demolition materials, excavated rock and fly ash have been considered as potential alternatives for natural sand. It is difficult to estimate the quantities consumed as data is not collected on their usage by the Department of Mineral Resources. It can reasonably be assumed that the proportion of the sand market occupied by these products is currently negligible. Their main characteristics and some of their limitations are discussed in the following section.

Slag sand is a by-product of steel making. It has potential to replace coarse sand in some applications such as asphalt and as fill. Approximately 470,000 tonnes is used as a substitute for natural sand in concrete and asphalt, mainly in the Illawarra region. The amount of slag sand used in the Sydney area is thought to be small.

Quarry sand (crusher fines/crushed hard rock residue) is produced during the crushing of hard rock for coarse aggregate. This material is by nature angular and, while it is available in a range of sizes, is suitable only for those applications in which the shape of the grain has little importance or is required to be angular. In addition, the availability of crusher fines is limited by a decline in the volume produced due to improved crushing techniques; their use in other quarry products such as road base and the variability of demand for coarse aggregate.

Manufactured sand is produced by either additional processing of crusher fines or by crushing hard rock to sand size particles. In the former, crusher fines are reprocessed to reduce the proportion of fine particles to improve the overall grading of the material. In the second case, where the primary objective is to manufacture sand, hard rock is crushed and then reprocessed to improve the shape of the resulting particles.

Significant quantities of coarse-grained sand are manufactured in other States. Manufactured sand may therefore be a long term supply option for coarse-grained sand. The use of manufactured sand in concrete, however, requires approximately 25 percent more fine to medium-grained sand in the mix and fine to medium-grained sand of adequate quality cannot be manufactured using technology available at present. Therefore there is a demand for fine to medium-grained sand which can only be supplied by natural sources.

In addition, the availability of manufactured sand is constrained partly by similar factors as those applying to quarry sand, and partly by the fact that using high quality hard rock to produce sand reduces its availability for use as coarse aggregate.

Recycled building and demolition materials include crushed recycled concrete and brick. Crushed recycled concrete can be used as a coarse sand replacement in low strength concrete. At present however, almost all crushed recycled concrete is used as fill, bedding and paving sand, or as aggregate in road pavements. Crushed recycled brick is only suitable for use as fill at present, though its use in concrete can be tolerated to some extent, depending on the application.

Excavated rock, commonly referred to as spoil, is derived from tunneling and large scale excavation projects. The composition of this material is governed by the local geology of the project site normally comprising sandstone with interbedded shale. The production of good quality sand products from such rocks would require selective extraction during excavation or intensive reprocessing, either on site or elsewhere. This may be extremely difficult and would add to the cost of excavation and/or production. Therefore, due to its heterogeneous nature and physical characteristics, the amount of excavated material which may be used as a substitute for natural sand in high quality applications is likely to be small. The material is, however, suitable for use as fill.

Fly ash (precipitated fuel ash and furnace bottom ash) produced by coal fired power stations has some potential as a sand alternative. Its main advantages are its light weight and its self cementing properties. The weight of fly ash enables it to be used as a light weight aggregate in applications which require strength but in which there are restrictions on the weight of the structure. The self cementing properties of fly ash mean that it can be used as a cement extender in concrete, which is the main use for this material. The main constraints on the use of fly ash are processing and transport costs. Fly ash initially consists of fine irregular fragments which must be reprocessed before the material is suitable as either coarse or fine aggregate. The economic viability of this process has yet to be determined. In addition, transport costs would be high as the material would have to be transported long distances from Lithgow and the Hunter Valley, which are the nearest sources to Sydney.

None of these materials has the ability to replace natural construction sand, particularly fine construction sand, in high quality applications such as concrete, to any significant degree. The most important constraints on their more widespread use are; cost of production and transport, limited availability, erratic quality and technical difficulties in obtaining suitable ranges of particle sizes and particles of acceptable shape and soundness.

2.9.3 Alternative extraction methods

All Tertiary sand would be extracted using an excavator and transferred to articulated dump trucks which would transport the material to the existing plant located at the northern end of the site. The material is sufficiently friable that ripping by bulldozer or drilling and blasting is not necessary.

2.9.4 Alternative processing and handling methods

Dump trucks would transport the material to the existing plant located at the northern end of the site. Here it would be mixed with water and transported by pipeline some 1.3 kilometres to the central wash plant located on Lot 198. The wash water would be returned to the site for settlement in a series of clay lined basins prior to recirculation from the clean water pond at the lowest point on the system and reuse.

The sand would be processed at the central plant. It would then be sent to market following checking at the weighbridge. There would be no transport of Tertiary Sand by truck from the site to the central wash plant except during periods of routine maintenance or following plant breakdown.

Alternative methods would involve either the installation of a new wash plant on the site or the trucking of the extracted material to the existing wash plant on Lot 198. Neither of these options is considered viable due to the existence of all necessary infrastructure.

The existing process does however require the use of large areas of the site for settlement ponds. This requirement both limits operational flexibility and results in lengthy periods for drying out and consolidation before these areas can be finally rehabilitated. The proposal therefore includes the provision of a series of cyclones at the central wash plant in order to recover a higher proportion of the fine sand which will not then be returned to the ponds for settlement.

2.9.5 Alternative access

An access to the site from Wisemans Ferry Road is currently in use. An alternative access to either of the two perimeter roads would be difficult to achieve due to site levels and topography and would need to be moved further from the access point to Lot 198. The existing access is safe and effective and an alternative is not required.

An alternative access is available from Lot 1 DP34599 onto Old Northern Road. This would be used for the transport of material (extracted and imported) to market which does not require further processing at the central wash plant on Lot 198.

2.9.6 Alternative waste and water management

There are no environmentally responsible alternatives to the waste and water management strategies proposed for the development.

2.9.7 Mitigation measures and energy sources

The proposed mitigation measures have been designed on the basis of a comprehensive knowledge of the site gained from years of operation. There are no feasible alternative sources of energy.

2.9.8 Failure to proceed with the proposal

Failure to proceed with the proposal would result in the sterilisation of a regionally significant resource located close to the Sydney market leading to increased reliance on sources at a greater distance resulting in higher costs to the consumer and increased environmental impacts.

Not proceeding with the proposal would result in foregoing the opportunity to extract and process a high quality, high demand resource which is accessible with minimal additional environmental impacts and using existing plant and infrastructure.

Failure to proceed would result in earlier closure of the operations on the site with the resultant loss of employment for the quarry staff. A number of jobs indirectly generated by the operation would also be foregone.

2.10 Need for the proposal

The Maroota Sand deposit has been identified as potentially a major source of sand within the Sydney region in the future (Department of Mineral Resources 2001) and this has been reinforced by the protection afforded by the provisions of Sydney Regional Environmental Plan 9.

The Sydney region consumed approximately six million tonnes of construction sand each year by 1992 increasing by one percent per year to reach approximately 6.8 million tonnes by 2005. It is also reasonable to assume that local sand production is immediately consumed within the region as there is little long term stockpiling of supply (Department of Mineral Resources 1992).

The predicted demand for medium to coarse grained sand of the type available at Hitchcock Road during the period from 2000 to 2010 is 25.4 million tonnes with a predicted supply from the region of 22.5 million tonnes over the same period. The potential shortfall of three million tonnes would need to be satisfied by increasing imports or by increasing production within the region (Department of Mineral Resources 2001).

In the medium term (2010 to 2020) the predicted demand for medium to coarse grained sand is expected to increase to 30.6 million tonnes. There will be no dominant secure supply of this material in the Sydney region following the closure of the Penrith Lakes scheme, expected in 2010. Current sand supplies from Maroota and elsewhere in the region are approximately 800,000 tonnes per year. The remainder of the annual requirement of three million tonnes would need to be derived from elsewhere, and, as a result, sand produced from sources such as Maroota will have an increasing importance in supplying the Sydney market for construction sand.

There is a need for additional sources of medium to coarse grained sand within the Sydney region in both the short and medium terms. Importation would both increase its price due to the additional transport costs involved and result in additional environmental impacts as new sources are exploited. It is therefore important to enable the maximum available resource to be obtained from existing sources of sand in the Sydney region while ensuring that appropriate environmental standards are maintained. The new proposal at Hitchcock Road is seeking to achieve these principle objectives.

3

CHAPTER

STATUTORY REQUIREMENTS



Chapter Three Statutory requirements

3.1 Introduction

The *Environmental Planning and Assessment Act 1979* (the Act) and *Environmental Planning and Assessment Regulation 2000* (the Regulation) control the use and development of land in New South Wales. The Act establishes the hierarchy of planning instruments that apply to the proposal. These instruments and all relevant legislation applying to the proposal are summarised in the following sections.

The Act was amended in August 2005 by the inclusion of Part 3A. The Minister for Planning is responsible for determining development which has been declared to be major infrastructure under this part of the Act. The Minister may declare a development to be a major project if defined in *Schedule 1: Major Projects-Classes of Projects in State Environmental Planning Policy (Major Projects)*. Group 2.7 in Schedule 1 includes extractive industries and the Hitchcock Road project therefore meets the criteria for consideration as a major project due to its scale and significance.

The Environmental Assessment (EA) has been prepared to accompany a development application by PF Formation for a change to their operations at the Hitchcock Road site in Maroota, Baulkham Hills. Although the proposal comprises a number of changes to the current approval, it is treated as a new development which would supersede it. The current approval would remain in force until it ceases to have effect when the present application is approved under Part 3A of the Act.

3.2 Environmental Planning and Assessment Act 1979

3.2.1 Development consent

Part 3A provides an assessment and approvals regime tailored to major infrastructure and other projects where the Minister is the approval authority. The provisions of Part 3A apply to major projects where the Minister for Planning has made a declaration relating to the specific development to which the project belongs. The process is divided into three stages:

- project application and environmental assessment;
- exhibition, consultation and review; and
- Director General's assessment and Ministerial determination.

Project application and environmental assessment

The proponent of major infrastructure under Part 3A must submit a project application to the Department of Planning. Information in the application is used to determine whether Part 3A of the Act applies and whether a concept plan will be required or authorised by the Minister. Under the provisions of Clause 75E(2) of the Act, the application must include a description of the proposal and any other matters required by the Director General. This would normally include a preliminary assessment to accompany the project application.

Depending on the proposal, the proponent may also need to establish whether the Minister will require or will authorize the submission of a Concept Approval for the project. The project application should include:

- description of the project and any ancillary components;
- location(s) and a map identifying the site(s)/alignment/corridor;
- capital investment value and other relevant information in relation to the parameters set out in the Major Projects State Environmental Planning Policy or any order relevant for determining whether Part 3A applies;
- planning provisions applying to the site;
- views of other agencies, local council or the community, if known;
- list of any other approvals required, in particular if a licence from the Department of Environment and Conservation under the Protection of the Environment Operations Act is required;
- justification of consideration of the project under Part 3A provisions, if necessary; and
- preliminary assessment aimed at identifying the likely environmental issues.

The preliminary assessment is based on the *Preliminary Assessment Guidelines* (Department of Planning 2005) which set out a systematic process of identifying and ranking environmental issues to provide the basis for the environmental assessment requirements for the proposal. The preliminary assessment is predominantly a desk top study which also identifies any likely environmental constraints on the site to assist in the formulation of the proposal.

The Department of Planning consults all relevant government agencies and local councils during the preparation of the environmental assessment requirements under Clause 75F(2). Where the issues are complex, a Planning Focus Meeting is convened by the Department for the participants to consider the issues and the level of assessment to be required.

The Director General issues the environmental assessment requirements which must be consistent with the guidelines. These are publicly available on the Department's web site. The requirements nominate the general contents of the environmental assessment, key issues to be addressed, the level of assessment required and the form and contents of the documentation.

The environmental assessment is essentially a technical document which identifies the environmental risk or benefits of the proposal so that the approval authorities or an informed member of the public can understand the implications of the key issues and can evaluate the proponent's commitments to environmental management and mitigation measures for the project together with any expected residual effects. The assessment should focus on those issues important for the management of the project in a sustainable manner.

The environmental assessment contains a draft Statement of Commitments indicating the measures that will be undertaken to minimise impacts on the environment should the proposal be approved. This will be included in the conditions of approval.

Exhibition, consultation and review

Prior to exhibition, the adequacy of the assessment is considered by the Director General in consultation with government agencies and the relevant council. Additional information may be required at this stage. When adequate, the environmental assessment is exhibited for a minimum of 30 days during which written submissions are invited.

Copies are sent to the proponent, the Department of Environment and Conservation if a licence is required, and any other public authority. The proponent may be required to respond to submissions, prepare a Preferred Project Report outlining any changes to the proposal to minimise its environmental impact and a revised Statement of Commitments.

Assessment and determination

The third stage comprises the Director General's assessment and the Ministerial determination. The draft assessment report includes recommendations for determination – either, approval subject to implementation of the Statement of Commitments with other conditions as appropriate, or refusal. The report takes account of the environmental assessment, any peer review, any panel or inquiry report and recommendations, submissions from public authorities and other stakeholders and any preferred project report.

The assessment focuses on the acceptability of the residual impacts, adequacy of measures in the Statement of Commitments to manage and minimise impacts and the justification of the proposal taking the Director General's requirements into consideration. The assessment report is submitted to the Minister for Planning for determination. A copy of the Minister's determination is sent to the proponent, relevant agencies and councils and is published on the Department of Planning's website.

Appeal rights under Part 3A are generally the same as those operating prior to its introduction. The proponent (except public authorities) has merit appeal rights except for proposals which are critical infrastructure or where a commission of inquiry or panel of experts has been involved in the process. Applications must be lodged within three months of a decision.

Third party objectors have merit appeal rights similar to those that applied to designated development under Part 4 except where there is a commission of inquiry or panel of experts. Applications must be lodged within 28 days of a decision.

The determination process for a major development is summarized on **Figure 1.4**.

3.2.2 Integration of other State legislation

Threatened species assessment and Aboriginal cultural heritage assessment (responsibilities of the Department of Environment and Conservation) have been integrated into the Part 3A assessment and approval process.

In both cases, an initial desktop assessment would be adequate to determine whether threatened species occur on site or are likely to be affected by the proposal or in order to determine Aboriginal cultural values associated with the affected site. If present, further assessment will be required and details included in the Director General's requirements for the EA.

Clause 75I(2) of the Environmental Planning and Assessment Act Part 3A requires the Director-General's report to include:

- (e) *except in the case of a critical infrastructure project-a copy of or reference to the provisions of any environmental planning instrument that would (but for this Part) substantially govern the carrying out of the project and that has been taken into consideration in the environmental assessment of the project under this Division,*
- (f) *a copy of or reference to the provisions of any State Environmental Planning Policy that substantially governs the carrying out of the project.*

The relevant provisions of all environmental planning instruments applying to the proposal are identified and discussed in the following sections.

3.3 Baulkham Hills Local Environmental Plan 2005

Land use in the Baulkham Hills local government area is governed by *Baulkham Hills Local Environmental Plan 2005*. The site is zoned Rural 1(b). Quarrying is permitted in this zone with development consent.

The following section provides responses to the relevant objectives of the zone.

Rural 1(b) Zone

- (a) *To ensure that existing or potentially productive agricultural land is not withdrawn unnecessarily from agricultural production.*

Parts of the proposed extraction area have been used for low key agricultural purposes. However, *Sydney Regional Environmental Plan 9 – Extraction Industry (Number 2)* identifies the sand/clay/shale and friable sandstone in these and surrounding properties as of regional significance. The Regional Environmental Plan takes precedence over local environmental planning instruments and therefore the use of land for sand extraction is considered to have greater value to the region than its use for agriculture. Once extraction has taken place, substantial parts of the rehabilitated site would be returned to agricultural use.

- (b) *To maintain the rural character of the area without adversely affecting the carrying out of agricultural activities.*

Although the proposal would restrict horticulture and grazing in the short term, it is proposed to use substantial parts of the site for these purposes once extraction has ceased. Buffer zones along the peripheral roads would assist in the retention of the rural qualities of the area when viewed from these public areas.

- (c) *To ensure that development is carried out in a manner that minimizes risk from natural hazards and does not unreasonably increase demand for public services and public facilities.*

The operation of the quarry is unlikely to result in any increase in the risk from natural hazards. While the area, in common with its surroundings, is susceptible to bush fires, it is unlikely that site operations would contribute to an increase in any risk. Substantial areas of the site are cleared and would therefore not be affected.

No additional facilities or services would be required as a result of the proposal. Total output from PF Formation's existing operations in Baulkham Hills Shire and the proposal would not exceed the approved rate of 200 laden truck movements per day off-site. The proposal would not therefore generate any need for improvements to the public road network in the area.

- (d) *To provide land on which development may be carried out that assists the operation and functioning of development in adjoining residential areas and appropriate locations for tourist facilities.*

The proposal would allow the continued supply of Tertiary Sand to the Sydney market for use in a wide range of development and infrastructure projects. The resource is recognized in Sydney Regional Environmental Plan 9 as regionally significant.

The proposed development is not a tourist facility. However, due to the prominent location of the site and its history, consideration would be given to the provision of a particular facility. Its nature and character will be determined in consultation with the local community. This is not part of the present application but would be considered once the development is further advanced.

- (e) *To protect and enhance those areas of particular scenic and environmental value.*

The proposed extraction area contains some native vegetation. The site supports a community of the threatened plant *Tetratheca glandulosa* and an area of the endangered ecological community, shale/sandstone transition forest. It would however be necessary to remove a number of small populations of the plant and the remnants of the transition forest which are located adjacent to the highest point on the site. Proposals for rehabilitation of the site include the collection and storage of an extensive seed base derived from the existing forest. This has been propagated to provide the basis for replanting as part of the rehabilitation program. The impact assessment concluded that the proposal would be unlikely to have an impact on the plant species or the recovery of the forest community.

The rural character of the area would be maintained by the provision of vegetated buffers along the boundary of the site and the inclusion of three metre high bunds at locations where views into the site would be possible. The bunds would also be vegetated.

The area of disturbance would be minimised by only clearing areas immediately prior to extraction and undertaking progressive rehabilitation using native seed derived from the adjacent bushland. Progress in rehabilitating the site is dependent on the rate at which the silt ponds fill and dry out.

These and other mitigation measures are discussed in more detail in **Chapters 4 and 5**.

- (f) *To ensure that development is designed and carried out having regard to the rural and heritage character of the surrounding land.*

The development would result in visual changes in the short term. However any impacts would be minimised by the implementation of mitigation measures such as visual bunding and extensive tree planting. The site would be rehabilitated in stages and returned to agricultural/horticultural uses consistent with the surrounding rural area.

- (g) *To ensure that development is designed and carried out having regard to adjoining land uses and the natural environment.*

All development on the site would comply with the requirements of Baulkham Hills Development Control Plan 16 including the provision of setbacks from all boundaries and the inclusion of visual management measures. Sand extraction inevitably leads to the removal of existing vegetation on the affected site. Progressive rehabilitation would recreate the vegetation communities using seed collected prior to the start of development. A range of mitigation measures would be implemented to protect other parts of the natural environment. These are described in **Chapters 2, 4 and 5**.

In light of this assessment, the proposal is generally consistent with the objectives of the Rural 1 (b) zone and is therefore permissible.

Clause 15 of LEP 2005 states that:

- (1) *A person must not carry out development on any land to which this plan applies unless arrangements satisfactory:*
- (a) to Sydney Water Corporation for water, sewerage and drainage; and*
 - (b) to Transgrid and/or Integral Energy for electricity; and*
 - (c) to Telstra Corporation Limited and/or telecommunications carriers for telephone services; and*
 - (d) to the Roads and Traffic Authority for classified roads in the Kellyville Rouse Hill Release Area;*

have been made in relation to that land.

The proposal would not require the provision of additional water, sewerage, electricity or telecommunication services and surface water would continue to be managed using the established and expanded drainage system.

Clause 21 relates to land subject to bushfire hazards and addresses the provisions of the Rural Fires Act 1997. The clause requires that Council must take into account whether:

- (a) the development is likely to have an adverse effect on the implementation of any strategies for bushfire control and fuel management adopted by the Baulkham Hills Bushfire management Committee in accordance with the Rural Fires Act 1997;*
- (b) access arrangements to and from the development will increase the hazard to residents, visitors and emergency services;*
- (c) the increased demand for emergency services during bushfire events created by the development would lead to a decrease in the ability of the emergency services personnel to effectively control major bushfires; and*

- (d) the measures adopted to avoid or mitigate the threat of bushfire, including siting of the development, design of structures and materials used, clearing of vegetation, fuel free and fuel reduced areas and landscaping and fire control aids such as roads and water supplies are adequate for the locality or would result in unacceptable environmental impacts.*

Division 2 of LEP 2005 addresses the conservation of heritage items, relics and conservation areas of the local government area.

Extractive industries or industries directly associated with, or dependent on extractive industries are classified as advertised development in LEP 2005 and are permissible with development consent in the 1(b) zone. Clause 41 relates to advertised development and states that:

- (1) Pursuant to Section 29A of the Act, the provisions of Sections 79 and 79A of the Act apply to and in respect of development specified in the table to Clause 9 under the heading Advertised Development (wherever occurring) in the same way as those provisions apply to and in respect of designated development.*

As the proposal is for extractive industry, the Department of Planning is required to exhibit the development application for 30 days and written notification given to applicable residents under Sections 79 and 79(A) of the Environmental Planning and Assessment Act.

The socio-economic effects of the proposal are outlined in Section 4.16 and consultation with the community during the development of the proposal is summarised in Section 1.3. The proposal would not adversely affect the cultural or ecological diversity of the Shire or significantly affect any archaeological sites or native fauna species. It would result in the removal of a small area of listed native forest community. However, this would be replaced by a substantial area of similar habitat derived from seed collected over the last three years from the existing forest community. The quality of the surface water and groundwater resources of the site would be maintained by the expansion of the existing drainage and erosion and sediment control measures to those areas not so far subject to sand extraction. No works would be undertaken within 40 metres of any tributary of Little Cattai Creek.

The environmental assessment of the proposal was undertaken with reference to the Industrial Noise Policy (Environmental Protection Authority 2001) and the Approved Methods and Guidance for the Modelling and Assessment of Air Pollutants in New South Wales (Environment Protection Authority 2001).

Clause 32 deals specifically with extractive industries.

32 Extractive industries

- (1) Consent must not be granted to the carrying out of development for the purpose of extractive industries unless the consent authority has given consideration to the following:*
- (a) social, economic and environmental impacts of the proposed development and management of those impacts; and*
 - (b) the extent to which internationally and nationally recognized environmental standards may be implemented in carrying out the proposed development; and*

- (c) *the extent of community consultation about and involvement in all phases of the proposed development; and*
- (d) *the existence, nature and level of detail of sound technical parameters for carrying out the proposed development in an environmentally sensitive manner; and*
- (e) *the conservation of the biological and cultural diversity and quality of land within the Baulkham Hills local government area; and*
- (f) *the impact of the proposed development on the archaeological resources of the site; and*
- (g) *the impact on the cultural landscape, including any significant views and vistas to or from items of environmental heritage located in the vicinity of the proposed development; and*
- (h) *proposed program of remediation for the site, including the post extractive industry usage; and*
- (i) *the impact of the proposed development on surface water and groundwater resources; and*
- (j) *the impact of the proposed development on native vegetation (trees, shrubs and groundcover species) including threatened species; and*
- (k) *the impact of the proposed development on native fauna habitat; and*
- (l) *the provision of an adequate setback, no less than 40 metres from the top bank of a watercourse to the extraction operations.*

All these considerations, where relevant, are addressed in the EA. The section of the document where these and other pertinent issues are discussed is listed in **Appendix B**.

Clause 45 of LEP 2005 addresses the protection of riparian zones and states that:

The Council shall not consent to the carrying out of development within 200 metres of a creek unless it is considered that such development will not have a detrimental impact on natural ecosystems, flora and fauna, water quality, natural drainage channels, visual amenity, flooding, soil erosion or topographical features.

The large farm dam on Lot 2 DP555184 (not included in the application) is located at the top of the catchment of Little Cattai Creek. The creek itself commences at the discharge from the dam. The creek crosses Lot 214 DP752039 approximately 200 metres from the eastern edge of the proposed extraction area. The proposal would have no detrimental effect on the ecology or water quality of the creek nor its visual amenity or the topography of its riparian corridor.

Clause 51 of LEP 2005 relates to the environmental management and monitoring of development within the Rural 1(b) zone and states that:

Council shall not consent to development within the Rural 1(a), 1(b), 1(c), 1(d) or 7(a) or 8(a) zones unless the Council is satisfied that the following issues are addressed:

- (a) water quality;
- (b) soil erosion;
- (c) air quality;
- (d) noise;
- (e) salinity;
- (f) bushfire hazard;
- (g) flora and fauna; and
- (h) the continued monitoring of these issues.

The potential impacts of the proposal on the drainage and groundwater of the site are addressed in **Sections 4.5** and **4.7** of the EA and soil erosion, air quality, noise impacts, bushfire hazards and ecology are discussed in **Sections 4.6, 4.9, 4.8, 4.14** and **4.10** respectively. The mitigation measures and environmental monitoring proposed for the site are outlined in **Chapter 5**.

Clause 59 of LEP 2005 relates to the clearing of bushland and states that:

Despite any other provisions in this plan, the clearing of bushland in the Rural 1(a), 1(b), 1(c), 1(d) or 7(a) and 8(a) zones requires the consent of Council unless a land owner has been directed by Bushfire and Emergency Services to carry out bushfire hazard reduction works.

The development would take place predominantly on cleared land or on areas used for orchards. An area of listed native forest would be removed. This is not expected to significantly affect the survival of this community and substantial parts of the site would be revegetated with seed from the existing remnant.

3.4 Baulkham Hills Shire Council development control plans

3.4.1 Development Control Plan 1 – Rural Land

Development Control Plan 1 – Rural Land applies to land zoned Rural 1(a), 1(b) and 1(c) under Baulkham Hills Local Environmental Plan 1991. Its aim is to ensure that development in rural areas is sympathetic and is undertaken taking account of appropriate environmental considerations.

The objectives of the Development Control Plan are to:

- provide guidelines for the development of rural areas;
- ensure that development in rural areas has regard to the agricultural and environmental quality of the land; and
- accommodate development which is compatible with the rural environment, does not unreasonably increase the demand for services and minimizes risks from natural hazards.

Development Control Plan 1 provides development objectives and standards for development sites, dwellings, dual occupancies, setbacks to roads, development near the Hawkesbury River, rural industries, tourist facilities, reception establishments, restaurants and developer contributions.

Development standards relevant to the proposal are:

- the site must have a minimum area of 10 hectares and a road frontage of 60 metres; and
- a minimum building setback of 30 metres from Old Northern Road must be provided.

The proposal complies with these development standards.

3.4.2 Development Control Plan 16 – Extractive Industries

Development Control Plan 16 – Extractive Industries has been designed to assist applicants in the preparation, assessment and determination of extractive industry proposals.

The objectives of the Development Control Plan are to:

- consider the social, economic and environmental issues in the assessment and management of extractive industries;
- implement the objectives of international and nationally recognized environmental standards;
- encourage community participation in all phases of extractive industry development;
- provide sound technical parameters to facilitate the orderly development of extractive resources within environmentally sensitive regions;
- conserve the biological and cultural diversity and quality of Baulkham Hills Shire; and
- implement the requirements of the *Environmental Planning and Assessment Act 1979* and other relevant environmental statutes.

The Development Control Plan also provides objectives, performance criteria and prescriptive measures for various environmental issues. Performance criteria and/or prescriptive measures relevant to the proposal are listed in **Table 3.1** together with comments regarding the proposal in response to these measures.

3.5 Regional environmental plans

3.5.1 Sydney Regional Environmental Plan 9 – Extractive Industry

Sydney Regional Environmental Plan 9 – Extractive Industry (Number 2) 1994 was introduced to help develop extractive resources located close to the Sydney metropolitan area so that the cost of supplying materials to the community could be kept to a reasonable level. The plan takes precedence over local planning instruments.

Table 3.1 Relevant performance criteria and other requirements of Development Control Plan 16 - Extractive Industries

Element	Performance criterion or prescriptive measure	Comments
Community Participation	<p>Community consultation should be undertaken in the preparation, assessment and management of extractive industries.</p> <p>Proponents are encouraged to promote a better understanding of the links with local cultural history and diversity; natural features and biodiversity; local economies and local views, values and aspirations.</p>	<p>A community meeting was held in December 2002 to provide information about the proposal and seek to identify those issues of concern. Ongoing consultation forms part of the existing operation including the provision of information in local newspapers and on the PF Formation web site. The existing telephone complaint line will continue to operate.</p> <p>In addition, two meetings are held each year with the Liaison and Review Committee relating to the operation of the site. The committee is made up of community members, Council, Department of Environment and Climate Change and Department of Natural Resources representatives and any others considered to be appropriate by Council. These meetings address issues raised in relation to current operations and those needing to be addressed as part of the current proposal.</p> <p>Articles on the web site include the reporting of monitoring results and a discussion of sand mining issues.</p>
Setbacks	<p>Extraction should be set back no less than:</p> <ul style="list-style-type: none"> • 10 metres from adjoining property boundaries; • 30 metres from a public road; • 40 metres from the top bank of a watercourse or otherwise to the requirements of the Department of Water and Energy; • 100 metres from a public or community facility; and • 100 metres from a residence not associated with extraction 	<p>The proposed development complies with these setback provisions.</p> <p>If adjacent lots, not part of the same development, both accommodate approved sand extraction operations, set backs would not be required along the common boundary following landowner agreement. This has been approved in other locations in the Maroota area in order to achieve a more natural final ground profile.</p>

Table 3.1 Relevant performance criteria and other requirements of Development Control Plan 16 – Extractive Industries (continued)

Element	Performance criterion or prescriptive measure	Comments
Transport	<p>Internal access roads should be:</p> <ul style="list-style-type: none"> no less than 20 metres wide; have a setback of at least 10 metres from adjoining property boundaries; have a setback of at least 50 metres from environmentally sensitive areas, including habitats of threatened species; and have a setback of 100 metres from residences not associated with extraction. 	The proposal would rely on the existing haul roads which comply with these requirements.
Water Resources	<p>A water management strategy should be prepared and submitted.</p> <p>Extraction should not occur within 2 metres of the wet weather high groundwater level or otherwise to the requirements of the Department of Land and Water Conservation.</p>	<p>The surface water management strategy is contained in Section 2.5.</p> <p>Extraction will not occur within 2 metres of the wet weather high groundwater level. Groundwater levels and quality will be regularly monitored and reported.</p>
Visual Amenity and Scenic Quality	<p>A landscape site analysis must be submitted that identifies and assesses the scenic qualities, landscape constraints and options for landscape protection of the extraction site.</p> <p>Visual pollution should be minimised through appropriate setbacks, perimeter screen planting and other measures.</p> <p>Extraction sites should be rehabilitated to a final landform compatible with the shape, grade, level, form, land use, landscape quality and biodiversity of the surrounding terrain.</p>	<p>A visual assessment of the site satisfying these requirements is provided in Section 4.12 and Technical Paper 8.</p> <p>Various measures will minimise the visual impact of the proposal including the maintenance of vegetated buffers along the boundaries of the site.</p> <p>A rehabilitation and revegetation strategy is in the process of implementation for the existing development and the principles of this strategy will be applied to the proposed development amended as appropriate.</p>

Table 3.1 Relevant performance criteria and other requirements of Development Control Plan 16 – Extractive Industries (continued)

Element	Performance criterion or prescriptive measure	Comments
Flora and Fauna	<p>A flora and fauna assessment should be undertaken including seven part tests and a Species Impact Statement where required.</p> <p>Extraction operations should provide a buffer zone of at least 50 metres from the critical habitat of threatened species, populations and ecological communities.</p>	A flora and fauna assessment has been undertaken and is documented in Section 4.9 and Technical Paper 6 .
Heritage and Archaeological Resources	<p>An archaeological study should be submitted which includes an assessment of the scientific, educational, landscape and cultural values of all Aboriginal and non-Aboriginal sites.</p> <p>Extraction should not occur within 40 metres of rock engravings, axe grinding grooves, open scatters of artifacts, stone arrangements, waterhole/well and/or scarred trees, archaeological sites protected under the <i>National Parks and Wildlife Act 1974</i> and listed in the Aboriginal Sites Register and any other requirements of the National Parks and Wildlife Service.</p>	<p>An archaeological study is documented in Section 4.10 and Technical Paper 7.</p> <p>No Aboriginal archaeological sites or areas of potential archaeological deposit were identified.</p>
Soil Conservation	A sediment and erosion control plan should be submitted.	Sediment and erosion control measures are discussed in Section 2.7 .
Acoustic Management	An acoustic impact assessment report must be submitted which identifies and assesses the range of noise levels within the locality and the impacts likely to be generated by the proposal.	An acoustic assessment is provided in Section 4.7 and Technical Paper 4 .

Table 3.1 Relevant performance criteria and other requirements of Development Control Plan 16 – Extractive Industry (continued)

Element	Performance criterion or prescriptive measure	Comments
Air Quality Management	An air quality assessment report should be submitted.	An air quality assessment report is documented in Section 4.8 and Technical Paper 5 .
Extraction Program	An extraction program should be submitted.	The proposed extraction plan is located in Section 2.4 .
Rehabilitation	A rehabilitation strategy should be submitted.	The principles of the present rehabilitation and revegetation strategy will be applied to the proposed development amended as appropriate.
Social and Economic Assessment	An economic appraisal report and social impact assessment should be submitted.	A socio-economic profile of the area is provided in Section 4.15 together with a discussion of the costs and benefits of the proposal.
Ecologically Sustainable Development	An ecologically sustainable development summary report should be submitted.	The manner in which the proposal would comply with the principles of ecologically sustainable development is described in Section 4.16 .
Post-Extraction Land Use	The extraction site should be rehabilitated to a useable and stable final landform that can support a variety of agricultural or other permissible land uses. A farm management plan should be submitted for agricultural post-extraction land uses.	The rehabilitation and revegetation strategy for the site of the proposal and details of final land uses are provided in Section 2.8 .

Table 3.1 Relevant performance criteria and other requirements of Development Control Plan 16 – Extractive Industries (continued)

Element	Performance criterion or prescriptive measure	Comments
Maroota	<p>Extractive industry set backs specific to the Maroota area are:</p> <ul style="list-style-type: none"> • 40 metres from Maroota State Forest; • 50 metres from known critical habitats of the Yellow Bellied Glider, <i>Kunzea rupestris</i> and <i>Tetratheca glandulosa</i>, other threatened species, populations and ecological communities; and • 250 metres from Maroota Public School. 	The provisions of Development Control Plan 16 have been addressed throughout the EA and are summarized in this table. The proposal complies with these setback requirements.
Section 94 Contributions	Section 94 contributions may be required.	Section 94 contributions will be made as required.
Environmental Management Systems	An annual environmental management plan should be submitted to indicate the overall performance and management of the operation, to include an acoustic management plan, a rehabilitation management plan, a water management plan and a social impact management plan.	An environmental management system is in place for the existing development on the site. This requires annual reporting of the overall performance and management of the operation. This would be continued following review and updating to take account of any changes.

The relevant aims of Sydney Regional Environmental Plan 9, as they apply to the proposal are:

- to facilitate the development of extractive resources in proximity to the population of the Sydney metropolitan area by identifying land which contains extractive material of regional significance;
- to permit, with the consent of the council, development for the purpose of extractive industries on land described in Schedules 1 or 2;
- to ensure consideration is given to the impact of encroaching development on the ability of extractive industries to realize their full potential; and
- to promote the carrying out of development for the purpose of extractive industry in an environmentally acceptable manner.

Clause 8 of *Sydney Regional Environmental Plan 9* requires Council to forward a copy of the development application to the Director-General of the Department of Mineral Resources with respect to land identified in Schedule 2 of the plan. The land, which is the subject of the present application, is listed in Schedule 2 and this clause therefore applies to the proposal.

Under Part 3A of the *Environmental Planning and Assessment Act 1979*, the Department of Planning is responsible for ensuring that all other relevant authorities are consulted and this and other requirements of Sydney Regional Environmental Plan 9 are satisfied.

Clause 9 of *Sydney Regional Environmental Plan 9* requires Council to consider planning recommendations for future resource extraction presented in the Extractive Industry Planning Report when considering development applications for extraction. The Planning Report states that in order to achieve the objective of environmental acceptability, Council should require that:

- noise and vibration levels are in accordance with Department of Environment and Conservation guidelines;
- a rehabilitation plan is prepared;
- rehabilitation measures are carried out in accordance with the guidelines in the *Urban Erosion and Sediment Control Handbook* (Department of Conservation and Land Management 1992); and
- the impacts on groundwater and/or watercourses are assessed.

These requirements are also stipulated in Clause 7 of *Sydney Regional Environmental Plan 9*.

A noise assessment, rehabilitation and revegetation strategy, surface and groundwater impact assessment have been completed as part of the EA in accordance with these guidelines and requirements.

Clause 11 of *Sydney Regional Environmental Plan 9* sets out details of special requirements for extractive industry at Maroota. Clause 11(2) is reproduced in the following section in italics followed by comments regarding the current proposal.

The council must not grant consent to the carrying out of development for the purpose of extractive industry on land to which this clause applies unless the council is satisfied that the proposed development:

- (a) *is unlikely to have a significant adverse impact on the Maroota groundwater resource or on other groundwater users in the region;*

The proposal is unlikely to have a significant impact on the Maroota groundwater resource or on local groundwater users as discussed in **Section 4.4** and described in the groundwater assessment report included in **Technical Paper 2**. Extraction would not occur below two metres above the wet weather groundwater level and groundwater levels and quality would be regularly monitored.

- (b) *will conserve the environmentally sensitive and significant areas and features of the Maroota locality including the environment of threatened species, populations and ecological communities;*

The proposal would protect adjoining bushland by maintaining buffer zones, employing appropriate erosion and sediment controls and removing weeds. It would however result in the removal of a remnant of shale sandstone transitional forest, a protected ecological community, from the highest point on the site. This is in poor condition and has been badly affected by the recent (December 2002) bush fires. Seed has been collected from this community and this will provide the basis for large scale revegetation of the site as part of the rehabilitation strategy. This is discussed in detail in **Section 4.9** and **Technical Paper 6**.

- (c) *will involve controlled and limited access points to main roads;*

Sand extracted from the site would be transported by articulated vehicles along the existing haul roads on the site to the slurry plant located at its northern end. Here the sand is mixed with water and would be transported via the existing pipeline to the central wash plant on Lot 198 for processing and stockpiling. All product would be sent to market via the existing intersection on Wisemans Ferry Road. No new access points are proposed.

- (d) *will result in a final landform capable of supporting agricultural production or other post-extraction land uses compatible with the established character and landscape and natural quality of the Maroota locality.*

The final land uses would be similar to that existing prior to sand extraction. These would include orchards, horticulture, pasture and native vegetation.

3.5.2 Sydney Regional Environmental Plan 20 – Hawkesbury-Nepean River

Sydney Regional Environmental Plan 20 – Hawkesbury-Nepean River (Number 2) (1997) applies to the proposal and aims:

to protect the environment of the Hawkesbury-Nepean River system by ensuring that the impacts of future land uses are considered in a regional context.

Sydney Regional Environmental Plan 20 contains general planning considerations, specific planning policies and recommended strategies that apply to development proposals. Those specific planning strategies that are applicable to the proposal are set out in italics in the following section. Comments are provided in relation to the proposal as appropriate.

Total catchment management:

- (b) consider the impact of the development concerned on the catchment; and*
- (c) consider the cumulative environmental impact of development proposals on the catchment.*

There are numerous sand extraction operations in the Maroota area and several studies have included investigations of their impacts. Cumulative impacts of traffic movement, noise, air quality and effects on flora and fauna are assessed in **Chapter 4**.

Environmentally sensitive areas:

- (b) minimise adverse impacts on water quality, aquatic habitats, riverine vegetation and bank stability;*
- (d) protect wetlands (including upland wetlands) from future development and from the impacts of land use within their catchments; and*
- (g) consideration should be given to the impact of the development concerned on the water table and the formation of acid sulphate soils.*

The Hawkesbury River is 4.5 kilometres to the north west of the site.

Erosion, sediment and stormwater controls described in **Sections 2.5 to 2.7** would include the maintenance of buffers, staged extraction and site rehabilitation, the diversion of clean runoff away from disturbed areas and the diversion of dirty runoff into sediment basins and catch ponds.

Water Quality

- (a) quantify and assess the likely impact of any predicted increase in pollutant loads on receiving waters; and*
- (f) consider the need for an Erosion and Sediment Control Plan (to be in place at the commencement of development) where the development concerned involves the disturbance of soil.*

An assessment of the impact of the proposed development on the quality of receiving waters is contained in **Section 4.4** and **Technical Paper 2** in Volume Two.

Water Quantity

- (b) ensure that the amount of stormwater runoff from a site and the rate at which it leaves the site does not significantly increase as a result of development. Encourage on-site stormwater retention, infiltration and (if appropriate) reuse; and*
- (d) consider the impact of development on the level and quality of the water table.*

All surface runoff from the site would be directed to a series of sedimentation basins and ultimately to a clean water storage dam from where it would be recycled for use in the sand/slurry transport system.

Extraction would not occur below two metres above the wet weather groundwater level. Groundwater levels and quality would be regularly monitored and the results reported.

Cultural Heritage

- (b) *protect Aboriginal sites and places of significance; and*
- (c) *consider an Aboriginal site survey where predictive models or current knowledge indicate the potential for Aboriginal sites and the development concerned would involve significant site disturbance.*

An archaeological study of the site has been carried out and is documented in Technical Paper 7.

Flora and fauna

- (a) *conserve and, where appropriate, enhance flora and fauna communities, particularly threatened species, populations and ecological communities, aquatic habitats, wetland flora, rare flora and fauna, riverine flora, fauna and heritage values, habitats for indigenous and migratory species of fauna and existing or potential fauna corridors;*
- (c) *minimise adverse environmental impacts, protect existing habitat and, where appropriate, restore habitat values by use of management practices;*
- (e) *consider the range of flora and fauna inhabiting the site of the development concerned and the surrounding land, including threatened species and migratory species, and the impact of the proposal on the survival of threatened species, populations and ecological communities, both in the short and long term;*
- (f) *consider the need to provide and manage buffers, adequate fire radiation zones and building setbacks from significant flora and fauna habitat areas; and*
- (g) *consider the need to control access to flora and fauna habitat areas.*

The site supports the threatened plant *Tetratheca glandulosa* and the endangered ecological community, Shale Sandstone Transitional Forest. A number of small populations of the plant and remnants of the transitional forest would need to be removed. Seeds have been collected from this community and these will provide the basis for the revegetation program. Consideration would be given to the possible translocation of *Tetratheca glandulosa*. The impact assessment concluded that the proposal would be unlikely to have an impact on the plant species or the recovery of the forest community.

3.6 State environmental planning policies

3.6.1 State Environmental Planning Policy 11 – Traffic Generating Developments

State Environmental planning Policy 11 – Traffic Generating Developments which applies to extractive industries requires that the Roads and Traffic Authority is made aware of the proposal and is given the opportunity to make representations concerning it.

3.6.2 State Environmental Planning Policy 33 – Hazardous and Offensive Development

State Environmental Planning Policy 33 – Hazardous and Offensive Development ensures that proposals are assessed in relation to potential off-site risk and offence. Two of the aims of the policy are:

- (d) *to ensure that in determining whether a development is a hazardous or offensive industry, any measures proposed to be employed to reduce the impact of the development are taken into account; and*
- (e) *to ensure that in considering any applications to carry out potentially hazardous or offensive development, the consent authority has sufficient information to assess whether the development is hazardous or offensive and to impose conditions to reduce or minimise any adverse impact.*

In order to determine whether a development is a hazardous, offensive or potentially hazardous or offensive industry, Clause 8 of the policy refers to *Hazardous and Offensive Development Application Guidelines* (Department of Urban Affairs and Planning 1996). On the basis of these guidelines the proposal is likely to be considered to be a potentially offensive industry because it requires an Environmental Protection Licence from the Environment Protection Authority.

A potentially offensive industry is defined in the policy as:

a development for the purposes of an industry which, if the development were to operate without employing any measures (including, for example, isolation from existing or likely future development on other land) to reduce or minimise its impact in the locality or on the existing or likely future development on other land, would emit a polluting discharge (including, for example, noise) in a manner which would have a significant adverse impact in the locality or on the existing or likely future development on other land, and includes an offensive industry and an offensive storage establishment.

The guidelines stipulate that:

a key consideration in the assessment of a potentially offensive industry is that the consent authority is satisfied that there are adequate safeguards to ensure (that) emissions from a facility can be controlled to a level at which they are not significant. An important factor in making this judgement is the view of the Environment Protection Authority (for those proposals requiring a pollution control licence under Environment protection Authority legislation). If the Environment Protection Authority considers that its licence requirements can be met, then the proposal is not likely to be an offensive industry.

A preliminary hazard assessment is required for a potentially hazardous industry. This is reported in **Section 4.13**. This assessment and the findings of the technical studies included in the EA regarding noise, flora and fauna, air quality, archaeology, surface water and groundwater demonstrate that the proposal would not have a significant impact on the environment as a result of the mitigation measures that would be employed.

3.6.3 State Environmental Planning Policy 44 – Koala Habitat Protection

State Environmental Planning Policy 44 – Koala Habitat Protection relates to the conservation of food trees specific to Koala habitat. There is no potential Koala habitat on the Hitchcock Road site and the policy does not therefore apply

3.6.4 State Environmental Planning Policy 55 – Remediation of Land

State Environmental Planning Policy 55 – Remediation of Land relates to the remediation of contaminated land. This plan does not apply to the Hitchcock Road site as no areas within the project site are known to be contaminated

3.7 Other approval requirements

Section 75U of the *Environmental Planning and Assessment Act 1979* specifies certain approvals that are not required for an approved project under Part 3A. Section 75A defines an approved project as a project to the extent that it is approved by the Minister under this Part, but does not include a project for which only approval for a concept plan has been given. Consequently, if the Minister grants approval to carry out the project (or part of it) under s75J(1) of Part 3A, the following would not be required:

- permit under Section 201, 205 or 219 of the *Fisheries Management Act 1994*;
- approval under Part 4 or an excavation permit under Section 139 of the *Heritage Act 1977*;
- permit under Section 87 or a consent under Section 90 of the *National Parks and Wildlife Act 1974*;
- permit under Part 3A of the *Rivers and Foreshores Improvement Act 1948*; and
- water use approval under Section 89, water management work approval under Section 90 or an activity approval under section 91 of the *Water Management Act 2000*.

In addition, under s75V(1), the following authorisations cannot be refused if necessary for an approved project and are to be substantially consistent with an approval to carry out the project given under Part 3A:

- environment protection licence under Chapter 3 of the *Protection of the Environment Operations Act 1997*; and
- consent under s138 of the *Roads Act 1993*.

No authorisation under Section 12 of the *Native Vegetation Act 2003* would be required as this Act does not cover urban areas listed in Part 3 of Schedule 1 of the Act, which includes south western Sydney. Similarly, a bush fire safety authority would not be required under Section 100B of the *Rural Fires Act 1997* as the proposal does not meet the definition of development requiring authorisation under the Act.

3.8 Commonwealth legislation

The *Environment Protection and Biodiversity Conservation Act 1999* specifies that (subject to some exceptions) an approval from the Commonwealth Minister for the Environment and Heritage is required to undertake controlled actions that include an action on any land that is likely to have a significant impact on a matter of national environmental significance. Items of national environmental significance include particular threatened species.

One ecological community (Shale Sandstone Transition Forest), two plant species (*Tetratheca glandulosa* and *Grevillea parviflora*) and one fauna species (Large-eared pied bat), listed as vulnerable under the Environment Protection and Biodiversity Conservation Act, were identified on the site. The impacts of the proposal on these species are discussed in **Section 4.9** and **Technical Paper 6**.

AS the community and the species are located on, or use the site, a referral under the EPBC Act 1999 was submitted to Environment Australia in March 2003. In a letter dated 18 July 2003, the Minister determined that approval under the Act was required (EPBC Reference 2003/991) and that an accredited assessment process should be conducted. This would be an Environmental Impact Assessment under Part 4 of the EP&A Act 1979.

The applicability of the provisions of Part 3A of the EP&A Act was confirmed by the Department of the Environment and Heritage in a letter dated 10 April 2006. This means that even though the proposal requires Commonwealth approval, the assessment will be generally undertaken in accordance with the relevant provisions of Part 3A of the Act.

4

CHAPTER

ENVIRONMENTAL ASSESSMENT



Chapter Four Environmental assessment

4.1 Land ownership

The Hitchcock Road site has an area of approximately 85 hectares and is bounded by Old Northern Road along its eastern side and Wisemans Ferry Road along the western perimeter. A description of the lots that make up the site and their owners is provided in **Table 4.1** and shown in **Figure 4.1**.

Table 4.1 Hitchcock Road site land ownership

Description	Owner	Area (Hectares)
Lot 1 DP570966	PF Graham (No 2) Pty Ltd	6.080
Lot 2 DP570966	PF Graham (No 2) Pty Ltd	10.120
Lot 1 DP1013943 (formerly Maroota Trig Reserve No 6739)	The Crown (45 year lease held by the applicant)	1.012
Lots 1 and 2 DP1063296 (formerly Crown Roads)	PF Graham (No 2) Pty Ltd	0.850
Lot 2 DP233818	PF Graham (No 2) Pty Ltd	6.890
Lot 1 DP1091018	PF Graham (No 2) Pty Ltd	15.340
Lot 167 DP752039	PF Graham (No 2) Pty Ltd	16.190
Lot 214 DP752039	Flora Shelf Company Pty Ltd	16.190
Lot 1 DP223323	PF Graham (No 2) Pty Ltd	2.023
Lot 1 DP34599	D Camilleri	10.220
Total		84.894

4.2 Land use and capability

Most of the site is currently undergoing sand extraction undertaken under consent orders issued by the Land and Environment Court in July 1998. Horticultural activities have also taken place on the site but these have now ceased. Extensive parts of the site have not been affected by sand extraction to date and remain with varying levels of native forest cover. An area of orchards is located on Lot 2 DP752039 in the southern part of the site.

Land uses in the surrounding area include agriculture, extractive industries, forestry, national park, nature conservation and water reserve. Agricultural activities include orchards, market gardens and grazing undertaken mainly on the plateau along the Maroota ridge.



Figure 4.1
LAND OWNERSHIP

Sand extraction now constitutes a major land use in the Maroota area with this activity protected by designation in the *Sydney Regional Environmental Plan 9 – Extractive Industries* (Department of Urban Affairs and Planning 1994). Sand mining has been undertaken in the Maroota area since 1983 and will become a resource of increasing importance as other sources in the metropolitan area reach the end of their active lives.

There are five residences associated with the development at various locations across the site and approximately 15 adjacent to the site, mainly along Old Northern Road, Hitchcock Road and Wisemans Ferry Road.

The *Agricultural Land Classification Atlas* (NSW Agriculture 1995) maps the site as Class 3 land. This is well suited to grazing and pasture improvement and may be cropped or cultivated in rotation with pasture. Soil conservation or drainage works may be required due to erosion hazard and soil structural breakdown on this class of land. Land classification in the Maroota area is shown in **Figure 4.2**.

The majority of the site to be quarried would be rehabilitated with grasses on the flatter slopes and local native plants on the batters and steeper slopes.

4.3 Climate

Rainfall in the area was recorded from 1925 to 1998 at the Maroota Bush Fire Brigade Station located opposite the junction of Roberts Road with Old Northern Road. The station was closed in 1998 due to a lack of personnel. The records show that the average annual rainfall over this period was 884.8 millimetres. This rainfall was, however, highly variable with a maximum of 1,637 millimetres in 1990 and a minimum of 354 millimetres in 1953.

The station was reopened in 1999 a short distance away in Roberts Road. Records for this station indicate that during the period from 2000 to 2003 rainfall has been below average with the lowest occurring in 2003 (636.6 millimetres). Rainfall data for the period between 1925 and 1998 are shown in **Table 4.2**.

Table 4.2 Monthly rainfall at Maroota 1925 to 1998

Month	Monthly rainfall (Millimetres) 1925 to 1998			
	Mean	Median	Highest	Lowest
January	101.5	73.6	395.5	0.0
February	104.8	75.9	464.9	0.0
March	103.9	84.0	437.7	2.1
April	90.5	58.8	467.2	0.0
May	61.2	41.9	370.1	1.5
June	89.9	50.8	445.4	0.0
July	46.6	26.0	250.6	0.0
August	55.2	22.8	497.4	0.0
September	53.9	40.3	174.0	0.4
October	64.7	53.7	220.3	0.6
November	76.9	66.6	208.3	0.5
December	76.4	69.1	375.0	0.0
Annual	884.8	869.2	1,636.6	353.9

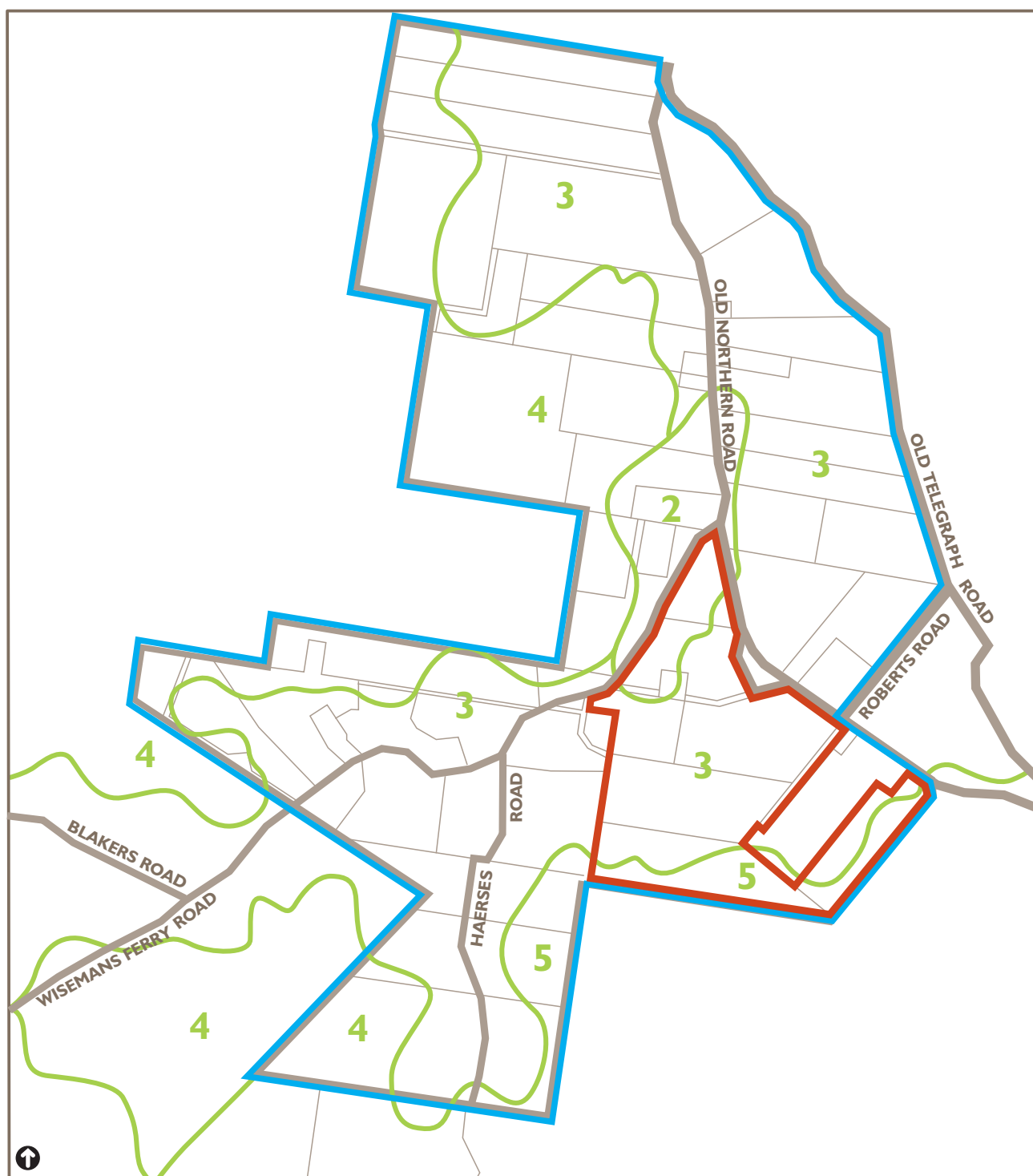


Figure 4.2

AGRICULTURAL LAND CLASSIFICATION

— Sydney Regional Environmental Plan 9 area boundary

— Hitchcock Road site

CLASS 2

Arable land suitable for regular cultivation for crops but not suited to continuous cultivation

CLASS 3

Grazing land or land well suited to pasture improvement

CLASS 4

Land suitable for grazing but not for cultivation

CLASS 5

Land unsuitable for agriculture or at best suited only for light grazing

Weather data are also collected at a weather station at the Richmond RAAF base some 25 kilometres to the south west of Maroota. Temperature data from here for the period between 1928 and 2000 are summarised in **Table 4.3**

Table 4.3 Monthly temperature at Richmond 1928 to 2000

Month	Temperature (degrees Celsius)	
	Mean daily maximum	Mean daily minimum
January	29.6	17.4
February	28.6	17.4
March	27.0	15.5
April	23.9	11.8
May	20.3	7.9
June	17.6	5.1
July	17.2	3.6
August	18.8	5.0
September	21.6	7.5
October	24.5	11.0
November	26.8	13.7
December	28.7	15.9

Highest rainfall is experienced during the first three months of the year. A daily maximum temperature of 29.6 degrees Celsius is typical

4.4 Geology

4.4.1 Regional geology

The Maroota sand deposit is located in an area where the regional geology comprises a Triassic basement of Hawkesbury sandstone (along with some Narrabeen Group sandstones), overlain by the Tertiary Maroota Sands. Late Tertiary and Quaternary alluvial deposits are also encountered within the existing Hawkesbury River Valley, generally located to the north of Maroota.

The Hawkesbury Sandstone is generally a medium to coarse grained quartz rich sandstone, with a kaolinitic clay matrix and secondary quartz and siderite (iron carbonate) cementation. The Narrabeen Group is generally a fine to coarse grained quartz lithic sandstone with a similar matrix and cementation to the Hawkesbury Sandstone. However it is generally more cemented, less quartzose and less porous.

The basement rock surface in the Maroota region, which comprises the Hawkesbury Sandstone, is highly irregular and bears no direct relationship to the present day topography. This is due to erosion of the ancient basement land surface by a river system flowing along drainage lines that existed prior to the current Hawkesbury River valley. The basement morphology appears to have been formed by two old river channels. One of these, situated on the western side of the deposit, had a north-south trend and is thought to have flowed to the north, while the other traverses the deposit with an east-west trend, and is believed to have flowed to the west. The confluence of these rivers is thought to be within the north-western part of the deposit.

These ancient drainage lines were incised into the upper portions of the Hawkesbury sandstone formation, and hence only exist on presently elevated surfaces. The rivers flowing within these ancient valleys deposited alluvial sediments which are largely confined to the river channels and now form the Maroota Tertiary Sands.

The Maroota sand deposit comprises a sequence of interbedded fluvial (river origin) sediments predominantly consisting of gravely sands and sand and clayey sand, along with lenses and layers of clay and gravel. The deposit undergoes rapid lateral and vertical facies changes and gravel and clay lenses/layers are widely distributed throughout its extent.

Due to erosion of the ground to the present surface, sediments within the north-south river channel have been largely eroded. This has separated the deposit into two known bodies of sediments that currently exist as isolated units. The body studied during this assessment is the southern most of the two units. The present surface topography, coupled with the irregular basement topography, has resulted in the Maroota sands having a highly variable thickness across their extent.

Late Tertiary and Quaternary alluvium has been deposited along the valley of the existing Hawkesbury River. These younger deposits occur stratigraphically lower than the Maroota Sands.

4.4.2 Local geology

The Tertiary Sand can be described as a sequence of interbedded clayey gravels, gravels, gravely sands, pebbly sands, clayey/silty sand, sand, silty clay, and clay. Gravel commonly occurs as layers and stringers within the sand units and clay lenses and layers are widely distributed throughout the deposit. Generally, the granular component of the deposit is well graded. The deposit contained in the Hitchcock Road site is located within the east-west trending river channel.

The main geological features of the Maroota area are shown in **Figure 4.3**. The resource, which comprises the Tertiary Sand, is generally a layered deposit comprising an Upper sand unit, overlying an extensive clay unit, beneath which lies an extensive Lower Sand unit. The deposit overlies a Triassic basement comprising Hawkesbury Sandstone. More details of these features are provided in **Section 2.2.2**.

4.5 Hydrogeological assessment

4.5.1 Background

The formations present in the Maroota area have dissimilar hydrogeological characteristics. The high degree of lithological variability (sands, clays, shale, and sandstone) often results in the establishment of perched water tables in both the Tertiary Sand and the Hawkesbury Sandstone and, possibly within the latter, between the weathered profile and the fresher sandstone.

Under these conditions, three separate aquifers can be identified, although the extent of their hydrogeological separation or, conversely, interconnection, is sometimes uncertain. These aquifer units are:

- Maroota sand;
- eluvial/weathered profile of the underlying Hawkesbury Sandstone; and,
- Hawkesbury Sandstone.

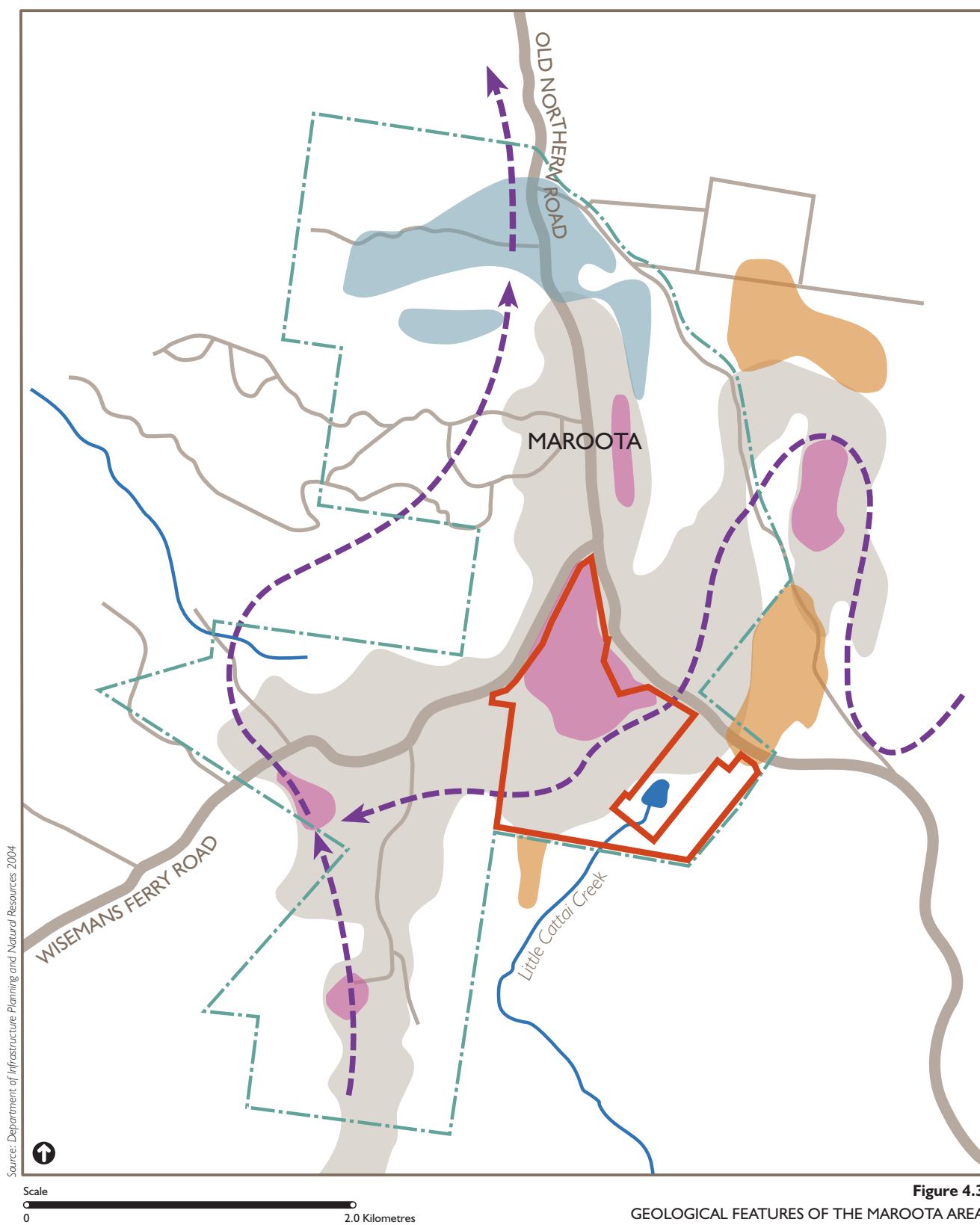









Figure 4.3

GEOLOGICAL FEATURES OF THE MAROOTA AREA

- | | |
|--|--|
|  Hitchcock Road site |  Clay occurrence |
|  Sydney Regional Environmental Plan 9 area boundary |  Ferruginised sand |
|  Paleochannel |  Hawkesbury sandstone |
|  Maroota Sand | |

The more significant of these are the Maroota sand and the deeper Hawkesbury Sandstone.

The schematic relationship between the various aquifer units is shown in the cross-section in **Figure 4.4**.

Maroota sand

The Maroota deposit is a sandy formation of limited extent, which was laid down mainly in two palaeochannels eroded into the exposed surface of the Hawkesbury Sandstone. The presence of the palaeochannels was first identified by Etheridge (1980) and confirmed by subsequent drilling and investigations. One palaeochannel runs south to north from the general area of Haerses Road and generally follows the Old Northern Road. The second palaeochannel follows a spur in the Hawkesbury sandstone east of Old Telegraph Road, then runs in a southwesterly direction north of Roberts Road, then westwards through Lot 167, and south of the former Maroota Trigonometrical Reserve, to join the first palaeochannel near Haerses Road. The path of the palaeochannels is shown in **Figure 4.3**.

Following subsequent processes of erosion and landscape forming, the thickest sequence of the Tertiary Sand is now found within the palaeochannels and it is in these areas that the major sand mining efforts are directed. The palaeochannels contain the more continuous aquifers in this formation, which also display the more consistent water table elevation in the area.

Away from the palaeochannels, the presence of considerable clay and cemented layers, particularly in the centre of the site, gives rise to localised perched water tables. These water bodies are found at variable elevations and depend on rainfall infiltration for their persistence.

The Tertiary Sand, where it occurs below the water table (such as in the deeper section of sands south of Maroota and around the former Trigonometrical Reserve area), constitutes a substantially unconfined, or water table, aquifer open to direct rainfall infiltration. As a consequence, it is subject to seasonal variations in response to rainfall patterns and climatic cycles.

The aquifer derives its permeability (its ability to store and transmit groundwater) from the pore spaces between its constituent sand grains. The permeability of the Tertiary Sand aquifer is variable and limited by its clay content, the degree of cementation of the ferricrete and ferruginous bands and the presence of substantial clay layers. Although the storativity of the Tertiary Sand aquifer is greater than that of the underlying Hawkesbury Sandstone, its total storage capacity is reduced by the formation's limited saturated thickness, particularly north of Maroota, and by its relatively small areal extent.

The natural groundwater flow (underflow) within the Tertiary Sand aquifer is dictated by its position at the top of the Maroota Ridge along Old Northern Road and Wisemans Ferry Road. The underflow, therefore, follows the topographic relief pattern and, where this relief intersects the base of the aquifer, seepages can be expected to occur at the contact with the less permeable underlying material. These seepage points, identified by Etheridge and Formosa at the margins of the sand outcrop, supply water to a number of perennial creeks outside the proposed development area.

Where the water table in the Tertiary Sand aquifer is at a higher elevation than that of the underlying Hawkesbury Sandstone, potential exists for groundwater recharge to the sandstone to occur from this source.

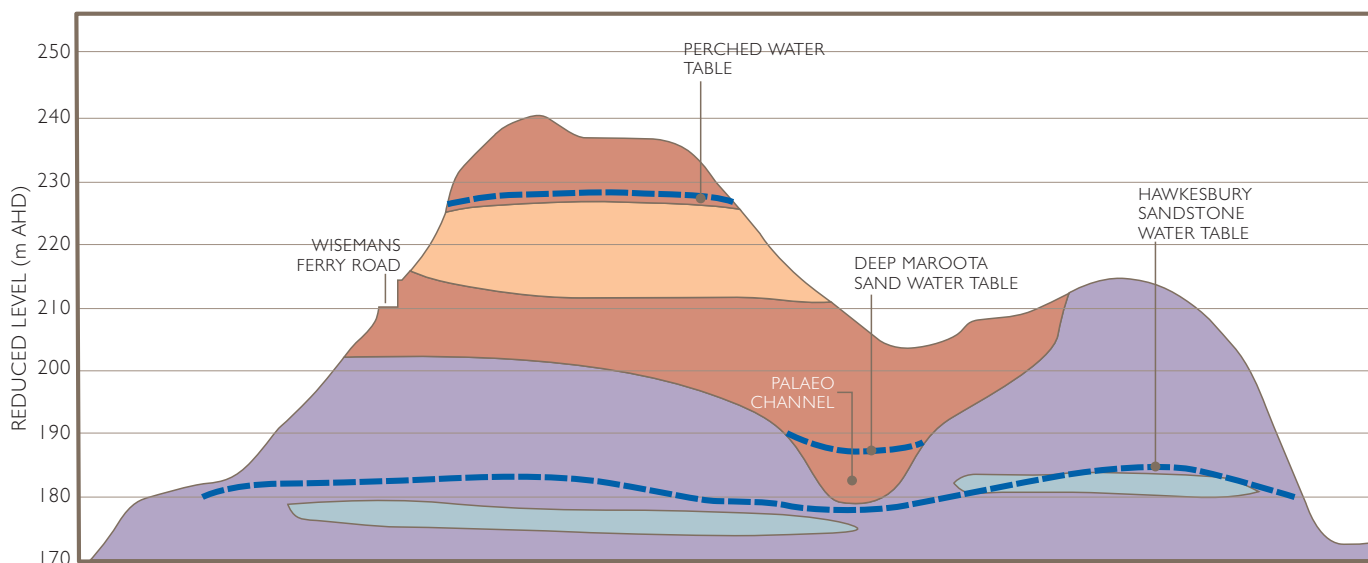


Figure 4.4

**SCHEMATIC HYDROGEOLOGICAL CROSS SECTION
NORTH WEST TO SOUTH EAST**

- Maroota Sand (Sand, silt and gravel)
- Maroota Sand (Clay)
- Hawkesbury Sandstone (Shale lenses)
- Hawkesbury Sandstone (sandstone)

Exaggerated vertical scale (10 times)

The extraction of groundwater from the Tertiary Sand aquifer requires large diameter excavations and dams, due to the relatively low permeability and storage capacity of the aquifer, even in the deeper sections of the buried palaeochannels. Irrigation supplies to orchards and market gardens in the area are drawn in this manner.

In addition to the regional water table within the Tertiary Sand aquifer, perched water tables occur above the extensive clay layers and ferricrete bands present within the formation.

The perched water table aquifers have limited value from a resource viewpoint due to their small extent and storage, but they may be significant in the maintenance of vegetation capable of tapping this source. However, where sand mining takes place, the vegetation is removed and the local aquifer excavated, so that the vegetation-perched water table interdependence is no longer an issue.

Estimates of hydraulic conductivity for the Tertiary Sand aquifer, calculated from contributions of several authors, have been summarised in Table 23 of the *Maroota Groundwater Study Technical Status Report*, where a value of four metres per day has been recommended. Storativity is estimated to be in the order of 0.20.

Eluvial sand/weathered sandstone profile

Small aquifer zones have developed in the eluvial sand, which comprises the leached and weathered profile of the Hawkesbury Sandstone. These zones often form perched aquifer systems above the deeper regional water level of the Hawkesbury Sandstone.

In the majority of cases, these perched aquifer systems have limited resource value because, like the Tertiary Sand, they are small in extent and storage capacity. They act as temporary storage of groundwater prior to release to streams or leakage to underlying aquifers. Dams and large diameter wells constructed into this material can provide a source of farm water supplies, but generally, permeability is too low to yield significant supplies to small diameter boreholes.

Hawkesbury Sandstone

The Hawkesbury Sandstone is generally an impermeable rock, due to the large degree of grain cementation resulting from the development of secondary minerals in the inter pore spaces, such as kaolinitic clay and iron oxides. The presence of these minerals in the groundwater gives the characteristic red-brown staining of the rock visible in road cuttings and building stone. Although the rock has negligible primary permeability, fracturing and jointing, where open and interconnected, provide secondary permeability and storativity.

A review of the bore records in the Maroota area held by the Department of Natural Resources returned a total of 50 recorded sites. However, records were available for only 32 bores. The majority of these relate to bores completed in the Hawkesbury Sandstone (70%).

The records show that different water tables are intersected during drilling into the Hawkesbury Sandstone, due to the different degree of fracturing and the presence of confining layers (such as the shale lenses) within the rock mass. However, because most bores in the Hawkesbury Sandstone are completed open hole, an equilibrium water table is eventually established with time, often coinciding with the deeper water table intersection, through drainage from the upper strata.

Most of the bores in the area are located at high elevations along the Maroota Ridge, which represents both a surface divide and a groundwater divide. The low density and distribution of the groundwater monitoring points on either sides of a surface and

groundwater divide makes the production of a reliable water table contour map difficult. Groundwater gradients measured in recent investigations in closely spaced bores are variable and steep in places due to the low permeability of the rock mass. Groundwater flow directions are expected to be generally to the northwest, east and south, away from the main axis of the groundwater divides, which coincide with the main surface divides.

Estimates of hydraulic conductivity for the Hawkesbury Sandstone, calculated from contributions of several authors, are summarised in Table 24 of the *Maroota Groundwater Study-Technical Status Report*, where a value of 0.1 metres per day has been recommended. Storativity is estimated to be in the order of 0.0045, due to the secondary permeability characteristics of the aquifer.

4.5.2 Groundwater levels

Maroota sand

Measurement of the water table in Lot 167 DP752039 started, using manual methods, in March 1996, the longest regular groundwater level records in the Maroota area. Since January 1999 the bores have been equipped with data loggers.

The determination of the position of the water table in the Maroota Sand and in the Hawkesbury Sandstone has been the focus of the groundwater studies conducted in the area by the former Department of Infrastructure, Planning and Natural Resources (now the Department of Natural Resources) and by consultants. A generally agreed position of the water table in the shallow aquifer under the former Trigonometrical Reserve would be the basis for the final level to which mining would be allowed in future. The former Department of Land and Water Conservation recommended and adopted as its policy in Stage 1 of the Maroota Groundwater study that:

the base of the excavations made for the purpose of sand mining should be maintained at least two metres above the seasonally highest elevation of the shallow water table.

No means of recognising the seasonally highest elevation of the shallow water table was proposed.

Development Control Plan 16 - Extractive Industries originally adopted by Baulkham Hills Shire Council in December 1996 states that:

extraction should not occur within two metres of the wet weather high groundwater level or otherwise to the requirements of the Department of Land and Water Conservation

Again, no method of determining the location of the wet weather high water table was provided.

Water is pumped under licence from an excavation (referred to as a dam) in Lot 167 DP75239. The licence allows an annual extraction volume of 50 megalitres.

Water levels in the dam, which was originally excavated to the base of the Tertiary Sand within the deep palaeochannel, have averaged 180.94 metres AHD over the period from September 1996 to June 2006. This average value is marginally higher than that for the 2005/2006 period (180.75 metres AHD), reflecting the lower water use from this source due to improvements in water management at the process plant.

The rainfall recorded at the PF Formation offices for the year to the end of June 2007 was 732 millimetres, which is below the yearly average of 884.8 millimetres. However, 52 percent (384.5 mm) of the annual total fell during the month of June, indicating the severity of the preceding dry period.

Although water is pumped from the dam for a variety of purposes, such as dust suppression and irrigation of rehabilitated areas and, more recently, for the preparation of sand slurry, records show that water levels return rapidly to the average values indicated above, even after higher levels are experienced following heavy rainfall and consequent run-off. These suggest that the Maroota Sand aquifer at the site is capable of sustaining the licensed pumping rate even under low recharge conditions and the additional demand placed on it in the wider Maroota area by the many groundwater users.

Table 4.4 shows the currently available water table records for the shallow aquifer within and close to the site. The location of licensed bores in the Maroota area is shown in **Figure 4.5**.

Table 4.4 Tertiary Sand water table records

Bore	Location	Surface (mAHD)	Static water level elevation (mAHD)			
			Lowest	Average	Highest	Range
PF167MW1	Lot 167 DP75239	187.64	177.7	181.7	182.8	5.1
PF166MW1	Lot 2 DP570966	209.94	199.3	200.4	201.0	1.7
75000/1 ⁽¹⁾	Lot 81	194.59	178.5	179.6	180.5	2.0
75002/1 ⁽¹⁾	Lot 1 DP531835	187.59	179.5	180.6	181.7	2.2
75002/2 ⁽¹⁾	Lot 1 DP531835	187.78	178.8	180.1	181.2	2.4
PF167DAM	Lot 167	-	-	180.9	-	-

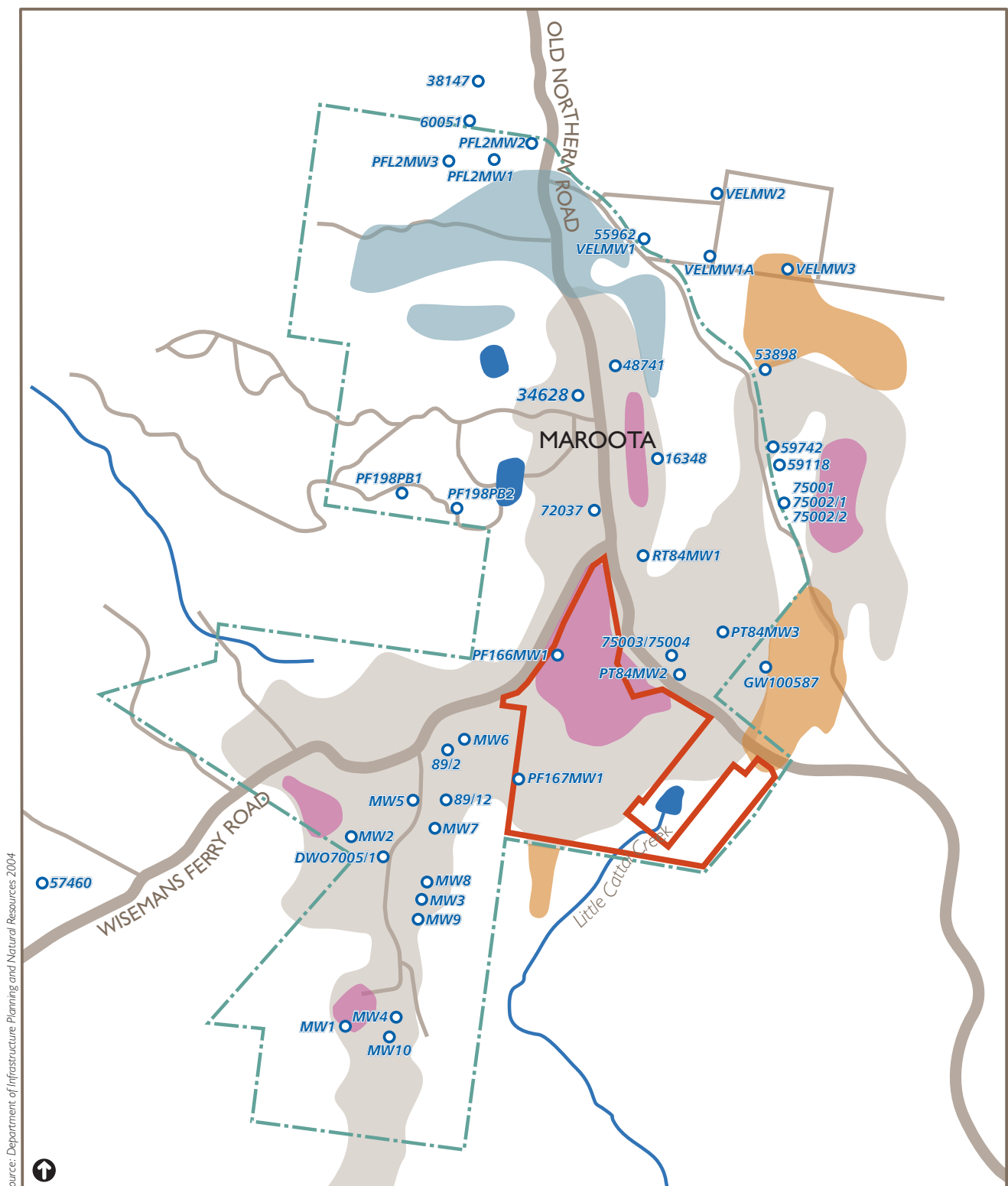
Source 1: Department of Land and Water Conservation 2001.

Table 4.4 shows a reasonable degree of consistency in water table elevation values, with the exception of Bore PF 166MW1 in Lot 2 DP570966, which appears to tap a perched water table at the edge of the Tertiary Sand outcrop. The other bores have water levels below the currently proposed depth of mining (183 metres AHD). Bore PF167MW1 is located along Hitchcock Road at the western boundary of the property. Although the highest recorded water level in this bore is 182.8 metres AHD (average since 1996 is 181.7 metresAHD), mining operations would be outside the required offset at this boundary and would remain at least two metres above the water table in this area.

Hawkesbury sandstone

Long term water level records are those for three monitoring bores installed by PF Formation in March and September 1996 in Lot 2 DP535538, approximately 2.5 kilometres north of the Hitchcock Road site. These data were made available to the former Department of Land and Water Conservation for inclusion in the *Maroota Groundwater Study Stage 2 Report*. Following cessation of mining in Lot 2 in June 2002, the data loggers for those bores were handed over to the Department of Natural Resources for continued monitoring.

The hydrographs show an apparent correspondence between the rainfall, electrical conductivity and water levels, with a possible two week delay in water level response to rainfall events. The water level plots are generally smooth, indicating that only a small proportion of the rainfall reaches the aquifer as recharge, with the remainder used by the vegetation or as run-off.



Source: Department of Infrastructure Planning and Natural Resources 2004

Figure 4.5
LICENSED BORES

Scale
0 2.0 Kilometres

- Hitchcock Road site
- Sydney Regional Environmental Plan 9 area boundary
- Maroota Sand
- Clay occurrence
- Ferruginised sand
- Hawkesbury sandstone
- 57460 Licensed Bore

The water level fluctuations are of slightly different magnitude in the three bores but the pattern of rise and fall response of the water table to rainfall is identical.

The available data indicate that the water table in the Maroota Sand aquifer is variable. In accordance with the conclusions (Item 5) of the *Maroota Groundwater Study Technical Status Report*, the definition of the wet weather high groundwater levels needs to be carried out on a site specific basis, due to the influence of land surface topography, sediment characteristics, position relative to the centre of the palaeochannel and basement elevation.

The water level in the Tertiary Sand aquifer in Lot 167 DP752039 can be better expressed by the average water level in the PF167 dam, which is considered to be a window into the water table. This dam receives direct rainfall and run-off and extraction from it depends on general weather conditions. For this reason, an average value is considered appropriate as a water table under the site. This average value over the period of available records is 180.9 metres AHD. It is considered that this value represents the level of the water table beneath the site and the depth of mining to 183 metres AHD would remain within the limits of the required buffer depth. This would maintain a buffer of two metres above the wet weather high groundwater level in compliance with the requirements of the Maroota Groundwater Study and Baulkham Hills Development Control Plan 16.

4.5.3 Water quality

Water quality in the proposed development site is monitored at two bores, PF167MW1 and PF166MW1, tapping aquifers within the Tertiary Sand. Electrical conductivity measurements in PF167MW1 started in March 1996, the longest regular groundwater quality records in the Maroota area, and in April 1998 in PF 166MW1.

Water quality has been monitored by quarterly collection of water samples submitted for chemical analysis since June 1999. The list of analytes comprises:

- pH, Electrical Conductivity and Total Dissolved Solids;
- Calcium, Magnesium, Sodium and Potassium;
- Chloride, Sulphate and Bicarbonate; and
- Oil and Grease.

Samples have been collected biannually since June 2000 to coincide with the downloading of the data loggers. Results of the chemical testing are reported annually in the environmental management plan.

Maroota Sand

The quality of the groundwater in the Tertiary Sand aquifer in the area within and around the proposed development is dependent on direct rainwater infiltration and the chemical processes and exchanges occurring with the minerals contained in the formation. This process is reflected in the generally low salinity of the groundwater.

The electrical conductivity data from Bore PF167MW1 in Lot 167 DP752039 from March 1996 to December 1998 ranged from 260 to 750 microsiemens per centimetre, corresponding to a salinity of between 156 and 450 milligrams per litre. The data indicate that the rainfall over this same period has been below normal and the recharge to the aquifer has, therefore, also been below normal as shown by the steady drop in water

level. However, in spite of the reduced recharge and contrary to normal expectations, the water salinity has not shown any deterioration over the period.

Electrical conductivity in bore PF167MW1 has averaged 195 microsiemens per centimetre (122 mg/L) since June 1999 when laboratory measurements started.

A second monitoring bore, PF166MW1, was installed in March 1998 adjacent to and west of the former Trigonometrical Reserve site and a regular program of monitoring commenced. Between March and December 1998, the electrical conductivity measurements averaged 293 microsiemens per centimetre, corresponding to a salinity of 176 milligrams per litre. Since June 1999, measurements in this bore have averaged 222 microsiemens per centimetre (195 mg/L).

The waters in the two monitoring bores are similar and have a characteristic meteoric composition, with low pH, low TDS and a Sodium-Chloride type. The samples were also analysed for oil and grease to monitor the possible effect of the sand extraction operations. Oil and grease in the groundwater was detected at LOR levels in bore PF166 in January 2003 (6 mg/L) and June 2004 (5 mg/L). As no oil and grease was detected on all other sampling occasions or in any of the other bores, it is considered that such occurrences do not represent a cause of concern. Bore PF166 is shallow and taps a perched aquifer distant and above the general level of excavation, so that the potential presence of oil and grease cannot be related to the quarrying operations. The presence in shallow groundwater of oil and grease could also be due to natural conditions.

Current consent conditions allow sand extraction to proceed down to a level of 187 metres AHD. During mining operations, the potential for rainfall to infiltrate into the undisturbed Tertiary Sand aquifer below this level will generally improve. The improvement will be the result of the removal of the effects of water consumption by cover vegetation (evapotranspiration) within the cleared areas, reduced run-off and increased infiltration, the reduction of the length of the infiltration path and the reduction of associated chemical reactions within the minerals matrix of the sand aquifer. The quality of the groundwater, therefore, may in the future reflect these more rapid processes by lower values of salinity.

Hawkesbury Sandstone

The quality of the groundwater in the Hawkesbury Sandstone aquifer is also dependent on the direct infiltration of rainfall in the areas outside the Maroota Sand outcrop. Where the Hawkesbury Sandstone is overlain by the Tertiary Sand, infiltration is expected to occur via the sand formation. Water quality in the Hawkesbury Sandstone is generally variable, but in the Maroota area is commonly suitable for most agricultural and domestic applications.

Hawkesbury Sandstone water quality data from Department of Natural Resources registered bores are scarce and, where available, are related to bores located at some distance from the proposed development area and in different catchments. The *Maroota Groundwater Study Technical Status Report* (Department of Land and Water Conservation 2001) provides data from bores completed in the Hawkesbury Sandstone, showing electrical conductivity values ranging from 35 to 300 microsiemens per centimetre, (approximately 21 to 180 mg/L), with a mean value of 161 microsiemens per centimetre (97 mg/L).

Salinity of the bores in Lot 2 DP595538 located some two kilometres north of the site of the proposal ranged from 80 to 560 microsiemens per centimetre, corresponding to 48 and 236 milligrams per litre respectively.

Salinity measurements are also taken from samples collected from the production bores in Lot 198 DP588936, installed in 1999 at the central process plant, approximately one kilometre north west of the Hitchcock Road site. Salinity here has ranged from 97 to 174 milligrams per litre and from 85 to 126 milligrams per litre in the two bores located here.

Although somewhat variable due to the heterogeneous character of the rock mass, and occasionally of lower salinity than the overlying Tertiary Sand, the water quality in the Hawkesbury Sandstone in the Maroota area indicates a groundwater regime of ready rainfall infiltration, recharge and of dynamic underflow.

4.5.4 The Maroota Groundwater Study

The Maroota Groundwater Study was initiated by the former Department of Land and Water Conservation with the aim of developing a Groundwater Management Plan for the Maroota area. This was structured in four stages:

- Stage 1:** definition of the study area and the development of geological and hydrogeological concept models with the objective of proposing sites for the installation of groundwater monitoring bores. This stage was completed and reported on by Hopkins and Ross (1996);
- Stage 2:** installation of a network of groundwater monitoring bores at locations selected to achieve the objectives outlined in the first stage. This stage was completed and reported on by Salotti et al (1998);
- Stage 3:** monitoring of groundwater level fluctuations over a period sufficient to include both seasonal and annual variations. This stage has been implemented and is continuing with monitoring likely to continue indefinitely; and
- Stage 4:** development of a groundwater management plan for the Maroota area. Following the introduction of the Water Management Act in 2000, the outcome of this stage has instead been focused on the development of a Water Sharing Plan.

The Department of Land and Water Conservation produced a *Technical Status Report* on the *Maroota Groundwater Study* in 2001. This is described as falling between Stages 3 and 4, providing information on the ongoing monitoring but failing to set out the management rules by which the Water Sharing Plan would be developed. This is the most recent published output of the study.

The Stage 1 investigation attributed the observed fluctuations in groundwater levels to groundwater abstraction, changes in climatic pattern, excavations below the water table and changes in land use. The study was hampered by a lack of information, particularly in the monitoring of groundwater levels and abstraction volumes. A survey of groundwater users in the Maroota area was therefore undertaken with the aim of defining demand on resources and the potential for adverse effects. The authors of the report concluded that the survey results indicated that irrigation practices consumed the bulk of the groundwater resource and that sand extraction operations required comparatively little supply. This was considered to be partly offset by the return of a small proportion of irrigation water to the shallow groundwater system via infiltration while process water would be recycled within the sand washing system and be effectively lost to the aquifer.

The following conclusions, among others, were contained in the Stage 1 report:

- In order to protect the integrity of the Maroota Sand aquifer, sand mining would not be allowed to proceed below the water table and a two metre buffer zone must be kept above it;
- The largest use of groundwater in the area was for irrigation, with extraction occurring from large excavations below the water table and to the top of the Hawkesbury Sandstone; and
- The majority of irrigation dams were not licensed under the Water Act 1912. An amnesty was declared to allow the issue of licenses for irrigation purposes.

Stage 2 described the field program of monitoring bore installation and Stage 3 the establishment of a network of automatic water level recording devices and the progressive retrieval of the recorded data for hydrogeological analysis.

The results of the final stage of the study have not, so far, been made available.

4.5.5 The groundwater monitoring network

In addition to the data records derived from the bores located on sites operated by PF Formation at Maroota, the assessment of the groundwater balance for the Hitchcock Road development has access to data from long term records of other sand miners in the area. No data are available on water use by farmers in the area. The data available from the monitoring bores are that provided to the Department of Natural Resources for use in the Groundwater Status Report and reported annually by the operators to Baulkham Hills Shire Council and Hornsby Shire Council in response to consent conditions.

The available groundwater monitoring network operated by PF Formation, HB Maroota and Maroota Mining consists of 15 bores. Records from this network have been used to develop a water balance assessment. Data is included from bores in mined areas that have been discontinued and rehabilitated. These include three bores which have been handed over to the Department of Natural Resources for continued monitoring, one which has been replaced following mining changes and one which was dry. In addition, two production bores in Lot 198, the site of the PF Formation wash plant have been included as they are monitored for water quality and extraction volumes. The location of the bores is shown in **Figure 4.5**.

Other monitoring bores have been installed and are monitored by the Department of Natural Resources (75000 series) and Dixon Sands, but these records are not available to this assessment.

4.5.6 Water table behaviour

The water levels in the monitoring bores have been continuously monitored using automatic data loggers since 1999 and prior to that, water level measurements were undertaken manually in some of the bores. A ten year record of groundwater levels is therefore available. Hydrographs for all bores together with all relevant rainfall data recorded at the PF Formation office site on Lot 198 are available.

The following is a summary of the behaviour of the water table at a selection of the bore locations. Details of the data records and hydrographs are included in Technical Paper 2 in Volume Two.

PF Formation-PF167Dam

The water supply excavation on the Hitchcock Road site was established prior to 1995. Water levels have been measured weekly since September 1996 and over this period these have ranged between 180.5 and 183 metres AHD. The dam receives direct rainfall and site runoff so that annual extraction is only in part derived from the Maroota Sand aquifer. The fluctuations in water level visible in the hydrograph are a combination of factors and indicate that the extraction rates (up to 50 ML per year) are in balance with the needs of the aquifer as no long term decline in the water level is discernible.

PF Formation-PFL2MW1

This bore monitored the water table in the Hawkesbury Sandstone in Lot 2 DP595538. Monitoring ceased in June 2002. The level of the water table ranged between 178.8 metres AHD in May 1998 and 180.5 metres AHD in January 2000, averaging 180 metres AHD. The water table responds rapidly to rainfall recharge illustrated by the rise in level following a period of sustained rainfall. No pumping was undertaken at this site.

PF Formation-PF166MW1

This bore was drilled to monitor a perched water table in the Maroota Sand. It is at some distance from the excavation on the Hitchcock Road site and is not affected by these activities. The water table at this site responds readily to a period of sustained rainfall and recharge and declines during periods of low rainfall indicating a clear relationship with long term climatic conditions,

HB Maroota-PT84MW3

This bore was drilled to monitor the Maroota Sand aquifer in the vicinity of the central excavation on the site. This was licensed to extract below the water table and mining has been undertaken by dredger, the only example in the Maroota area. Water levels in the central pond were generally around 179 metres AHD while those in the bore at its lowest level of 182 metres AHD maintained a head of about three metres. In common with other monitoring bores in the Maroota area, a fall in the water table has occurred since mid-2002 during the current period of below-average rainfall. Prior to that, the water table fluctuated between 182 and 184 metres AHD.

The consistent response of the water table in different locations in Maroota to groundwater extraction and recharge and the lack of an overall long term decline in levels suggest that the present extent of extraction from the Maroota Sand and Hawkesbury Sandstone in the area are in a hydrogeological balance. The sand mining operators continue the monitoring of groundwater levels and quality through the extensive network of monitoring bores and, except in the single example noted above, maintain a buffer above the water table.

4.5.7 Potential impacts on groundwater

General

A development of the type proposed for the Hitchcock Road site, where the existing landscape is subjected to substantial modification, could be expected to have some impacts on its surrounding environment. Possible impacts which may require consideration are:

- reduced groundwater availability to users;
- reduced flow to streams;

- increased turbidity in streams; and
- lowering of the water table.

Each of these are discussed in the following section.

Reduced groundwater availability to users

There is unlikely to be any change from the current conditions resulting from additional extraction at the site, as no additional groundwater demand above the current licence would be necessary. The volume of water pumped from the licensed extraction point on Lot 167 DP752039 and the production bores on Lot 198 DP752025 has decreased following improvements to the wash plant and is now consistently below the volume licensed for use.

No mitigation measures against a reduction in groundwater availability would be required because mining would not be carried out below the water table, the aquifer would not be disturbed and no groundwater would be extracted for mining purposes from the shallow aquifer apart from that already licensed by the Department of Natural Resources on Lot 167 DP752039. Because no additional groundwater pumping would occur, no additional effects above the present conditions can be expected. On the contrary, the increased potential for groundwater recharge to the deep aquifer means that a potential benefit may be derived for nearby users.

Equally, users exploiting the deep aquifer of the Hawkesbury Sandstone would not be affected by the proposed development as no pumping occurs at the site from this aquifer.

Reduced flow to streams

Perched water tables in the Tertiary Sand and the weathered profile of the Hawkesbury Sandstone are capable of providing contributions to stream flows where these streams have been eroded to the level of the bedrock. This is particularly the case along the perimeter of the Tertiary Sand outcrop. Seepage zones have been identified (Etheridge and Formosa) at some distance from the site, and drainage or removal of perched groundwater bodies could cause a reduction of stream flow. However, it is not known what percentage of stream flow is due to natural drainage of perched water tables, to bank storage and to catchment run-off.

The increased volume of recharge to the shallow aquifer, which would occur as excavation progresses, is likely to create a mound in the water table under and around the site. This mound would dissipate within the rock mass at a rate dictated by the permeability of the formation and the new hydraulic gradients. It is possible that the water table would rise in places above the thalweg of drainage lines in the Sandstone and discharge groundwater to these streams. Thus, this discharge would contribute to the maintenance of stream flow and offset some, if not all, the losses from the perched water tables in the Tertiary Sand.

No mitigation measures would be required for the maintenance of stream flow. The regional shallow water table, which is probably the main contributor to stream flow after run-off, would be unaffected by the extraction operations.

Increased turbidity in streams

The proposed development is located at the head of three catchment areas. Release of turbid water from site, should it occur, could have a possible impact on the water courses downstream of the area. Turbid water release can occur from overbank flow of site storages and tailings dams, from surface run-off from surfaces not effectively bunded

and/or from poorly rehabilitated areas. In addition, turbid water releases may occur from accidental occurrences, such as abnormal storm events.

However, the mined area will be internally draining and management of the surface water resources is an essential component of the water supply to the project. In these conditions, it is highly unlikely that any release of turbid water to streams would occur.

Mitigation measures to prevent and offset the effects of occurrences with the potential to increase stream turbidity are contained in the Water Management Strategy and would be reported in the annual Water Management Plan.

Lowering the water table

No lowering of the water table in the Tertiary Sand aquifer is possible due to the maintenance of a two metre buffer depth as required by *Development Control Plan 16 - Extractive Industry*.

None of these effects have occurred during the current operations at the site and are not expected to occur in future as a result of the proposal.

Beneficial effects

The impacts described above are, potentially, of an adverse nature. However, some beneficial effects are also likely to be derived from the operation. These include more direct (increased) groundwater recharge to the shallow and deep aquifers from the site storages and rainfall via the exposed surfaces, and maintenance of stream flow by release of excess stored waters. Aquifer recharge from beneath the site would also be stimulated by the removal of clay lenses present within the Tertiary Sand over the site.

These beneficial effects respond to the principles of an ecologically sustainable groundwater development, whereby current groundwater resources would be maintained to existing users and future generations would not be affected by the present activities.

The environmental impact of the proposed development on the groundwater in the known aquifers in the area is likely to be negligible after the recommended mitigation and monitoring procedures have been implemented.

The change in the landform and the removal of soil material above the shallow and deep aquifers is likely to result, on balance, in beneficial long term effects to those aquifers, represented by increased recharge rates. The water table along the edge of the shallow aquifer would intersect the natural surface in places and issue as spring flow along the deeply incised gullies and streams. This flow would contribute to the maintenance of stream flow in areas which might have been affected by the removal of perched water tables within the extracted Tertiary Sand aquifer.

Surface water quality should be maintained by the prevention of releases of turbid water to the natural drainage system. This would be achieved by the implementation of appropriate design and management measures and procedures. Excess water could be released, if necessary, in a controlled manner during periods of high flows.

Although the proposed development is likely to have some varying impacts on the present environment, the implementation of proper design and management measures and procedures would reduce any effects to a manageable level, within the constraints that would be applied in the development consent.

4.5.8 Contingency plans

One of the requirements of the Director-General of the Department of Planning for the environmental assessment (see **Appendix B**) requires the consideration of:

a surface and groundwater contingency strategy setting out the measures that would be implemented in some circumstances to protect the water supply of surrounding landowners and the environment.

The data presented in **Technical Paper 2** and summarised above indicate that current groundwater extraction for mining at the Hitchcock Road site (and at other sand extraction locations) is at present in balance with the hydrogeological regime of the area. Therefore, should there be little variation from present activities, it is unlikely that further drawdown would occur.

Contingency plans would only be required in the event that water table levels fall to such an extent that sand mining and other water-reliant activities are seriously affected. In such an eventuality, contingency plans would, by necessity, require the reduction, or complete cessation of sand production. This would have very significant impacts on the economy of the area and the region.

According to the *Groundwater Technical Status Report* (Department of Land and Water Conservation 2001), the largest user of groundwater from the Maroota Sand aquifer in the region is agriculture. Use of groundwater for this activity is not directly controlled and the volume of groundwater extracted for this purpose can only be estimated. The use of groundwater for sand mining is controlled: the volume extracted from licensed bores is reported annually and the depth of sand extraction is limited relative to the depth of the water table. Water efficient procedures introduced by the sand miners have resulted in a decreased use of water in spite of an increased rate of sand production fuelled by the recent construction boom. During persistent drought periods, it is likely that an increased demand for groundwater may arise for agricultural usage in the Maroota area. This usage is not monitored or managed by the regulatory authorities.

Contingency plans, should they be required, cannot be limited to the sand miners, whose records show that they are careful managers of the groundwater resources and that their activities are in balance with the hydrogeological regime. In the event of a serious decline of the water table which could derive from a combination of extended drought and increased extraction, contingency measures could only be effectively developed and implemented within the overall context of agricultural and sand mining usage in the area based on an evaluation by the managers of the Water Management Act using accurate records of all users.

An effective set of contingency measures (strategy) cannot be created for one mining operation in isolation from all other activities in the area including those which consume the highest proportion of the groundwater resource. It is more appropriate that the Department of Natural Resources should take the initiative by setting the framework for an area contingency strategy to be implemented in the event of a decline in the water table of such an extent that economic activities in the area are endangered. Contributions to such a strategy would be provided by the sand miners monitoring network and from that managed by the Department itself.

4.6 Soils

4.6.1 Soil landscapes

Several soil landscapes occur in the area but the Maroota Soil Landscape dominates the area (Hunt 1992). The following summary is based on a detailed soil survey carried out in 1996 (Morse McVey & Associates).

The soil profiles examined generally comprise 200 to 300 millimetres of topsoil (dark brown, loamy sand - sandy loam) overlying more than 500 millimetres of subsoil (earthy, yellowish brown, sandy clay loam-medium clay). Such soils are commonly classified as Yellow Earths. The boundaries between the soil materials are obvious but gradual. Some shallow soils lack a well developed profile and would be classified as earthy sands. These are limited to upper ridge lines and crests where they are associated with minor rock outcrops.

Topsoils are all coarse in texture, Type C as defined by the Department of Housing (1993). However some subsoils have field textures indicating clay content greater than 35 percent which would normally place them in Type F. These occur in isolated pockets and might sometimes contain 10 to 13 percent total dispersed clay. Sediments having more than 10 percent dispersed fines are expected to be of only limited distribution south of the former Maroota Trigonometrical Reserve.

The physical attributes assigned to these materials by Murphy (1992) indicate that there is little potential for exposure of materials with more than 10 percent total dispersed clay, although sampling has not confirmed the presence of this material on site.

4.6.2 Erosion risk

The erodibility of soil due to sheet flow is measured by the K-factor. It is a measure of the susceptibility of soil particles to detachment and transport by rainfall and runoff. In NSW, it normally ranges from 0.005 (very low erodibility) to 0.07 (very high erodibility). At the study site, very low to moderate erodibility ratings ranging from around 0.004 to 0.026 (median is low 0.012) for overland flows have been confirmed by laboratory testing. Wherever their texture has a high sand/silt component, topsoils are susceptible to erosion by concentrated flows. Prompt reshaping, surface stabilisation and runoff control is essential. This would be undertaken as a priority on all surfaces draining away from the enclosed operational area such as on the outer batters of bund walls).

The predominance of fine sand and silt in these soils makes their erodibility by wind, a significant risk wherever they are allowed to become dry and pulverised by traffic.

The erosion hazard posed by sheet flow at the site is generally low, with calculated soils losses ranging between 25 and 380 tonnes/hectare/year, depending on slope and erodibility. Erosion hazard as high as 380 tonnes/hectare/year only arises in very steep slope situations (>30%) and on exposed batters. This places most of the lands into the low to moderate erosion hazard classes as defined by the Department of Housing (1993). Revegetation would be undertaken in accordance with these Soil Loss Classes and guidelines issued by the Department of Environment and Conservation. These are generally to establish temporary vegetation on disturbed areas remaining non-operational for more than 40 days.

Permanent revegetation would be established within 20 to 30 days on all externally draining areas where final post mining contours have been reached or the surface will remain unaffected by operations for more than 12 months.

Wind erosion from roadways will be controlled by watering or binder applications. Other bare areas can be left in generally cloddy state, watered, treated with binder, mulched or protected with wind fencing constructed normal to strong prevailing winds.

4.6.3 Mitigation measures

Constraints relating to erosion and sediment control during operation and rehabilitation following sand extraction would be expected to include:

- seasonal waterlogging and lowered wet strength;
- acidity in most profiles;
- sodicity in all layers;
- low fertility;
- potential aluminium toxicity in layers with pH less than 4.5;
- low permeability in layers with greater than 30 percent clay and silt;
- moderate erosion hazard on slopes above 30 percent;
- poor moisture holding in topsoils;
- rill and gully erosion under concentrated flows; and
- erosion of steep slopes and batters.

These limitations can be managed using the following methods:

- reshaping the ground profile as soon as possible to grades of one vertical to three or four horizontal;
- liming of all soils to be used in rehabilitation;
- reuse of stockpiled topsoil as soon as possible; and
- re-establishment of temporary vegetation on long term stockpiles.

4.7 Surface water

The area of the site available for extraction can be divided into three sub-catchment areas for the purposes of surface water management. The first (northern catchment) is approximately 16 hectares in size and incorporates the area to the north of the former Trigonometrical Reserve. The second (southern catchment) is approximately 52 hectares in area and is located to the south of the former reserve. The third (eastern catchment) is approximately 29 hectares in extent located on the eastern side of the site. This area includes Lot 2 DP555184 which is not included in the proposal and is subject to a separate application for sand extraction and related activities to Baulkham Hills Shire Council.

The northern catchment is bounded by Wisemans Ferry Road and Old Northern Road with a natural drainage line to the north west. The southern and eastern catchments are a part of the upper headwaters of the Little Cattai Creek catchment area. This catchment is estimated to be 10,000 hectares in extent, with the southern and eastern catchments on the site contributing less than one percent. Due to the topography of the site and the modifications implemented as part of the current extraction program, the whole area

included in these catchments is internally draining with surface runoff captured in the detention basins used in the process water system. The southern catchment contains three drainage lines to the south of the site. The largest of these is intercepted by a large dam located on Lot 2 DP555184. This catchment drains to the headwaters of Little Cattai Creek via an intermittent creek. It makes up less than 0.3 percent of the total area drained by Little Cattai Creek. Surface water catchments are shown in **Figure 4.6**.

Operation of the site would provide an internal drainage system to ensure that all runoff from it flows to sediment retention basins. This would ensure that sediment is retained on site and water quality is maintained for any discharge waters.

Pond capacities would be sufficient to satisfy the requirement to contain the 100 year ARI storm. It is unlikely that the proposed extraction and stormwater retention would have a measurable effect on catchment discharge to the Hawkesbury River.

4.8 Noise

4.8.1 Introduction

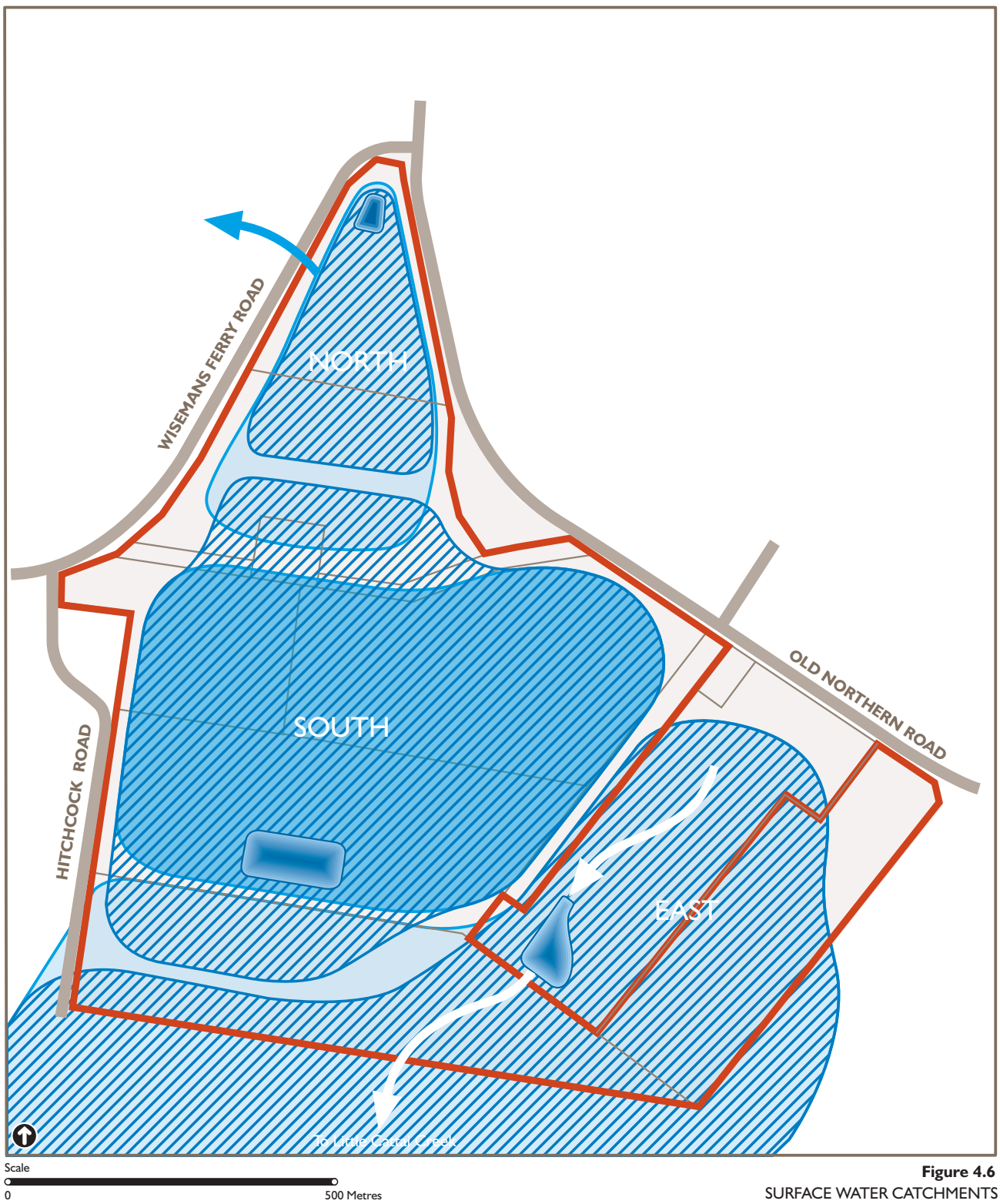
Noise would be generated on those parts of the site where extraction and subsequent rehabilitation is taking place. This would vary depending on the location of these activities at any one time. Noise levels would be similar to those currently generated and would provide the basis for the assessment of future impacts.

The focus for the noise assessment was the nearest non-project related sensitive receptors adjacent to the site. These are mainly located on the north eastern side of Old Northern Road with the exception of two residences on the south western side. All are protected from site generated noise by acoustic mounds and one residence is at a considerable distance from current operations. Two residences are located close to the western side of the site-one at the intersection of Hitchcock Road and Wisemans Ferry Road and one close to the intersection of Old Northern Road and Wisemans Ferry Road. A residence located on Lot 2 DP555184 is considered to be an exception as the site is currently the subject of a development application for sand extraction and is not therefore a sensitive receiver.

The responsibility for the control of noise emissions in NSW is vested in local councils and the Department of Environment and Conservation. The Environment Protection Authority (now part of the Department of Environment and Conservation) released an Industrial Noise Policy in January 2000. This provides a framework and process for deriving noise criteria for consents and licences that regulate premises scheduled under the *Protection of the Environment Operations Act 1997*. The Hitchcock Road site is scheduled under the Act.

Specific policy objectives are to:

- establish noise criteria that would protect the community from excessive intrusive noise and preserve amenity for specific land uses;
- use the criteria as the basis for deriving project specific noise levels;
- promote uniform methods to estimate and measure noise impacts, including a procedure for evaluating meteorological effects;



- Existing catchment
- Catchment on completion
- Retention basin

- outline a range of mitigation measures that could be used to minimise noise impacts;
- provide a formal process to guide the determination of feasible and reasonable noise limits for consents or licences that reconcile noise impacts with the economic, social and environmental considerations of industrial development; and
- carry out functions relating to the prevention, minimisation and control of noise from premises scheduled under the Act.

The Department of Environment and Conservation also relies on *Environmental Criteria for Road Traffic Noise* (Environment Protection Authority 1999) and relevant sections of the *Environmental Noise Control Manual* (Environment Protection Authority 2000).

The amenity assessment is based on noise criteria specific to the affected land use and associated activities. The criteria relate only to industrial noise sources and do not include traffic or community noise. If the measured noise level from an industrial source approaches the criterion value, noise generation from the new activity would need to be managed so that the cumulative effect does not significantly exceed the criterion. A separate amenity criterion is applied to areas affected by high traffic volumes. Relevant amenity criteria relating to industrial noise sources are shown in **Table 4.5**.

Table 4.5 Amenity criteria- noise levels from industrial sources (dBA L_{Aeq})

Type of receiver	Indicative noise amenity area	Time of day ¹	Recommended noise level	
			Acceptable	Maximum
Residence	Rural	Day	50	55
		Evening	45	50
		Night	40	45
School Classroom (Inside)	All	Noisiest 1-hour period when in use	35	40

Note 1: Daytime is 07.00 to 18.00 hours; Evening is 18.00 to 22.00 hours; Night time is 22.00 to 07.00 hours on Monday to Saturday.
 Daytime is 08.00 to 18.00 hours; Evening is 18.00 to 22.00 hours; Night time is 22.00 to 08.00 hours on Sunday and public holidays.

The Industrial Noise Policy also provides non-mandatory guidelines for cumulative noise assessment that address existing and additional industrial development by setting acceptable (and maximum) cumulative L_{Aeq(15 minute)} amenity levels for all industrial (non-transport related) noise in an area. These seek to control cumulative noise by application of amenity criteria rather than setting acceptable cumulative criteria for each noise source in an area.

4.8.2 Existing Noise and Operational Assessment Criteria

Unattended background noise monitoring conducted between 20 July and 29 July 2004 at a number of representative receiver locations in the vicinity of the proposed extraction operations indicated that the Rating Background Levels (L_{A90(15 minute)}) ranged from 30 dBA to 37 dBA during the daytime and was 30 dBA at night. The measured background noise levels are typical of rural areas with natural noise sources and some transport noise contributions from traffic. Operator-attended noise measurements confirm these results.

The operational noise criteria relevant to the proposal are based on an assessment of the Rating Background Levels, intrusiveness criteria based on the proposed hours of operation and amenity criteria applying to an industrial noise source in a rural environment. The resulting criteria are listed in **Table 4.6**. Criteria for locations not measured directly during the monitoring are based on the nearest measured location representative of the locality. Locations of the receivers are shown on **Figure 4.7**.

The amenity criteria are higher than the intrusiveness criteria noise levels. Therefore, compliance with the intrusiveness criteria will generally demonstrate compliance with the amenity criteria.

Table 4.6 Operational noise emission criteria (dBA)¹

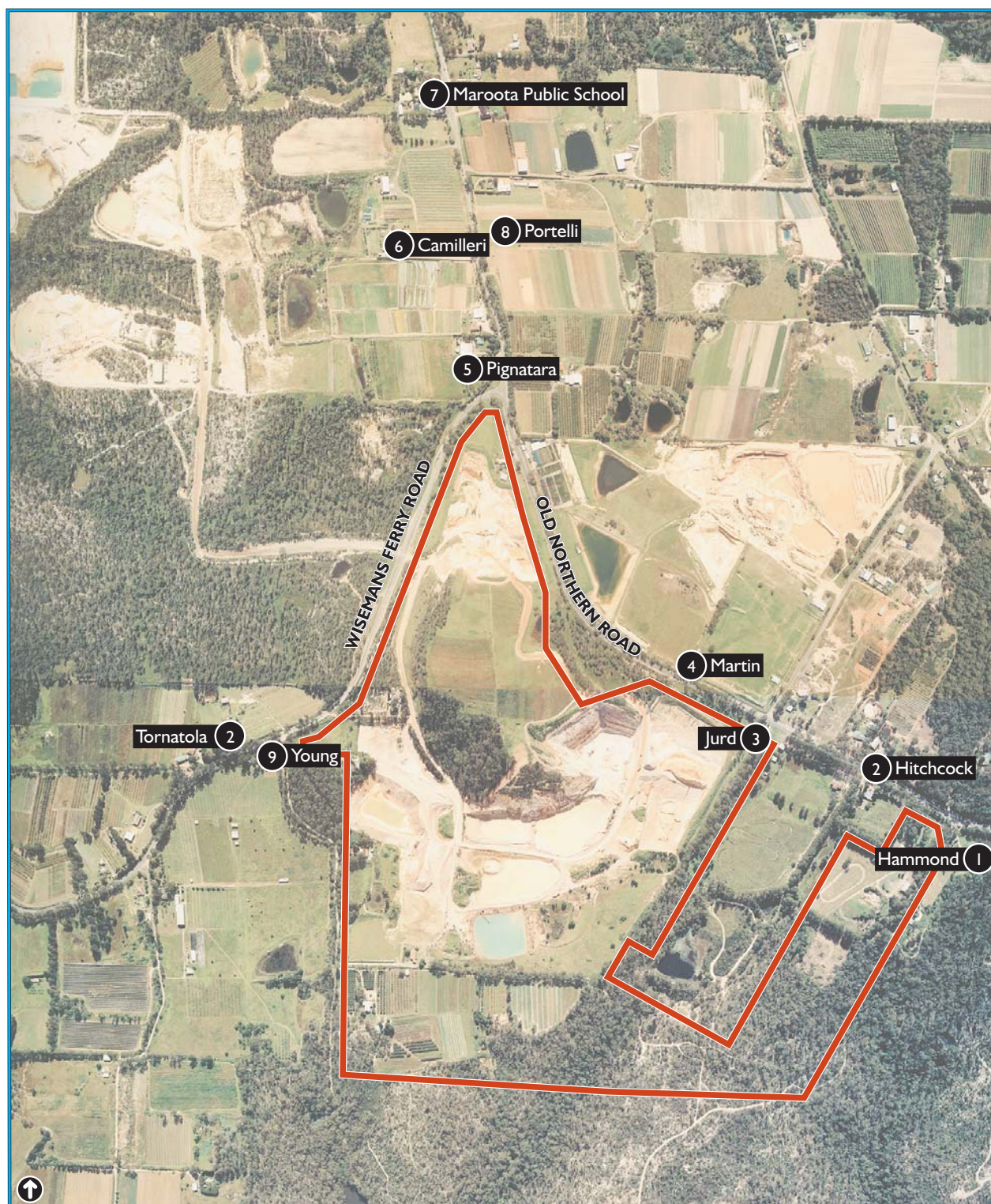
Receiver	Intrusiveness criteria $L_{Aeq}(15 \text{ minutes})$		Amenity criteria $L_{Aeq}(15 \text{ minutes})$	
	Daytime ²	Night time ²	Daytime ²	Night time ²
1	42	35	49	42
2	42	35	49	42
5	42	35	49	42
6	42	35	49	42
7	42	N/A	45	N/A
8	42	35	49	42
9	39	35	52	51
10	39	35	52	51

Note 1: The controlling criteria (PNSL) are shown in bold type.

2: Daytime is from 07.00 hours to 18.00 hours. Night time is from 22.00 hours to 07.00 hours.

Noise generated from transport operations within the site is included in the overall predicted operational noise emissions. However, different noise assessment criteria apply to vehicles when travelling along public roads where they become traffic rather than part of the noise generated by site operations. The relevant criteria are contained in *Environmental Criteria for Road Traffic Noise* (Environment Protection Authority 1999). These relate to land use developments with the potential to create additional traffic on collector roads. The criteria are 60 dBA ($L_{Aeq}(1 \text{ hour})$) (daytime) and 55 dBA ($L_{Aeq}(1 \text{ hour})$) (night time). If the criteria are already exceeded, existing noise levels should be mitigated where feasible and reasonable to meet the criteria. In all cases, traffic arising from the development should not lead to an increase in existing noise levels of more than 2 dBA.

Noise has been monitored at a number of locations around the periphery of the site for some ten years and reported on an annual basis to Baulkham Hills Shire Council as required in the Court Orders (Number 10064 of 1998) which control existing sand extraction operations on the site. Two of the monitoring locations (Numbers 3 and 5 in **Table 4.6**) correspond with the assessment locations shown on **Figure 4.7**. The Annual Audit Report for 2005-2006 (DFA Consultants 2006) concludes that extraction works were inaudible over the year at Location 5 while a marginal exceedance (2dBA) was recorded during one month at Location 3 which is closer to active site operations. There were no recorded complaints from the local community about noise over the monitoring period. Recent noise monitoring undertaken for the 2006-2007 audit report (not yet published) indicates that there were no exceedances of the relevant criteria over that period.



Scale
 0 500 Metres

— Hitchcock Road site boundary

9 Monitoring locations

Figure 4.7

NOISE MONITORING AND ASSESSMENT LOCATIONS

4.8.3 Assessment of operational impacts

The acoustic impact of the proposed operations at Hitchcock Road was determined using a computer model developed to incorporate all significant noise sources, the terrain between the sources and the closest potentially affected residential properties and those meteorological factors which influence noise propagation. These include wind speed and direction and temperature inversion. Noise predictions were calculated for seven assessment locations adjacent to the site of the proposal. These are shown in **Figure 4.7**.

All operational scenarios modelled represent worst case situations where all fixed and mobile plant and equipment likely to be used over the life of the project is operating simultaneously. The scenarios are shown in **Figure 4.8**. This situation is not representative of noise generation experienced in practice and correspondingly lower received noise levels would result at the assessment locations as shown by the consistent noise monitoring results obtained over a long period. Impacts can therefore be expected to be overstated, substantially so in some cases.

Four daytime operational scenarios and one early morning scenario were assessed in order to represent the development stages throughout the life of the project. A full complement of plant and equipment is assumed to be operating during daytime hours. Only trucks entering or leaving via the weighbridge on Lot 198 were assumed to be operating during the early morning hour (06.00 to 07.00 hours).

Predicted noise level contributions from the proposed sand extraction operations over the life of the project are summarised in **Tables 4.7** and **4.8**.

Table 4.7 Daytime noise levels at selected receivers (dBA L_{Aeq}(15 minute))¹

Receiver	Daytime (0700-1800 hours) - calm				Daytime operational criterion
	Stage 1	Stage 2	Stage 3	Stage 4	
1	41	34	22	21	42
2	38	40	38	36	42
5	41	45	45	43	42
6	37	40	40	39	42
7	33	36	36	35	42
8	32	38	39	36	42
9	42	44	39	42	39
10	39	44	38	39	39

Note 1: Noise levels indicated in bold type exceed the controlling criterion during the stage indicated.

Receivers 3 and 4, shown on **Figure 4.7**, have not been included in the assessment. Receiver 3 is located on a property (Lot 1 DP555184) which is included in the proposal and the dwelling at Location 4 is on a site currently subject to sand extraction operations (HB Maroota) and would not normally be considered to be a sensitive receiver.

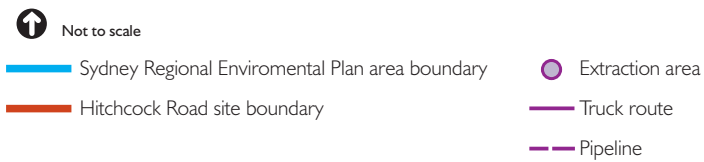
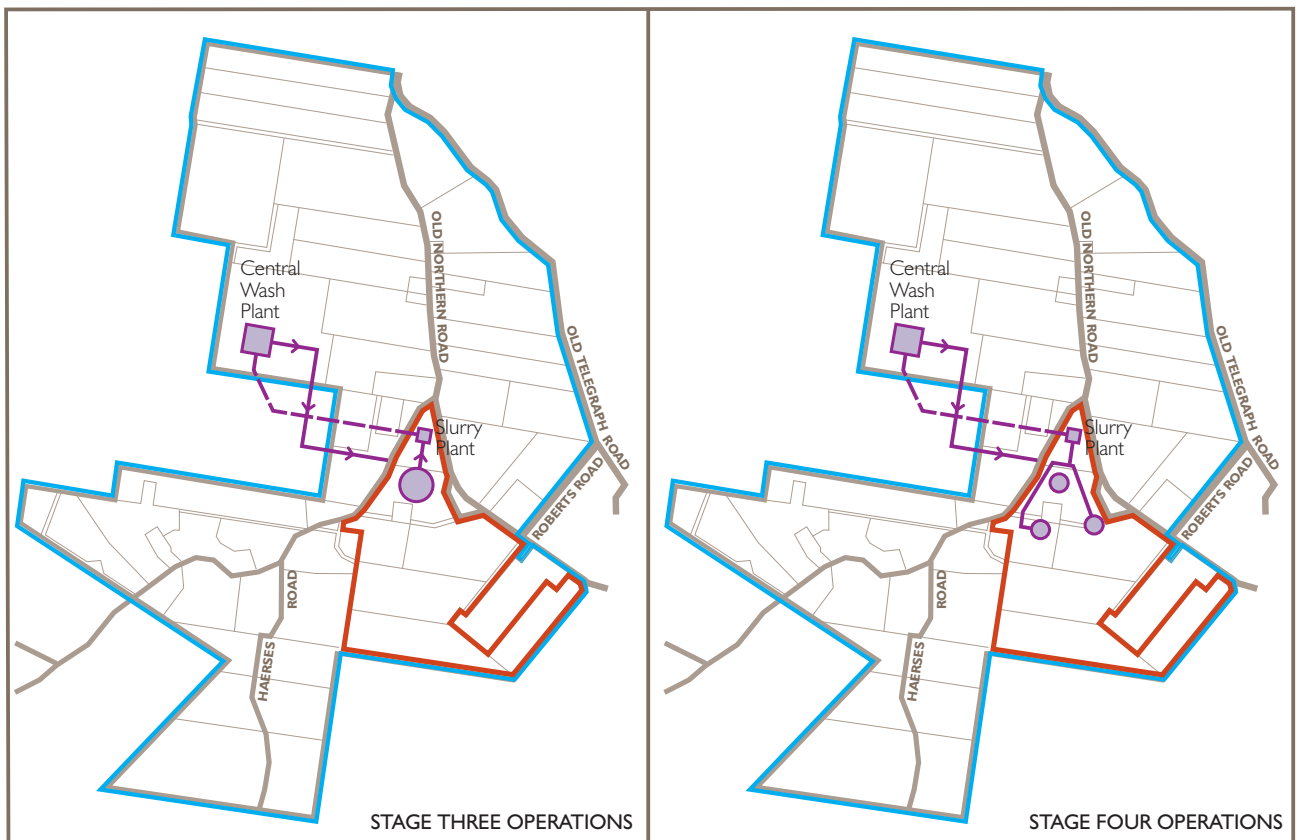
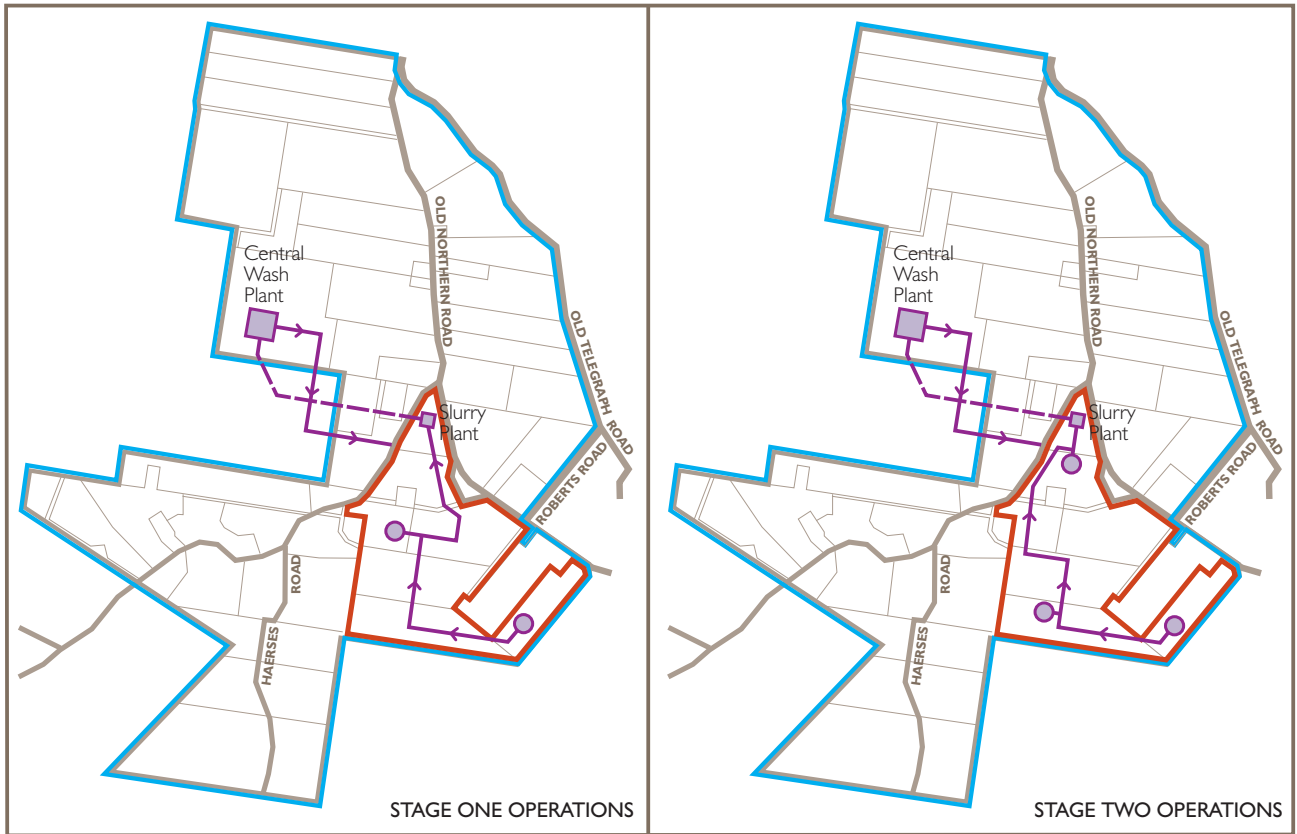


Figure 4.8
SITE OPERATING SCENARIOS FOR NOISE ASSESSMENT

Three assessment locations would be affected to some degree (between 1 dBA and 5 dBA above the relevant daytime criterion) with Stage 2 operations resulting in the most exceedances of the relevant criteria. However, this situation is not expected to occur in practice due to the factors described in **Section 4.8.2**. Noise monitoring at an adjacent location (Number 3 on **Figure 4.7** which is closer to the extraction works) has indicated that the relevant criteria are not normally exceeded.

Table 4.8 Early morning noise levels (dBA L_{Aeq}(15 minute))¹

Receiver	Early morning (0600-0700 hours)			Night time operational criterion
	Calm	NW Wind	Inversion	
1	<10	<10	<10	35
2	12	18	18	35
5	33	35	37	35
6	33	34	37	35
7	N/A	N/A	N/A	N/A
8	28	30	32	35
9	31	34	35	35
10	34	37	38	35

Note 1: Noise levels indicated in bold type exceed the controlling criterion during the stage indicated.

Noise emission levels at various assessment locations are predicted to be below relevant criteria during the early morning period when trucks are operating along the haul road except for marginal exceedances at Location 10 under prevailing north west winds and Locations 5, 6 and 10 under temperature inversion conditions. However, the use of the night time criterion for this assessment is considered unduly stringent in the *NSW Industrial Noise Policy* (Department of Environment and Conservation 2000).

4.8.4 Assessment of Road Traffic Noise Impacts

Noise impacts resulting from truck movements generated by operations on the Hitchcock Road site already contribute to traffic noise emissions experienced by affected residents and have been included in the background levels recorded during the monitoring. The number of truck movements using Old Northern Road and Wisemans Ferry Road following approval of the current application would be little changed as a result of the proposal and therefore noise impacts from this source would change only marginally under worst case conditions.

The predicted minimum daytime L_{Aeq}(1 hour) noise levels comply with the Department of Environment and Climate Change recommended criterion of 60 dBA at all assessment locations while predicted increases in the peak daytime L_{Aeq}(1 hour) traffic noise levels with the inclusion of truck movements generated by the approved development on Lot 198 would exceed the daytime criterion by 1 dBA at one location.

The night time criterion of 55 dBA, when applied to the early morning period (0600-0700 hours), is exceeded at two locations (numbers 9 and 10). It remains doubtful that this criterion is appropriately applied to a rural location and may not reflect local perceptions of intrusion (Department of Environment and Conservation 2000).

4.8.5 Cumulative Noise Impact Assessment

Several other sand extraction and processing operations currently exist in the vicinity. The amenity criterion in the Industrial Noise Policy requires that the LAeq (period) level does not exceed the specified acceptable or maximum noise level appropriate for the particular locality and land use. This is aimed at restricting the potential increase in amenity noise levels known as background creep.

The potential for the simultaneous operation of adjoining developments to exceed the acceptable and maximum noise amenity criteria can be assessed on a worst case scenario basis by adding the intrusive noise levels from the recently approved Lot 198 project and the Hitchcock Road proposal together with the approved noise limits from the licence conditions for Dixon Sands and HB Maroota. This assumes that all projects simultaneously emit their maximum noise levels to a common receiver during non-adverse or adverse weather conditions. The location of these adjacent operations is shown in **Figure 4.9** and the results of the assessment in **Table 4.9**.

Table 4.9 Cumulative noise amenity (dBA re 20 µPa)¹

Receiver ²	Operating period	Cumulative noise source ³				Amenity level	Maximum acceptable criterion
		A	B	C	D		
1	Daytime	41/46	39/44	5/10	37/42	44/49	50/55
	Night time	5/10	32/37	5/10	37/42	38/44	40/45
2	Daytime	40/46	39/44	17/22	37/42	44/49	50/55
	Night time	12/18	32/37	13/18	37/42	38/43	40/45
5	Daytime	45/49	39/44	35/40	37/42	47/51	50/55
	Night time	33/37	32/37	32/37	37/42	40/45	40/45
6	Daytime	40/44	39/44	38/43	37/42	45/49	50/55
	Night time	33/37	32/37	32/37	37/42	40/45	40/45
7	Daytime	36/41	40/45	35/40	37/42	43/48	45/50 ⁴
	Night time	N/A	N/A	N/A	N/A	N/A	N/A
8	Daytime	39/43	39/44	31/36	37/42	43/48	50/55
	Night time	28/32	32/37	27/32	37/42	39/44	40/45
9	Daytime	44/48	39/44	29/34	37/42	46/50	50/55
	Night time	31/35	32/37	30/35	37/42	39/44	40/45
10	Daytime	44/48	39/44	32/37	37/42	44/50	50/55
	Night time	34/38	32/37	32/37	37/42	44/45	40/45

Note 1: Predicted noise levels are LAeq (15 minutes) for non-adverse/adverse conditions.

2: Receiver locations are shown on Figure 4.7.

3: Cumulative noise sources are:

A Hitchcock Road Sand Extraction and Rehabilitation Project (the proposal)

B Dixon Sands

C Lot 198 (PF Formation)

D HB Maroota.

4: External criterion assuming a typical 10 dB loss from inside to outside.

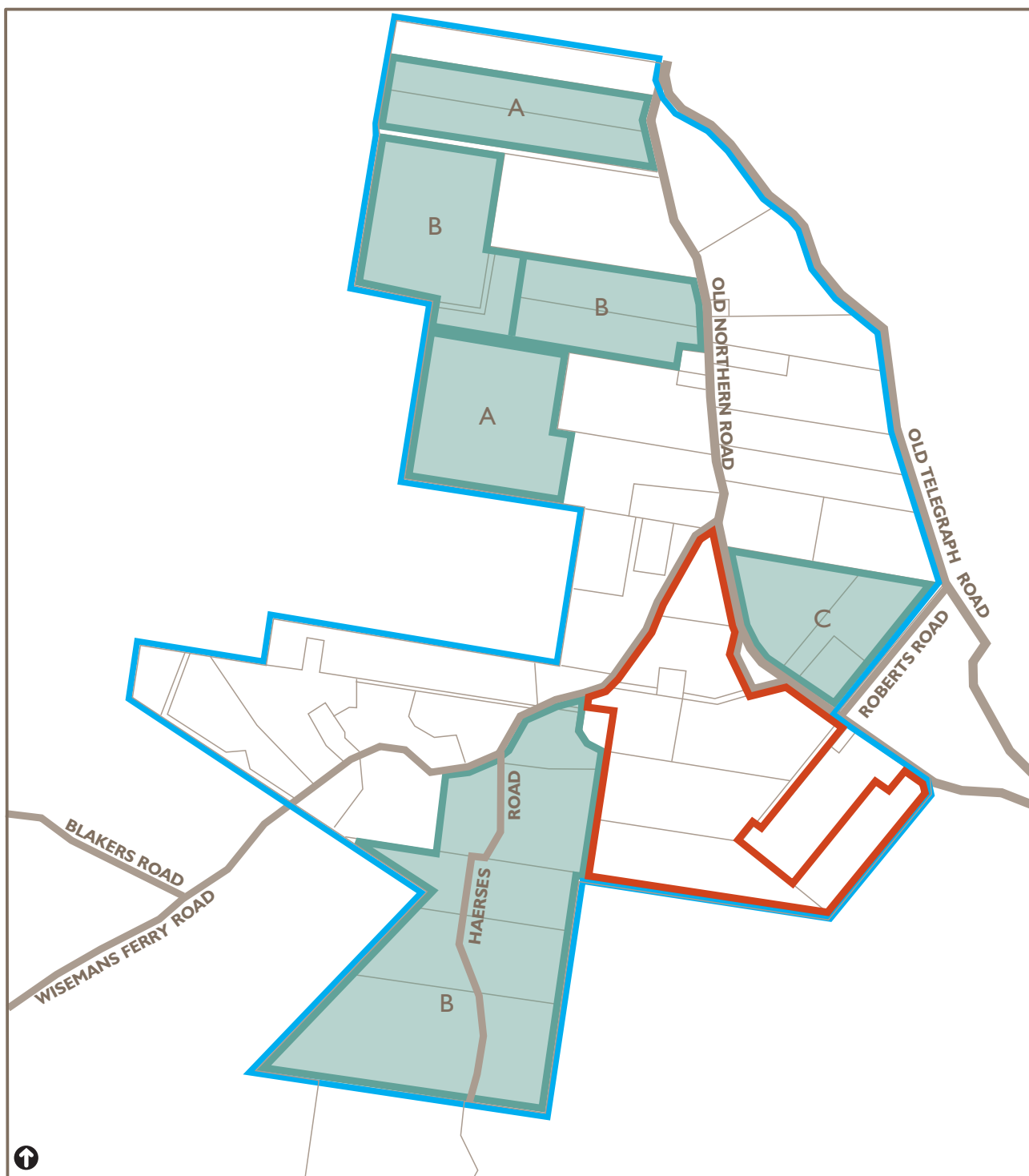


Figure 4.9

**ADJACENT SAND EXTRACTION OPERATIONS
(COMPLETED, EXISTING AND APPROVED)**

- | | |
|--|-----------------------|
| — Sydney Regional Environmental Plan 9 area boundary | A PF Formation |
| — Hitchcock Road site | B Dixons Sand |
| | C HB Maroota |

This assessment indicated that the cumulative noise emissions of the proposed development at Hitchcock Road and its adjoining developments would be below the relevant acceptable amenity criteria for industrial noise during the daytime and night time periods at all nine assessment locations.

Cumulative noise emissions generated by the proposal and adjoining developments would be below the relevant acceptable amenity criteria for industrial noise (non-transport) impacts during the daytime and night time periods at all assessment locations.

4.8.6 Noise management and control

Project specific noise criteria derived in accordance with the Industrial Noise Policy are designed to protect at least 90 percent of the population living in the vicinity of industrial noise sources from adverse effects for at least 90 percent of the time. Provided the criteria are met, it is unlikely that most people would consider the resulting noise levels to be excessive. Even where the assessment criteria are not achieved, it does not automatically follow that everyone exposed to this noise would find it unacceptable.

In the case of the Hitchcock Road development, all locations predicted to experience noise level increases have been subject to operational noise from sand extraction and transport activities for at least six years and the continuation of these operations can be expected to result in little overall perceived change. However, in the event of complaints concerning noise from any local resident, monitoring would be undertaken at the site, discussions held with the affected residents and appropriate mitigation measures, where reasonable and feasible, agreed and implemented.

4.9 Air quality

4.9.1 Introduction

Dust generation would be the principle air quality issue on the Hitchcock Road site. Airborne dust has the potential to affect human health as well as contribute to the general degradation of the environment depending on the size and concentration of particles in the air and their composition. The human respiratory system includes a defensive mechanism which prevents particles larger than about 10 microns (μm) from reaching its most sensitive areas. Particles smaller than this are referred to as PM_{10} . The air quality assessment also considered the total mass of particles suspended in the air (Total Suspended Particulate matter) as particles larger than $10\mu\text{m}$ can also contribute to environmental degradation. Total Suspended Particles (TSP) generally include dust particles smaller than $30\mu\text{m}$ as larger material tends to settle out of the atmosphere quickly. The latter are referred to as deposited dust.

Dust likely to be generated on the Hitchcock Road site would comprise mainly clay and silt, possibly with smaller proportions of very fine sand grains, the bulk of which would be silica.

4.9.2 Existing air quality

Air quality standards and goals refer to pollutant levels which include the proposal and existing sources. It is therefore necessary to measure or estimate existing dust concentrations and deposition levels in the area adjacent to the proposal. Monitoring data for insoluble solids deposition rates is available for three sites in the vicinity of Hitchcock Road from 1998 to 2007 but data on particulates is not available. Local air

quality monitoring data includes the effects of current extraction operations in the area as well as other sources of dust normally expected in rural areas.

One of the monitoring sites (Maroota Public School) is approximately 1,200 metres to the north, closer to other sand mining operations while the other two are on the boundary of the current operations but within the Hitchcock Road site itself. Maximum annual average dust deposition rates are above the criterion of 4 g/m²/month at all these locations, ranging from 4.4 g/m²/month to 4.9 g/m²/month. However, these levels include any contribution from present activities on the Hitchcock Road site. As these would not change in future, any predicted affects on air quality would be marginal relating more to the location of operations on the site than any change in activities.

There are no data currently available for the immediate area from which to establish annual average TSP and PM₁₀ concentrations. The annual average PM₁₀ concentration for all 16 Department of Environment and Climate Change monitoring stations across the Sydney metropolitan area for the years from 2001 to 2005 is 20.4 µg/m³. The goal is 30 µg/m³. A continuous PM₁₀ monitor has recently been installed at Maroota Public School. Anecdotal evidence suggests that there have been no exceedances of the 24-hour goal of 50 µg/m³ at this location to date.

As the annual PM₁₀ concentrations across the Sydney basin are approximately two-thirds of the goal, it has been assumed that the following background concentrations apply at the closest dwellings to the Hitchcock Road site:

- annual average Total Suspended Particles of 60 µg/m³;
- annual average PM₁₀ of 20 µg/m³; and
- annual average dust deposition of 4 g/m²/month.

4.9.3 Potential sources of dust

The main activities likely to generate dust during the operation of the proposed extraction areas on the Hitchcock Road site would include:

- topsoil stripping and overburden removal;
- ripping and excavation of friable sandstone;
- vehicles travelling on unsealed surfaces;
- loading and unloading the raw feed and products to trucks and stockpiles; and
- wind erosion of stockpiles and exposed unpaved areas.

The quantity of dust generated by each activity has been established by reference to emission factors developed both locally and by the US EPA.

4.9.4 Operational safeguards and management procedures

The following safeguards and management procedures are implemented on the Hitchcock Road site to limit the generation of dust from site activities. These would be extended to include those areas for which approval is currently sought.

- A 10,000 litre water truck would continue to be used to regularly wet the active internal unsealed roads. Watering would take place at least five times per day depending on the prevailing conditions with an application of at least two litres per square metre.
- Topsoil stockpiles and areas where landform preparation is complete would be seeded with either native or pasture species to assist in stabilising exposed surfaces.
- Mobile equipment used for ripping and loading of friable sandstone would have enclosed cabs to avoid exposure of operatives to generated dust.

The raw feed material delivered to the wash plant would include a degree of inherent moisture that would contribute to the overall control of dust.

All safeguards and management procedures would be reviewed as part of the annual environmental management audit and any changes to the site operations would be reflected in the review of the dust management strategies adopted at the site.

4.9.5 Guidelines for dust impact assessment

A range of air quality goals for particulate matter developed by the Department of Environment and Conservation apply to the proposal. These goals have been established to protect surrounding residents from adverse health effects and maintain the amenity of the surrounding environment. The air quality goals used in the air quality assessment are set out in **Table 4.10**.

Table 4.10 Air quality goals for particulate matter

Pollutant	Standard/goal	Averaging time	Agency ¹
Total suspended particulate matter	90µg/m ³	Annual mean	NHMRC
Particulate matter <10µm (PM ₁₀)	50µg/m ³	24-hour maximum	NSW DECC
	30µg/m ³	Annual mean	NSW DECC long-term reporting goal
	50µg/m ³	24-average – five exceedances permitted per year	NEPM
Particulate matter <2.5µm (PM _{2.5})	8µg/m ³	Annual mean	NEPM
	25µg/m ³	24-hour maximum	NEPM

Note 1: NHMRC is the National Health and Medical Research Council of Australia
NSW DECC is the NSW Department of Environment and Climate Change
NEPM is National Environment Protection Measure

The Department of Environment and Climate Change also requires an assessment of 24-hour PM₁₀ concentrations where the contribution from the proposal should be less than 50 µg/m³ at the nearest dwelling or sensitive receptor.

In addition to health impacts, airborne dust has the potential to cause nuisance by depositing on surfaces and possibly on edible crops. Dust deposition criteria are set out in

the procedures for modelling of air pollutants from stationary sources (NSW Environment Protection Authority 2001). These are listed in **Table 4.11**.

Table 4.11 Criteria for dust fallout

Pollutant	Averaging period	Maximum increase in deposited dust level	Maximum total deposited dust level
Deposited dust	Annual	2 g/m ² /month	4 g/m ² /month

Source: NSW Department of Environment and Climate Change

4.9.6 Assessment of impacts

The main generators of dust are those listed in **Section 4.9.3**. Four phases have been developed for future operations at the site. These are listed in **Section 2.4.3** and would affect different parts of the site as the development progresses. Total dust emissions have been estimated by analysing activities taking place during Phases 1 and 2 as these are the closest to adjacent dwellings and therefore represent a worst case. An average and maximum extraction rate (250,000 and 400,000 tonnes per year respectively) was used in the calculations.

The operations which apply in each case have been combined with emission factors developed both locally and by the US EPA to estimate the volume of dust produced. These estimates assume that an appropriate level of control is achieved using the methods outlined in **Section 4.9.4**.

The approach taken to the assessment of air quality impacts closely follows the guidelines published by the Department of Environment and Conservation in 2005. These specify the method for preparing meteorological data to be used in the dispersion model, the way in which emissions should be estimated and the relevant air quality criteria for assessing the significance of predicted concentration and deposition rates.

The assessment used a modified version of the US EPA ISCST3 model (ISCMOD). The modelling used three ISC source groups with each corresponding to a specific particle size category. Extraction operations were represented by a series of volume sources located according to the location of activities for the modeled scenario. A detailed description of the modelling process is included in **Technical Paper 5** in Volume Three.

Dust concentrations and deposition rates due to sand extraction activities have been prepared for existing and proposed operations for predicted:

- annual average PM₁₀ concentrations (See **Figure 4.10a**);
- maximum 24-hour average PM₁₀ concentrations (See **Figure 4.10b**);
- annual average TSP concentrations; and
- annual average dust deposition.

The maximum 24-hour average contour plots shown in **Figure 4.10b** do not represent the dispersion pattern for any particular day but represent the highest predicted 24-hour average concentration that occurred at each location. The maxima are used to show concentrations that could possibly be reached under the modeled conditions.

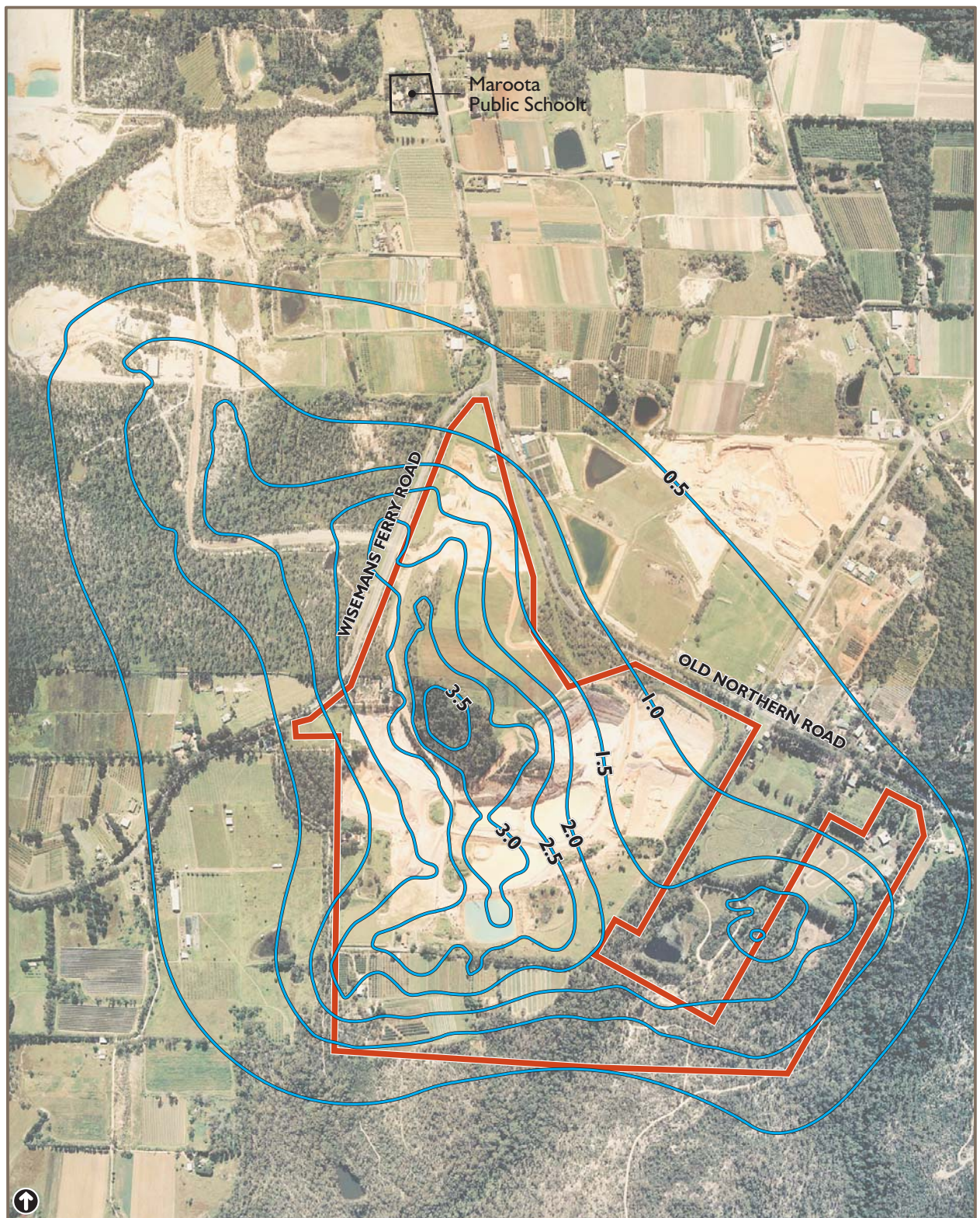


Figure 4.10a

AIR QUALITY IMPACTS - AVERAGE EXTRACTION RATES
 PREDICTED ANNUAL AVERAGE PM₁₀ CONCENTRATIONS ($\mu\text{g}/\text{m}^3$)

Scale
 0 500 Metres

Study area

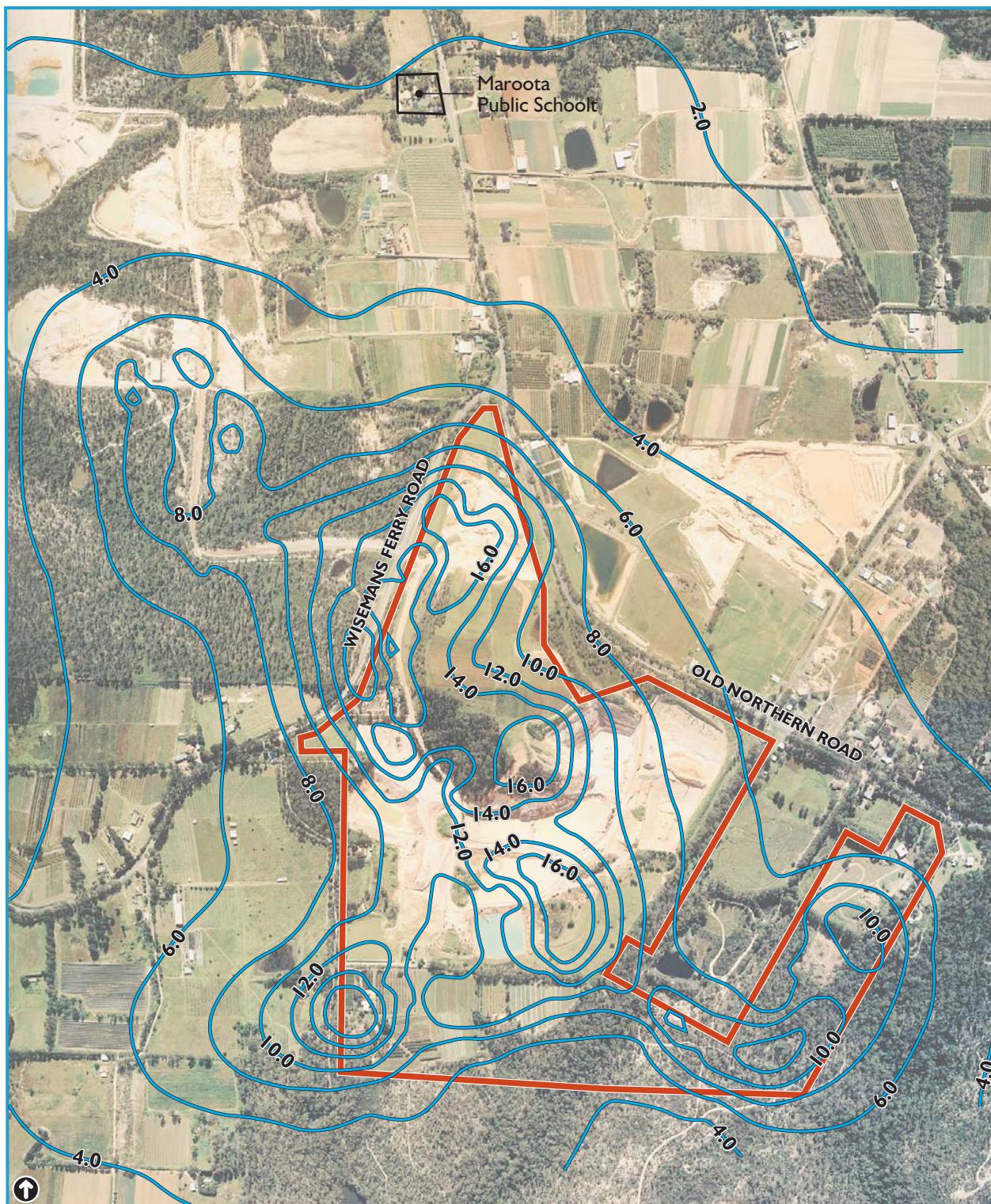


Figure 4.10b

AIR QUALITY IMPACTS - MAXIMUM EXTRACTION RATES
 PREDICTED MAXIMUM 24 HOUR AVERAGE PM₁₀ CONCENTRATIONS ($\mu\text{g}/\text{m}^3$)

Scale
 0 500 Metres

Study area

The results of the assessment indicate that:

- maximum 24-hour average PM₁₀ concentrations at the nearest dwelling are predicted to be 11.0 µg/m³. It is unlikely that the 24-hour average goal of 50 µg/m³ would be exceeded due to the proposed operations even with existing PM₁₀ concentrations;
- annual average PM₁₀ concentrations at the nearest dwelling are predicted to be a maximum of 1.6 µg/m³. It is unlikely that the annual average goal of 30 µg/m³ would be exceeded due to the proposed operations even with existing PM₁₀ concentrations;
- annual average TSP concentrations at the nearest dwelling are predicted to be a maximum of 3.4 µg/m³. It is unlikely that the 90 µg/m³ NHMRC goal would be exceeded due to the proposed operations even with existing annual average TSP concentrations; and
- annual average dust deposition levels at the nearest dwelling are predicted to be a maximum of 0.2 g/m²/month. It is unlikely that the proposal would result in any additional exceedances of the goal of 4 g/m²/month.

Results from the dispersion modelling indicated that off-site dust concentrations at all nearby dwellings would be below relevant air quality goals as a result of the proposed operations at the Hitchcock Road site. Dust deposition levels have exceeded Department of Environment and Climate Change assessment criteria in the area but recent monitoring (2005/2006 and 2006/2007) is showing an overall trend of diminishing rates of deposition at the monitoring sites. Predicted additional impacts resulting from the proposal are minimal.

4.10 Flora and fauna

4.10.1 Introduction

A flora and fauna assessment of the Hitchcock Road site at Maroota was undertaken including detailed targeted surveys for threatened species of plant and animal from 11 to 14 October 2004. Detailed fauna assessment surveys included trapping, spotlighting and call playback. During the surveys the weather was hot and dry with maximum daily temperatures ranging between 26 and 39 degrees Celsius. An additional assessment is based on a survey carried out on 13 July 2006. The weather was cool and clear with a maximum temperature of 13 degrees Celsius during this visit.

The purpose of the assessment was to determine the existing natural environment and likely impacts of the proposed sand extraction on plants and animals of the area and in particular threatened species, populations and communities listed under the *Threatened Species Conservation Act 1995* (TSC Act) and the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). The assessment covers all the area included in application although only part of this would be subject to sand extraction and large areas would not be affected.

All work was carried out under a Department of Environment and Climate Change Scientific Licence (S10445) and a NSW Department of Primary Industries Animal Research Authority (AW01/1380).

Details of the flora and fauna investigations are provided in **Technical Paper 6** in Volume Three

4.10.2 Existing vegetation and fauna habitat

The site contains four vegetation communities plus cleared areas which are dominated by weeds and cannot be considered to be a native community. These are shown in **Figure 4.11**.

Shale Sandstone Transition Forest

Shale Sandstone Transition Forest occurs as three remnants of open forest in the central section of the site and within Lot 1 DP223323. This community is listed as endangered under both the TSC and EPBC Acts.

The canopy consists of *Eucalyptus eugenioides*, *E. punctata*, *E. resinifera*, *Angophora costata*, *E. gummifera*, *E. globoidea* and *Syncarpia glomulifera*. The shrub layer is regenerating following a fire in December 2002 and includes *Acacia parramattensis*, *Oxylobium ulicifolium*, *Gompholobium latifolium*, *Bossiaea lenticularis*, *Ceratopetalum gummiferum*, *Telopea speciosissima*, *Lomatia silaifolia*, *Xylomelum pyriforme*, *Boronia pinnata* and *Boronia ledifolia*. Ground cover is dominated by native grasses and herbs such as *Lomandra longifolia* and *Themeda australis*.

The remnants are small (approximately 7.3 hectares in total), narrow with high edge to area ratios which leaves them prone to impacts such as weed invasion. Weeds in these communities include the noxious Bridal Creeper, Small-leaved Privet, Prickly Pear and Blackberry. The remnants are in poor to moderate condition.

The relatively undisturbed and moderately dense upper storey canopy of tall Eucalypt trees characterise the fauna habitats available within these remnants. There is a moderate number of large senescent trees containing small to medium sized tree hollows and a small number of standing dead tree stags is present. The understorey vegetation consists of a dense shrub layer in most areas, and there is an abundance of grasses and herbs scattered throughout the forest that emerge from the limited amounts of rocky outcrops which are present on the steeper areas.

The tree hollows provide nesting and roosting habitat for hollow-dwelling fauna (cockatoos, parrots, possums and bats), and the tall trees provide roosting, nesting and foraging resources for generalist/forest species of bird. Foraging resources are also available for reptiles and macropods such as the Swamp Wallaby and microchiropteran bats are likely to use this community as a marginal foraging area.

Although the community contains a variety of microhabitat resources for native species of animal, it is unlikely that potential habitat for threatened species of animal exists in the community due to the relatively small size and isolated nature of the remnants from other bushland. Fauna habitats in the Shale Sandstone Transition Forest community are in moderate condition.

Sydney Sandstone Gully Forest

Sydney Sandstone Gully Forest occurs in the southern part of the site in the Little Cattai Creek Valley. This community corresponds to Sydney Gully Forest (Map Unit 10ag) as described by Benson and Howell (1994).

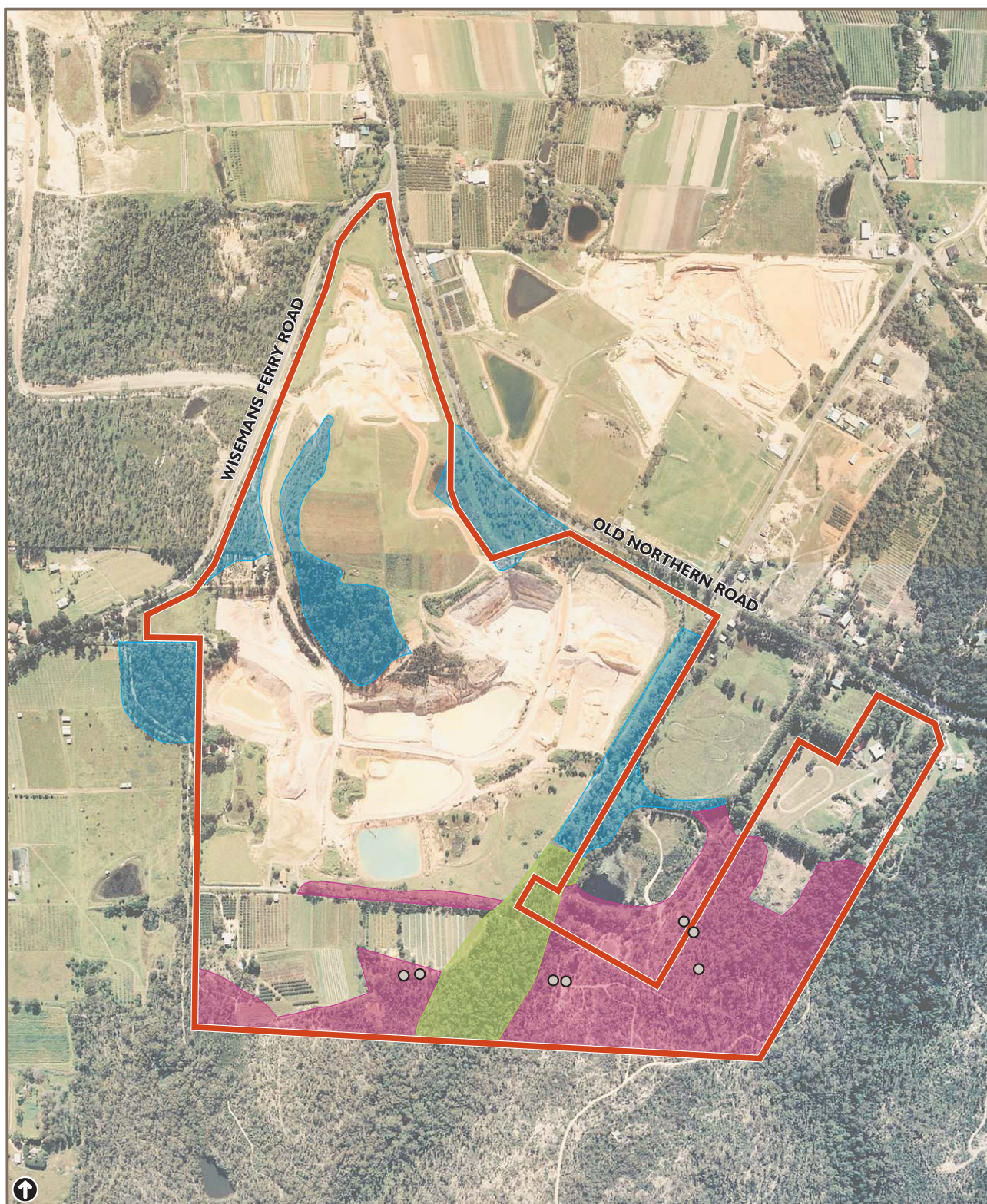


Figure 4.11

VEGETATION COMMUNITIES AND LOCATION OF THREATENED SPECIES

- Study area
- *Tetratheca glandulosa*
- Sydney Sandstone Gully Forest
- Sydney Sandstone Ridgetop Woodland
- Shale Sandstone Transition Forest

The canopy is dominated by *Angophora costata*, *Eucalyptus piperita*, *Syncarpia glomulifera* and *Corymbia maculata*. The shrub layer is sparse and is currently regenerating from fire and includes a tall shrub layer consisting of *Allocasuarina littoralis*, *Callicoma serratifolia* and *Banksia serrata* and a low shrub layer of *Acacia myrtifolia*, *Telopea speciosissima*, *Lomatia silaifolia*, *Boronia pinnata* and *Gompholobium latifolium*. The ground cover consists of grasses, herbs, ferns and sedges including *Entolasia stricta*, *Themeda australis*, *Adiantum aethiopicum*, *Tetratheca thymifolia* and *Smilax australis*.

Very few introduced species were recorded and this community is in good condition.

The community is relatively undisturbed and contains high quality microhabitat resources suitable for a variety of native species of animal. The dense upper storey canopy is dominated by a diversity of large senescent Eucalypt trees that contain a high number of medium sized tree hollows. Standing dead stags and fallen dead timber are both abundant. There is a tall and sparse regenerating shrub layer throughout the understorey of the forest, with a groundcover of grasses, herbs and sedges scattered amongst rocky outcrops and along the dry ephemeral drainage line. The forest floor contains a thick layer of leaf litter and decorticated bark is scattered throughout the community.

The community contains foraging, nesting and roosting resources for a variety of native species of animal which include the Swamp Wallaby, small ground-dwelling mammals (rodents and Antechinus), reptiles, and generalist/forest species of bird. Insectivorous microchiropteran bats are likely to use the temporary roosting resources in some of the tree hollows and forage along the open drainage lines and the outer margins of the forest. Fauna habitats in the Sydney Sandstone Gully Forest are in good condition.

Sydney Sandstone Ridgetop Woodland

Sydney sandstone Ridgetop Woodland occurs on the ridge along the eastern side of the site. This community corresponds to Sydney Sandstone Ridgetop Woodland (Map Unit 10ar) as described by Benson and Howell (1994).

The canopy is dominated by *Angophora costata*, *Corymbia gummifera*, *Eucalyptus sparsifolia*, *Eucalyptus punctata* and *Eucalyptus haemastoma*. The Shrub layer contains tall shrubs such as *Leptospermum trinervium*, *Persoonia levis*, *Acacia linifolia* and *Kunzea ambigua* as well as low shrubs such as *Grevillea buxifolia*, *Acacia ulicifolia*, *Bossaea heterophylla* and *Lambertia formosa*. The ground cover consists of grasses, herbs and sedges including *Scaevola ramosissima*, *Billardiera scandens*, *Themeda australis*, *Anisopogon avenaceus*, *Cyathochaeta diandra* and *Ptilothrix deustum*.

Very few introduced species were recorded and these were largely restricted to the edges of patches. This community is considered to be in good condition.

Two threatened species were recorded within this community: *Tetratheca glandulosa* and *Grevillea parviflora*.

A majority of the community is transitional to fauna habitats of the Sydney Sandstone Gully Forest and is relatively undisturbed, while some of the eastern areas of the upper ridgetop are regenerating,

The upper storey canopy cover from tall myrtaceous trees is relatively dense throughout most of the community and there is a moderate number of small sized tree hollows present in mature senescent trees. There is a small amount of standing dead tree stags and a moderate amount of fallen dead timber. The understorey vegetation consists of a low-lying shrub layer that is relatively dense throughout the community and a dense groundcover of grasses, herbs and sedges are prolific throughout the woodland. The

woodland floor contains a moderately thick layer of leaf litter that is scattered amongst small areas of rocky outcrops.

The community contains foraging, roosting, and nesting resources for generalist/woodland and nectivorous species of bird, reptiles, microchiropteran bats, small ground dwelling mammals and macropods such as the Swamp Wallaby. The eastern areas of the community are connected to extensive areas of remnant bushland outside the area proposed for clearance. The condition of fauna habitats in the Sydney Sandstone Ridgetop Woodland is moderate.

Regrowth areas

Regrowth vegetation occurs in the eastern section of the site in the vicinity of the dams. These areas have been previously cleared but are adjacent to native vegetation and have been allowed to regenerate.

This community consists of a low dense canopy dominated by *Allocasuarina littoralis* and *Kunzea ambigua*. The understorey is sparse and includes both native and introduced species of grasses and herbs such as *Themeda australis*, *Sida rhombifolia* and *Pennisetum clandestinum*.

This community is in moderate condition and given time is likely to regenerate well.

The low-lying and sparse canopy cover of Casuarinas provides foraging resources for generalist species of bird. The sparse understorey of grasses and herbs provides foraging and sheltering resources for reptiles and small ground dwelling mammals. The groundcover layer of the community generally contains a thin layer of leaf litter. The area does not contain any tree hollows or standing dead tree stags, although fallen dead timber is present in small amounts. There is a limited availability of rocky outcrops and three dams including a 250 square metre sized water body that provides habitat for a variety of common species of waterbird and amphibian, as well as drinking resources for small ground-dwelling mammals and macropods such as the Swamp Wallaby.

The regenerating regrowth areas are likely to support a variety of native species of animal through the ecological development of fauna habitat resources over time. At present however, the condition of fauna habitats in the regrowth areas is poor.

Cleared areas

Cleared areas cover most of the site with much of the vegetation previously removed for grazing, cropping and mining. These areas are dominated by weeds and introduced grasses such as *Verbena bonariensis*, *Asparagus asparagoides*, *Sida rhombifolia*, *Pennisetum* and *Chloris virgata*. The vegetation in these areas has been highly disturbed and modified and cannot be considered to represent a native vegetation community. Parts of the cleared areas, some of which contained settlement ponds now capped and sealed, have been regraded and seeded with plant material derived from the existing communities as part of the site rehabilitation program.

The condition of the fauna habitat in the cleared areas is poor.

4.10.3 Corridors and connectivity

Wildlife corridors are retained and/or restored systems of habitat which, at a minimum enhance connectivity of wildlife populations and may help them overcome the main consequences of habitat fragmentation (Wilson and Lindenmayer 1995). Corridors can provide ecological functions at a variety of spatial and temporal scales from daily foraging of individuals to broad-scale genetic gradients across biogeographical regions.

The Sydney Sandstone Ridgetop Woodland and Sydney Sandstone Gully Forest vegetation communities provide good connections to relatively large areas of adjacent bushland. However, the Shale Sandstone Transition Forest is highly fragmented and is isolated from connective vegetation by areas of cleared land and sand extraction activities. Future clearing would not result in the further fragmentation of vegetation or habitats within the site.

4.10.4 Plant species

A total of 207 plant species was recorded on site, 87 percent of which are native. Five weeds (Crofton Weed, Prickly Pear, Bridal Creeper, Small-leaved Privet and Blackberry) declared noxious within the Hawkesbury River County Council control area, which includes Baulkham Hills Shire, were also present.

Tetratheca glandulosa, which is listed as threatened on both the EPBC and TSB Acts, is present on the site. A total of 43 individuals were identified scattered within the bushland in the southern part of the site during the recent survey and some 80 individuals were previously recorded adjacent to the haul road in the south eastern part of the site. Since this species is cryptic and difficult to detect, population sizes are routinely underestimated and vary depending on the season and the proportion in flower at any given time.

One *Grevillea parviflora* individual, listed as threatened on both the EPBC and TSC Acts was recorded on the site. However, this individual is located outside the area subject to sand extraction and is not likely to be affected.

4.10.5 Fauna species

A total of 44 species of animal was recorded on site comprising three species of amphibian, three species of reptile, twenty eight species of bird, seven species of native mammals and three introduced species. These are listed in Technical Paper 6 in Volume Three.

While no threatened species of animal was recorded on site, the threatened Glossy Black-cockatoo was recorded flying overhead.

4.10.6 Species, populations and communities of conservation concern

Threatened ecological communities

Endangered Ecological Communities are listed under Schedule 1, Part 3 of the TSC Act, while threatened ecological communities (Critically Endangered, Endangered and Vulnerable) are listed under the EPBC Act. Shale Sandstone Transition Forest is listed as an endangered ecological community under both the TSC Act and the EPBC Act. This community is located on Lot 1 DP223323 as well as other remnants within the Hitchcock Road site.

Endangered populations

Endangered populations are listed under Schedule 1 Part 2 of the TSC Act. *Dillwynia tenuifolia* and *Darwinia fascicularis* subsp *oligantha* are listed in the Baulkham Hills Local Government Area as endangered populations and are known to be located in the Maroota area. Land clearing is recognised as a threatening process for both these populations (NSW National Parks and Wildlife Service 2000 and 2003). *Darwinia Fascicularis* subsp *oligantha* habitat has been affected and reduced to small isolated remnants by sand mining which has been extensive in the Maroota area (National Parks and Wildlife Service 2000).

Both species are found around rock platforms and in rocky heath associated with friable sandstone. No individuals of these species were found in the study area during the current surveys.

Threatened plants

A total of 29 species of threatened plant listed under the TSC Act and/or the EPBC Act were considered in this study. These are listed in **Technical Paper 6** in Volume Three.

Based on habitat assessment and the known distribution of these species in the Sydney Basin Bioregion, 23 species are considered unlikely to be present on the site. The remaining six species occur in environments similar to those on site.

Two threatened species (*Tetratheca glandulosa* and *Grevillea parviflora* subsp *parviflora*) were recorded within the Sydney Sandstone Ridgetop Woodland. Seven locations of *Tetratheca glandulosa* were recorded within Sydney Sandstone Ridgetop Woodland in the southern section of the site. One *Grevillea parviflora* individual was recorded in the vicinity of an existing track outside the study site.

Critical habitat

There are no areas of critical habitat defined within the locality nor any areas of high conservation value in the study area.

4.10.7 Threatened fauna

A total of 45 threatened species of animal has been recorded or has the potential to occur within 10 kilometres of the site, including six species of amphibian, 21 species of birds, two species of mammal and two species of reptile. All species are listed under the TSC Act and 11 are listed under the EPBC Act.

It is, however, unlikely that all these species occur at or near the proposed development site on a regular basis, and even fewer species would be affected by the proposed expansion of sand mining activities.

Despite the occurrence of local records or predicted habitat, 34 threatened species are unlikely to be significantly affected by the proposal for one or more of the following reasons:

- habitats were not recorded in the study area;
- the species has a large home-range, significantly larger than the area of proposed development and as such are unlikely to be dependent on resources within the development areas;
- the species is not endemic to the area and is therefore a vagrant;
- the species is unlikely to occur on a regular basis; or,
- the species is considered locally extinct.

Full details of species requirements are shown in **Technical Paper 6** in Volume Three. Impact assessments as required under the TSC Act and/or the EPBC Act have been completed for the remaining species. These are also included in **Technical Paper 6**.

4.10.8 Migratory species

A total of 10 migratory species could be expected to occur within a 10 kilometre radius of the study area based on the Environment Protection and Biodiversity Conservation Protected Matters Search Tool. No migratory species listed on the EPBC Act was recorded on site. While terrestrial migratory species of bird may potentially use the area, it is not classed as an important habitat as defined under the administrative significance guidelines of the EPBC Act in that the site does not contain habitat:

- utilised by a migratory species occasionally or periodically within a region that supports an ecologically significant proportion of the population of the species;
- utilised by a migratory species which is at the limit of the species range; or
- within an area where the species is declining.

As such there is unlikely to be an impact on migratory species and this group is not considered further.

4.10.9 Impact assessment

Flora

Impact assessments were carried out for threatened plants and vegetation communities, including *Shale Sandstone Transition Forest*, *Tetratheca glandulosa*, and *Grevillea parviflora*. These are included in **Technical Paper 6** in Volume Three.

Two remnants of Shale Sandstone Transition Forest within the development footprint totaling 5.2 hectares, are small, isolated, have a large edge to area ratio and are almost entirely subject to edge effects. The removal of these remnants is unlikely to have a significant impact on the recovery of this community.

Tetratheca glandulosa was found at seven locations on the site, three of which could be affected by the proposed operations (comprising approximately 42 individual plants). The proposal involves the clearing of 5.4 hectares of habitat for this species including the recorded plants. The site is not at the limit of distribution for *Tetratheca glandulosa* and the species is well represented within conservation reserves across its range, including stronghold populations and populations at the limit of distribution. The removal of this area of habitat and the identified plants is unlikely to significantly interfere with the recovery of the species. The impact assessment concluded that the proposed sand mining activities are unlikely to have a significant impact on this species. Areas to be cleared are shown in **Figure 4.12**.

Only one individual of *Grevillea parviflora* was recorded within the site in the vicinity of an existing track and is unlikely to be part of a viable population. This individual is not within the development footprint and as such this species is unlikely to be significantly affected by the proposed development.

Fauna

No threatened species of animal was recorded on site. However, it is likely that five species of microchiropteran bat (*East Coast Freetail Bat*, *Common Bent-wing Bat*, *Yellow-bellied Sheath-tail Bat* and the *Large-eared Pied Bat*) and four species of nocturnal bird (*Masked Owl*, *Powerful Owl*, *Barking Owl* and *Sooty Owl*) use the habitat on site as a marginal foraging and/or roosting resource. Impact assessments under the TSC Act and EPBC Act significance assessment guidelines concluded that the proposed mining activities will not have a significant impact on threatened species of microchiropteran bat or nocturnal bird. These are included in **Technical Paper 6** in Volume Three.

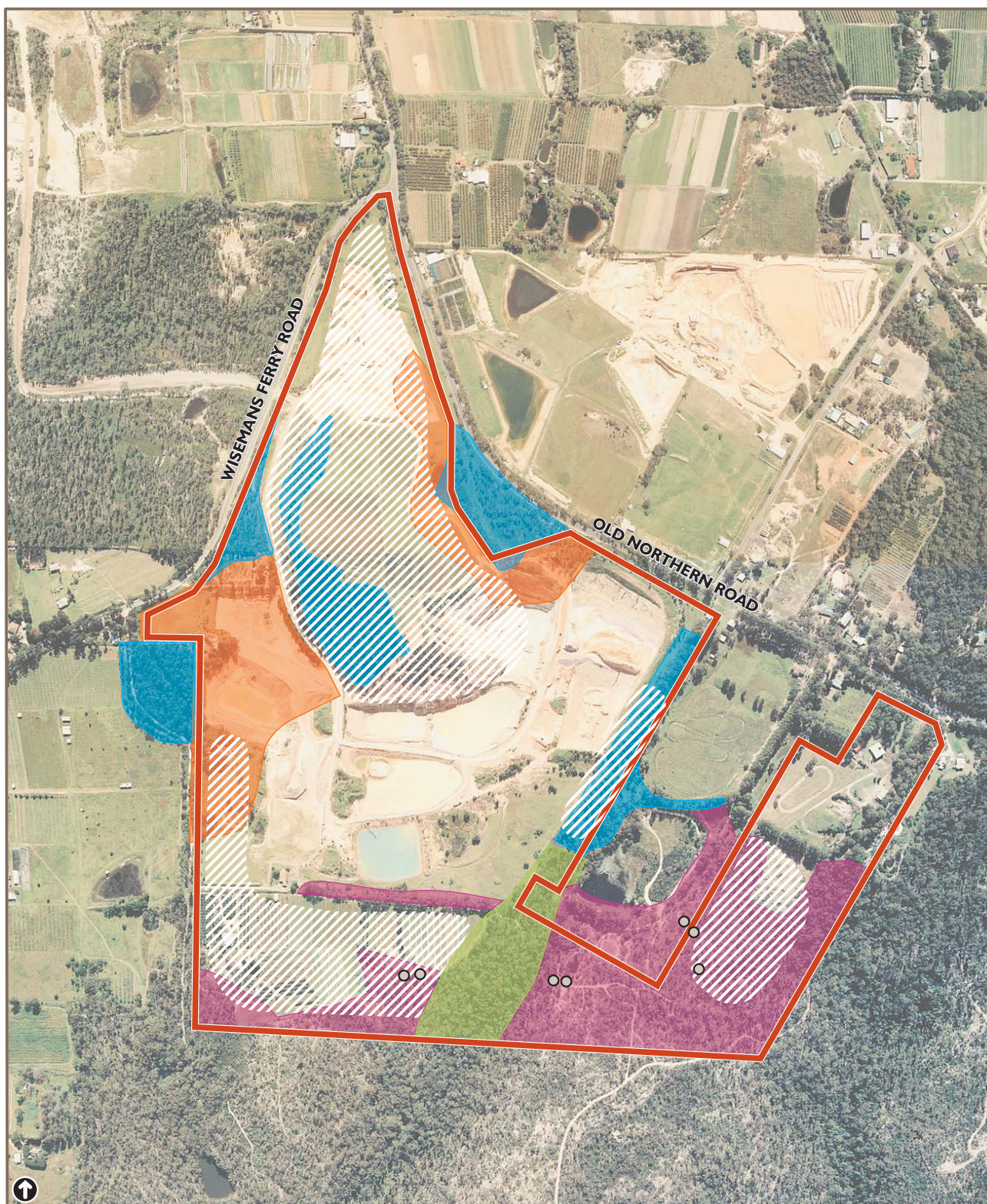


Figure 4.12

AREAS TO BE CLEARED AND NEW PLANTINGS

- Study area
- Areas for new plantings
- Sydney Sandstone Gully Forest
- Sydney Sandstone Ridgetop Woodland
- Shale Sandstone Transition Forest
- Area to be cleared
- *Tetratheca glandulosa*

Note: Shale Sandstone Transition Forest shown at time of photograph (2005)
Parts of this area can be cleared under the current consent

4.10.10 Conservation of flora and fauna values

Sand mining inevitably results in the removal of existing vegetation in the areas affected. However, the rehabilitation of the site presents the opportunity to recreate, as far as possible, some of the major features of its previous vegetation coverage.

Some impacts have been avoided or can be adequately mitigated or managed. However, some other impacts cannot be adequately mitigated. These relate to the loss of native vegetation as a consequence of sand extraction.

As identified in **Section 4.10.9**, the following endangered ecological community (EEC) and threatened flora species are likely to be affected by the proposal:

- approximately 5.2 hectares of Shale Sandstone Transition Forest (EEC);
- approximately 5.4 hectares of Sydney Sandstone Ridgetop Woodland; and
- approximately 42 individuals of *Tetratheca glandulosa*.

It is therefore proposed to address these residual impacts by implementing an offset strategy that would contribute to the long term conservation and enhancement of local biodiversity values. The development of the Biodiversity Offset Strategy would be based on the principles set out in Appendix 2 of *Guidelines for Biodiversity Certification of Environmental Planning Instruments, Working Draft* (Department of Environment and Climate Change 2007). These are:

- inclusion of all appropriate measures to eliminate offsite impacts on biodiversity values;
- addressing all regulatory requirements;
- application of sound ecological principles;
- achievement of a net improvement in biodiversity values over time;
- provision of management resources to achieve a permanent improvement;
- agreement on measures to be implemented prior to the occurrence of the impacts;
- clear focus on measures directly related to the identified loss of biodiversity resulting from the Proposal, appropriately located and targeted on biodiversity priorities; and
- amenable to monitoring to determine that actions are leading to positive outcomes.

Based on the results of the ecological assessments undertaken for the environmental assessment and the discussion of impacts, a preliminary offset strategy has been identified. This comprises a set of actions which could be implemented to offset residual biodiversity impacts. It is anticipated that through further investigations and consideration involving consultation with government agencies that these actions would be refined to form the adopted offset strategy for the proposal. The principle components of the Offset Strategy are:

- Provision of compensatory habitat through revegetation of land surplus to final use of the site. Availability of suitable land within the site would determine the location of those areas to be revegetated. As far as possible, these would be contiguous with the appropriate vegetation communities not disturbed by site activities or those located adjacent to the site boundary.
- Supplementary revegetation and enhancement of retained vegetation within the site.

Figure 4.12 shows 5.2 hectares of Shale Sandstone Transition Forest to be removed as part of the proposal. Areas considered suitable for revegetation with the principle flora species making up this community and derived from seed obtained from the existing woodland have been identified and make up approximately 12 hectares resulting in a 2:1 compensatory ratio. Approximately 5.4 hectares of the Sydney Sandstone Ridgetop Woodland would also be removed. Compensation for this loss would be provided by suitable revegetation of the steeper slopes around the periphery of the site. No Sydney Sandstone Gully Forest would be removed.

Areas of known *Tetratheca glandulosa* would be marked and protected with suitable setback distances maintained where these are in the proximity of the extraction areas.

4.11 Cultural heritage

4.11.1 Introduction

A survey for Aboriginal sites in the vicinity of the former Maroota Trig was carried out by John Edgar in July 1995 (Corkill 1995) as part of the EIS supporting the original application to Baulkham Hills Shire Council to extract sand from the site (Collin Donges & Associates 1996). The survey covered the entire site subject to the current application with the exception of Lot 2 DP752039. It identified one open site, a scatter of five stone artifacts (MR1) in addition to two isolated stone artifacts (IF1 and IF2) and concluded that both, located in areas of heavy and continuous disturbance, had low archaeological significance. A second survey was undertaken as part of the current environmental assessment covering Lot 2 DP752039 and Lot 1 DP34599 (Navin Officer 2004). This is summarised in the following sections and is included as **Technical Paper 7** in Volume Three with the earlier study attached as an appendix.

4.11.2 Aboriginal heritage

A survey of Aboriginal Archaeological Sites on the areas proposed for extraction was undertaken in August 2004. The archaeologists were accompanied by representatives of the Deerubin Local Aboriginal Land Council, Darug Tribal Aboriginal Corporation and the Darug Custodians Aboriginal Corporation. The report of this survey and its findings is provided in **Technical Paper 7**.

The assessment included four main components:

- review of existing documentation;
- liaison with relevant local Aboriginal organisations;
- field survey of the study area; and

- assessment of site significance.

Previous archaeological impact assessments in the Maroota area have identified 99 sites within a five kilometre radius of the Hitchcock Road site. These have been recorded on the Aboriginal Heritage Information Management System held by the Department of Environment and Climate Change. Some of these sites comprise multiple elements or features, such as a shelter containing art, deposit and engravings totaling 112 occurrences. The majority of these, approximately one third of the total comprised rock engravings.

Archaeological survey has previously been undertaken within the present study area. Edgar (1995) completed an assessment of the entire 100 hectares of the Hitchcock Road mining area. The report aimed to assess the impacts of development of the sand quarry operation on Aboriginal heritage sites (Edgar 1995). Edgar found that much of the study area (50%) had been heavily disturbed by previous land use practices such as orchard and vegetable gardens. The rest of the study area had been disturbed through sand mining, clearing and dam construction (Edgar 1995:3).

Three Aboriginal sites were identified, a scatter of five artifacts (MR1) and two isolated finds (IF1, IF2), all within the south eastern part of the study area. The isolated finds were found on the edge of a dam where visibility was 100 percent. These are shown in **Figure 4.13**. They are not located in the area included in the proposal.

The most relevant site was therefore MR1. It consisted of five artifacts scattered within the cleared ground used as the fuel depot. The ground surface had been leveled and highly disturbed. Edgar found that there was no potential for subsurface deposits in the immediate vicinity of MR1 and that visibility was good within the surrounding forest (Edgar 1995:11). Edgar concluded that the site had low significance due to the level of disturbance, while also acknowledging that such open sites are rare in the Hawkesbury sandstone region.

Corkill (1989) investigated about 40 hectares of land comprising Lots 198 and 35 and Lot 1 DP588936, adjoining blocks about one kilometre north of the present study area, for extension of sand mining proposals. Much of the study area was disturbed through clearing, excavation and dumping. The survey was carried out on foot, inspecting all rock exposures and areas of bare ground such as vehicle tracks. No sites were found during the survey, no areas of rock overhangs suitable for occupation were identified, and none of the rock platforms showed engravings, despite close inspection (Corkill 1989:7-8). Additional surveys by Corkill in the Maroota area associated with the sand mining operations also failed to find any archaeological sites (Corkill 1991a, 1991b, 1991c).

The largest survey apart from the Edgar (1995) study was a comprehensive survey of 3.45 square kilometres conducted by Koettig within the upper catchment of Little Cattai Creek (Koettig 1989). This area is situated to the southwest of the present study area. The survey detected 14 archaeological sites, 97 rock shelters where past Aboriginal occupation or utilisation was considered to have been possible, and three isolated finds. The recorded sites consisted of nine shelters with art (three with occupation deposit), one open engraving site and four open sites with grinding grooves. A small percentage of the total survey area included ridgeline contexts on the main watershed ridgeline.

Corkill (1994) surveyed another sand mining operation about three kilometres north of the present study area and four new sites were identified. Site CC1 comprised two sets of grinding grooves with nine and 11 definite grooves about 20 metres apart within the bedrock of an ephemeral drainage line. Site CC2 comprised two engravings and a set of 11 grinding grooves about 10 metres from the engravings. The engravings were found on a boulder about 20 metres above the creek and the grooves were located within a



Figure 4.13

ABORIGINAL AND EUROPEAN HERITAGE ITEMS

- Isolated find (IF)
- Artifact scatter (MR)
- Potential archaeological deposit (MRPAD)
- HRH European site
- Area previously subject to sand extraction or agriculture

shallow rock-lined watercourse. The third site, CC3 was a shelter with deposit and a single silcrete flake. A second shelter with deposit CC4, contained two basalt flakes that showed evidence of grinding. Another shelter with potential archaeological deposit but no artifacts was also located (Corkill 1994).

4.11.3 Aboriginal sites

No Aboriginal sites were identified during the survey.

A thorough inspection of the location of site MR1 was carried out but no artifacts were found. The area had been recently graded and debris pushed into large piles of soil and rubbish. This activity may well have removed any artifacts.

A potential archaeological deposit (PAD) is defined as any location where the potential for subsurface archaeological material is considered to be moderate or high, relative to the surrounding study area landscape. Archaeological potential is assessed using criteria developed from the results of previous surveys and excavations relevant to the region.

The boundaries of PADs are generally defined by the extent of particular landforms known to have high correlation with archaeological material. A PAD may or may not be associated with surface artifacts. In the absence of artifacts, a location with potential will be recorded as a PAD. Where one or more surface artifacts occur on a sedimentary deposit, a PAD may also be identified where there is insufficient evidence to assess the nature and content of the underlying deposit. This is mostly due to poor ground surface visibility.

The topographic location of the site MR1 is on a flat spur crest at the head of Cattai Creek. The topographic feature extended beyond the disturbance into areas of more natural vegetation that had been considerably less disturbed. It is possible and even likely therefore that the artifact scatter extends beyond the heavily disturbed area into the remnant forest. Although the crest of the spur line has shallow soils, visibility was poor enough to prevent making unequivocal statements about the potential for the site to be larger, with the main area of visibility provided by a track with sandy sheet wash.

The section of spur crest retaining native vegetation therefore has been identified as having potential archaeological deposit, even though the actual deposits may be shallow. The crest area extends for approximately 200 by 100 metres. This area is referred to as MRPAD1.

4.11.4 European heritage

Settlers had moved into the area west of Wisemans Ferry by the late eighteenth century and grain and other crops were being grown for the colony. These early farmers provided Sydney Town with a great deal of its food. The produce was delivered by boat down the Hawkesbury River - a situation which saw Wisemans Ferry rapidly develop as an important river port - out into the Pacific Ocean and around into Sydney Harbour.

The convict Solomon Wiseman arrived in Sydney on 20 August 1806. In 1817 he was granted 200 acres on the banks of the Hawkesbury River where by 1821 he had established an inn called the Sign of the Packet. In 1826 he built himself a two-storey residence, Cobham Hall, which he later used as a hostelry calling it The Branch Inn.

During this time the main land route from Sydney to Newcastle was via Windsor, along to Wisemans Ferry and up the Putty Road to Singleton. Governor Darling had ordered the construction of a road from Sydney to the Hunter Valley after receiving a petition from settlers in the Hunter Valley.

Construction of the Great North Road, as it was called, started in 1826 from Castle Hill and proceeded to Wisemans Ferry and on to the Hunter. It was finished in 1836 but even as the convict gangs working on the project completed their task, the Wisemans Ferry section had fallen into disuse. The road was not the most favoured route due to the threat from bushrangers, its isolation and lack of facilities such as hotels. Other routes emerged and the impact of the paddle steamer industry also meant that there were more efficient means of travel (Comber 1990).

The Maroota Trigonometrical Station, which formed part of the main geodetic network of NSW, was originally a stone cairn type constructed in 1880. The Maroota parish map indicates that the station was first notified in 1888 but the original trig has been destroyed. It was replaced in 1974 with a standard concrete pillar trigonometrical station (TS2985 [P] Maroota) which is located 3.5 metres east of the original stone trig site. The reserve number is 6739 (personal communication, Paul Neale, Survey Services, NSW Department of Lands 2004).

The Maroota Trigonometrical Station is typical of the standard and most common type in NSW. It is less than 50 years of age and as such is not a heritage item under the NSW Heritage Act.

4.11.5 European sites

One European site (HRH1) was located during the investigations.

The site was a simple farm shed but appeared to be over 50 years of age and therefore of potential heritage significance. The shed was about 12 metres long, seven metres wide and three metres high at its northern end. It comprised a gable roof at the southern end and a simple sloping awning type roof at the northern end. This section had been upgraded recently with new battens and corrugated iron.

The main part of the semi-enclosed shed was constructed with upright timber slabs, probably taken from the back of sleepers. Internal posts have been squared using an adze and there was a double swinging door at the southern end for vehicles. There were also two person doors, one at the eastern side and one on the southern end of the shed.

In general the shed is in poor condition and does not appear to be in use except to house disused farm equipment and vehicles.

Moveable items in the shed included a fruit conveyor, old rotary hoe, a trailer, vehicle chassis and various pieces of timber and wooden fruit boxes.

The farm shed located during the survey does not meet the threshold where it would be considered significant under any of the criteria established by the NSW Heritage Office. The site does not therefore require any additional assessment or listing on any of the local or State registers.

4.12 Traffic and access

4.12.1 Existing road network and traffic conditions

Wisemans Ferry Road

Wisemans Ferry Road is a two lane, two-way rural road with a posted speed of 70 kilometres per hour in the vicinity of the site entrance. Access to the site is available via an existing intersection on Wisemans Ferry Road, located approximately 400 metres south of the Old Northern Road intersection. This intersection provides access to both the western section containing the central process plant (Lot 198) and the eastern section

(Hitchcock Road). Wisemans Ferry Road provides access to Pitt Town and Windsor to the south-west and connects to Old Northern Road to the north-west of the site.

Changes in traffic volumes from 1987 to 2002 on Wisemans Ferry Road, south of Old Northern Road are shown in **Table 4.12**. The annual average daily traffic in 2002 was 1,745 vehicles. The annual average daily traffic on Wisemans Ferry Road increased at a rate of less than one percent per annum over the 15 year period, well below the metropolitan average. Since 1999, traffic on Wisemans Ferry Road has declined at a rate of 1.3 percent per annum in the most recent three year period.

Full traffic classification counts were conducted on Wisemans Ferry Road north of the site entrance. These data were collected for a week between 17 and 23 July 2004. The counts show that average daily traffic (seven-day average) of 1,505 vehicles per day was recorded at this point. This is equivalent to 1,862 axle pairs per day, which is slightly higher than the Annual Average Daily Traffic figure reported by the RTA for 2002. While this may indicate an increase in traffic volumes on Wisemans Ferry Road, the difference could also be attributed to seasonal adjustments by the RTA which are not explained and cannot be taken into account in comparison to the full classification counts.

Table 4.12: Traffic on Wisemans Ferry Road, south of Old Northern Road

Year	Annual Average Daily Traffic
1987	1,663
1989	1,481
1991	1,573
1993	1,636
1996	--
1999	1,820
2002	1,745

Source: Traffic Volume Data for Sydney Region, RTA, 2002

The two-way peak hour traffic for an average weekday occurred from 08.00 to 09.00 hours and 16.00 to 17.00 hours during the morning and evening peak periods respectively. The peak hour volumes are summarised in **Table 4.13**.

Table 4.13: Average weekday peak hour volumes on Wisemans Ferry Road, north of the site entrance 2004

	Northbound	Southbound	Total
Morning Peak (8.00 to 9.00)	78 (9.8%)	48 (6.1%)	126 (8.0%)
Evening Peak (4.00 to 5.00)	52 (6.6%)	88 (11.2%)	140 (8.9%)

Average weekday traffic volume is 1,578 vehicles on Wisemans Ferry Road. The classification count shows that of these vehicles:

- 79 percent (or 1,249 vehicles) were light including cars, vans, or a car towing a boat (Classes 1 and 2);

- 13 percent (or 200 vehicles) were rigid trucks and buses (Classes 3, 4 and 5);
- 8 percent (or 121 vehicles) were articulated trucks with three to six axles (Classes 6, 7, 8 and 9); and
- less than one percent (or 7 vehicles) were B-Doubles (Classes 10, 11 and 12).

While overall traffic volumes were similar in both directions, the data show that there was an additional 47, or 94 percent of Class 3 vehicles (two axle trucks) traveling southbound compared to that class in northbound traffic. There was a similar reduction in the number of Class 1 vehicles (passenger cars) recorded for the southbound traffic. Class 3 vehicles (two axle trucks) had the second highest vehicle count for both directions followed by Class 9 vehicles (six axle articulated trucks). The highest number of vehicles counted was Class 1 vehicles (passenger cars).

These figures indicate a slight bias toward northbound traffic during the morning peak period, and the reverse is true for the evening peak period with a slight bias toward southbound traffic. The number of Class 3 vehicles (two axle trucks) was the highest during the evening peak period and the number of Class 9 vehicles (six axle articulated trucks) the highest following the morning peak period.

Old Northern Road

Old Northern Road is a two lane, two-way rural road with a posted speed of 70 kilometres per hour in the vicinity of the Wisemans Ferry Road intersection. Maroota Public School is located some 600 metres to the north of the intersection. Speeds are limited in the school zone to 40 kilometres per hour during school periods. There is a posted speed limit of 90 kilometres per hour to the south of the intersection. Old Northern Road provides access to Wisemans Ferry to the north, Glenorie and Dural to the south.

Table 4.14 shows the changes in traffic volumes from 1987 to 2002 on Old Northern Road, south of Wisemans Ferry Road. The annual average daily traffic in 2002 was 2,212 vehicles. Annual average daily traffic on Old Northern Road has increased at a rate of 1.5 percent per annum over the 15 year period.

Table 4.14: Traffic on Old Northern Road, south of Wisemans Ferry Road

Year	Annual Average Daily Traffic
1987	1,806
1989	1,502
1991	1,677
1993	1,996
1996	--
1999	2,108
2002	2,212

Source: Traffic Volume Data for Sydney Region, RTA, 2002

Full classification counts were conducted on Old Northern Road, south of Wisemans Ferry Road. These data were collected for the week between 17 July 2004 and 23 July 2004. The traffic counts generate an average daily traffic (seven-day average) of 1,837 vehicles on Old Northern Road. This is equivalent to 2,178 axle pairs per day, which is comparable to the annual average daily traffic figure for 2002. There has been no significant increase in traffic over the past two years.

Two-way peak hour traffic for an average weekday occurred from 07.00 to 08.00 hours and 16.00 to 17.00 hours during the morning and evening peak periods respectively. The peak hour volumes are summarised in **Table 4.15**.

Table 4.15: Average weekday peak hour volumes on Old Northern Road, south of Wisemans Ferry Road 2004

	Northbound	Southbound	Total
Morning Peak (8.00 to 9.00)	102 (10.9%)	47 (7.9%)	149 (7.9%)
Evening Peak (4.00 to 5.00)	61 (6.5%)	111 (11.5%)	172 (9.1%)

Average weekday traffic was 1,895 vehicles on Old Northern Road. The classification count shows that of these vehicles:

- 83 percent (or 1,567 vehicles) were light vehicles including cars, vans, or car towing a boat (Classes 1 and 2);
- 11 percent (or 209 vehicles) were rigid trucks and buses (Classes 3, 4 and 5);
- 6 percent (or 112 vehicles) were articulated trucks with three to six axles (Classes 6, 7, 8 and 9); and
- less than one percent (or 6 vehicles) were B-Doubles (Classes 10, 11 and 12).

Vehicle composition was similar in both directions, with northbound carrying slightly more articulated trucks during the day. The number of Class 3 vehicles (two axle trucks) was the second highest for both directions, followed by Class 9 vehicles (six axle articulated trucks). The highest number of vehicles counted was Class 1 vehicles (passenger cars).

The figures show a distinctive tidal flow during the peak periods, with a bias towards the northbound traffic during the morning peak period, with the reverse occurring during the evening peak period where the bias was towards the southbound traffic. The number of Class 3 vehicles and Class 9 vehicles (two axle trucks and six axle articulated trucks respectively) were the highest before the morning peak period.

4.12.2 Intersection turning movements

Full turning movement counts were conducted at two key intersections near the site along Wisemans Ferry Road: at Old Northern Road and at the site entrance. The counts were conducted on 22 July 2004 for four hours covering the morning peak period (from 05.00 to 09.00 hours) and for three hours covering the evening peak period (from 16.00 to 19.00 hours).

At the intersection of Wisemans Ferry Road and the quarry site entrance, the morning peak hour occurred between 08.00 and 09.00 hours. At the intersection of Wisemans Ferry Road with Old Northern Road, the morning peak hour occurred from 07.15 to 08.15 hours. The evening peak hour for both intersections occurred from 16.00 to 17.00 hours.

The morning peak hour for the heavy vehicle movements at the quarry site entrance occurred from 06.00 to 07.00 hours, earlier than the morning peak hour for all vehicles. As the variation in the heavy vehicle movements was minor compared to the light vehicle

movements during the surveyed period, the morning peak hour for the light vehicle movements was considered to be more significant and is therefore used in the assessment.

Analyses were undertaken for two intersections using the modeling software SIDRA. The intersection assessment results are summarised in **Table 4.16** and the criteria used for assessing intersection performance are discussed in **Technical Paper 3** in Volume Two.

The two intersections analysed are currently operating satisfactorily with a level of service A in both peak periods. The intersection results indicate that both intersections currently operate with minimal delays and virtually no queues form in either peak periods analysed. The results produced by SIDRA correlate very well with on-site observation of the current intersection performance.

Table 4.16 Intersection assessment

Intersection	Peak period	Assessment results			
		Degree of saturation	Delay (seconds)	Level of service	Queue length (m)
Wisemans Ferry Road/Old Northern Road	Morning	0.11	11	A	4
	Evening	0.08	11	A	3
Site Access/Wisemans Ferry Road	Morning	0.07	102	A	1
	Evening	0.07	10	A	1

4.12.3 Site access and internal haul road

Access to the site is available via an existing intersection on Wisemans Ferry Road, purposely built to accommodate heavy vehicle movements. This is located approximately 400 metres south of the Old Northern Road intersection. The intersection provides access to both the eastern section (the Hitchcock Road site) and the western section (Lot 198 and the central process plant).

As the proposed changes to sand extraction would occur mainly within the existing site boundaries, any additional traffic generated would continue to use the existing access on Wisemans Ferry Road.

The majority of traffic generated by the proposal to use Wisemans Ferry Road would be from the western site (Lot 198), as there will be no transport of Tertiary sand by truck from the site to the central wash plant, except during periods of routine maintenance or as a result of plant/pipeline breakdown.

It is also proposed to use the existing access onto Old Northern Road from Lot 1 DP34599 on a temporary basis for the transport of extracted friable sandstone which does not need to be washed at the central process plant. This is a high standard access with good sight lines along the road at a point where it has been widened to three lanes. The use of this access would not generate any additional truck movements.

4.12.4 Site traffic movements

The existing consent allows 200 laden trucks (or 400 truck movements) per day to be generated as a result of all PF Formation sand extraction activities in Baulkham Hills local government area. The site currently operates from 06.00 to 18.00 hours, Monday to Saturday. The proposal does not seek to amend the consent condition relating to the daily number of truck movements allowed.

Currently, there are between 50 and 60 laden truck movements per day generated by activities on the Hitchcock Road site. It is expected that future development on the Hitchcock Road site will not significantly increase the daily generation of laden truck movements although this will vary depending on market conditions. It is anticipated that up to an additional 20 laden trucks could be generated in each direction if the consent is extended to permit the processing of materials transported from sites other than the Hitchcock Road or Lot 198 developments. Depending on the material type, the incoming trucks would be processed either on the Hitchcock Road site or at the central process plant on Lot 198.

In addition to the Hitchcock Road development, the future development of Lot 198 would generate a maximum of 10 laden trips per day over the period from 2005 to 2010 onto Wisemans Ferry Road.

Due to variability in market demand over time and the low volume of heavy vehicles at the quarry site entrance, no specific pattern can be established for the truck movements in the area. Currently there is an approximate 50:50 split in truck movements between Old Northern Road and Wisemans Ferry Road and this is expected to continue. There are no existing route restrictions applying to truck movements in the region. In addition, it is assumed that the inbound and outbound truck movements are evenly distributed during the operating hours of the site.

As there is no proposed change to staff numbers as a result of the proposed development, it is assumed that there would be no variations in the movement of light vehicles to and from the site in the future.

Table 4.17 shows the estimated peak hour generation of the ultimate development. This includes the development of Hitchcock Road and Lot 198 site and the extension of the consent to process materials transported from other sites. The impact is small as for the most part the truck movements do not occur in peak traffic periods.

Table 4.17 Estimated peak hour traffic generation (trucks)

Development	Origin/destination	Morning peak		Evening peak	
		Wisemans Ferry Road	Old Northern Road	Wisemans Ferry Road	Old Northern Road
Hitchcock Road	Inbound	2	2	2	2
	Outbound	2	2	2	2
Lot 198	Inbound	1	1	1	1
	Outbound	1	1	1	1
Recycling	Inbound	1	1	1	1
	Outbound	1	1	1	1

4.12.5 Assessment of impacts

The performance of the two key intersections in the vicinity of sites under post-development conditions was simulated using SIDRA. As the proposed development could generate up to an additional 10 laden truck movements per day until the year 2015, this future year was adopted as representing the maximum generation of truck movements from the site. The post development conditions were analysed in two scenarios – one based on the projected 2006 traffic volumes and the other on the projected 2015 traffic

volumes using a growth factor derived from a 15 year range of RTA annual average daily traffic volumes.

2006 Scenario

The post-development intersection turning volumes for 2006 estimated by projecting the surveyed traffic flows using an average growth rate derived from traffic data for Old Northern Road, south of Wisemans Ferry Road. The post-development intersection assessment results are summarised in **Table 4.18**.

The proposed developments would have no significant impact on the performance of the two intersections analysed and would be operating satisfactorily with a level of service of A in both peak periods. Under 2006 post-development traffic conditions, the two key intersections would continue to experience minimal delays and virtually no queue in both peak periods. In essence, current intersection performance would be retained.

Table 4.18 Post development intersection assessment 2006

Intersection	Peak period	Assessment results			
		Degree of saturation	Delay (seconds)	Level of service	Queue length (m)
Wisemans Ferry Road/Old Northern Road	Morning	0.13	11	A	5
	Evening	0.10	11	A	4
Site Access/Wisemans Ferry Road	Morning	0.07	10	A	1
	Evening	0.07	10	A	1

2015 Scenario

The projected morning and evening peak hour volumes for 2015 post-development conditions were derived by superimposing the 2015 projected volumes onto traffic generated by the proposed developments. The post development intersection assessment results are summarised in **Table 4.19**

Table 4.19 Post development intersection assessment 2015

Intersection	Peak period	Assessment results			
		Degree of saturation	Delay (seconds)	Level of service	Queue length (m)
Wisemans Ferry Road/Old Northern Road	Morning	0.13	11	A	5
	Evening	0.10	12	A	4
Site Access/Wisemans Ferry Road	Morning	0.08	10	A	1
	Evening	0.08	11	A	1

The proposed developments would have no significant impact on the performance of the two intersections analysed. They would continue to operate satisfactorily with a level of service of A in both peak periods. The analysis results indicate that both intersections would operate with minimal delays and queue for both peak periods during the 2015 post development conditions. Both intersections would essentially retain their current 2004 base intersection performance even under the worst case scenario for traffic impact.

4.12.6 Mitigation measures

The aims of the proposed traffic impact mitigation measures are to:

- minimise the impact of trucks on the local road network and local residents;
- comply with approved access and vehicle movements under the existing development consent; and
- comply with the performance criteria for sand transport set out in *Baulkham Hills Development Control Plan 16*.

The results of the intersection analyses indicate that there would be significant spare capacity at the two key intersections within the vicinity of the sites. The intersections would be operating satisfactorily with a level of service of A in both peak periods under scenarios including additional traffic generated from the ultimate development of the Hitchcock Road and Lot 198 sites, the extension of the consent to include the processing of materials transported from other sites and projected traffic growth along Wisemans Ferry Road and Old Northern Road,. Both would retain their current intersection performance for both peak periods under the 2006 and 2015 peak post-development traffic conditions. Therefore no additional mitigation measures would be required in relation to infrastructure provision.

The existing quarry operates under an Environmental Management System (DFA Consultants, 1999), which includes an Environmental Procedure for Roads and Traffic Management. This procedure would be followed for the proposed operation and would be revised to include the following additional mitigation measures:

- all truck loads will be covered before leaving the site;
- the intersection and access road will be inspected by the site manager for damage to road surfaces on a monthly basis and damage repaired as required;
- the intersection will be inspected weekly by the site manager for accumulated sand and clay and maintained as necessary by removing the material;
- all new truck drivers will be provided with Site Induction for Drivers outlining site requirements and expected driver behaviour such as observing the speed limits and not using exhaust brakes in sensitive locations; and
- speed limited to 20 kilometres per hour on roads within the site.

4.13 Visual impacts

4.13.1 Objectives

The aim of the visual assessment is to:

- describe and illustrate the existing visual environment of the site and its surroundings;
- determine the sensitivity of the site to public view;
- determine the level of visual impact that the proposal would produce and establish appropriate development guidelines; and
- provide visual quality objectives for the development.

Commonly used methods of visual assessment seek to minimise its subjective nature (United States Forestry Service 1974, the Forestry Commission of Tasmania 1983 NSW Department of Planning 1988 and the Queensland Department of Main Roads 1997). The main elements of the assessment consider:

Visual quality-which measures the degree to which the visual aesthetics of a landscape are valued from a human perspective. Relevant studies by others have concluded that landscapes that are relatively natural and vegetated are preferred, especially those with water features, dramatic topography and visual contrasts. Landscapes least preferred are those with a high degree of human disturbance as well as those with few trees and landforms that are flat and unvaried (Wright 1973, Collieran and Gearing 1980).

Visual sensitivity-which measures the degree to which any visual change to the landscape is likely to affect humans. Locations normally most sensitive to visual change are those with high and/or fixed viewing populations, relatively natural settings and visually prominent and elevated sites. In addition, the closer the viewer is to the site of the change, the higher the potential for impact. Permanent visual impacts to residents are also obviously of more concern than the more transient impacts on passers-by.

Landscape change-the greater the proposal would contrast with the surrounding landscape, the more the type and severity of the landscape change would be an issue. Aspects of this could include dramatic alterations to the natural landform, the effect of the introduction of alien (urban) elements into a natural or rural landscape, visual separation between adjacent areas or the obstruction of existing and valued views. All these factors influence the extent to which the proposal would result in visual impacts.

Impacts over time-an allowance needs to be made for the changes that would occur over time following completion of the proposal, the implementation of any mitigation measures and their maturation. Impacts can be expected to be highest during and immediately following completion of extraction with a gradual reduction in impacts occurring as the surrounding landscape matures and viewers become more familiar with the permanent visual changes.

The following is a summary of the visual assessment which is included in full in **Technical Paper 8** in Volume Three.

4.13.2 Existing visual environment

The site is bounded to the north west by Wisemans Ferry Road, to the north east by Old Northern Road, to the west by Hitchcock Road and to the south and south east by adjoining Crown land which also constitutes the boundary of the Maroota sector of *Sydney Regional Environmental Plan 9 - Extractive Industry (No 2)*.

The dominant natural feature of the site is the former Maroota Trigonometrical Hill which reaches an elevation of 240.7 metres Australian Height Datum. The lowest point on the site has a level of approximately 188 metres Australian Height Datum while the majority the area has an elevation at or above 200 metres Australian Height Datum. The site is therefore generally higher than the surrounding areas. As a result, views into and across the site from the peripheral roads are limited to a small number of locations along Old Northern Road and Hitchcock Road. Views from other locations are restricted by rising ground within the site or bunds constructed as part of the present development.

The site is located in a rural environment at the southern end of the Maroota Ridge which forms part of the Hornsby Plateau. The Hawkesbury River is to the north west of the site within a deeply incised valley with heavily forested steep river terraces.

The high parts of the site provide views of the Blue Mountains to the west, the heavily forested areas to the south and across the cleared and cultivated areas to the east.

A number of visual mitigation measures, predominantly earth bunds along the periphery of the site included as part of the current development, have reinforced the natural screening effects of the topography resulting in a reduction in visual sensitivity.

4.13.3 Scenic quality guidelines

Under *Sydney Regional Environmental Plan 9 – Extractive Industry (No 2)* consent must not be granted to extractive industry on land identified in Schedules 1 or 2 unless a rehabilitation plan has been prepared. The form and content of the required plans is set out in the planning report attached to the plan. This includes an item on visual amenity of the site where its protection or improvement so that it blends into the surrounding landscape is considered to be a rehabilitation objective. Tree planting and/or a landscape program is required for visual screening, the reduction of wind-blown dust, noise attenuation or as part of the post-extraction land use.

Development Control Plan 16 – Extractive Industries (Baulkham Hills Shire Council 1997) addresses the issues of visual amenity and scenic quality and provides the following performance criteria:

- provision of setbacks capable of minimizing the visual impact of extraction sites particularly when viewed from surrounding private and public places;
- protection and retention of visible features of local historical, archaeological and geological significance;
- protection of the surrounding natural and/or rural landscape;
- minimise the sources of visual and other environmental pollution; and
- rehabilitation of extraction sites to a final landform capable of integrating with the physical elements and land use patterns contributing to the high scenic quality and diversity of a catchment.

4.13.4 Visual elements of the proposal

The proposed development would remove vegetation, topsoil, overburden and the available Tertiary Sand and friable sandstone resource from defined areas on the site. This would result in remoulding of the existing landform and, during active extraction, the exposure of substantial parts of the area. Progressive rehabilitation would return the site to a vegetated state as quickly as possible.

Visual mitigation measures such as bunds and vegetated setbacks have been implemented along the periphery of the site and parts of the site where extraction is complete have been reformed and seeded with local native species.

4.13.5 Mitigation measures

Extraction to date has taken place behind vegetated bunds within the setbacks prescribed in *Development Control Plan 16–Extractive Industry* (Baulkham Hills Shire Council 1997). This has resulted in the minimisation of visual impacts and will be extended, as appropriate, into those areas where extraction is yet to be undertaken.

Large-scale revegetation, predominantly on the steeper slopes would be undertaken as part of site rehabilitation. Over time, this would assist in blending the topography into the

surrounding area and remove visual contrast between the lighter colour of the disturbed parts of the site and the darker background of the existing native vegetation.

4.13.6 Assessment of impacts

While visibility is a key factor in determining the level of potential visual impact of a proposal, other considerations need to be addressed. These are:

- visual contrast with the surrounding landscape; and
- the capacity of the proposals including various mitigation measures and the time required to restore any contrasts that would occur as a result of the development.

The use of these two additional factors is based on the premise that all developments, particularly of this nature, will cause, to varying degrees, some form of visual contrast with the surrounding landscape. This contrast may take the form of landform contrasts, soil colour contrasts, vegetation pattern contrasts and so on. Depending on its extent, this contrast may, over time, be reduced so as to become negligible within the surrounding landscape. Factors which affect this recovery time include the capacity of the site to be rehabilitated, that is, soil types, water and nutrient availability and work programs specifically aimed at reducing the length of time that contrasts exist, such as progressive rehabilitation programs.

In determining the possible visual contrasts that could be generated by the development, the key variables are:

- landform - in terms of its change, its scale and its form;
- colour contrasts - caused by exposed soils, haul roads and other physical changes; and
- vegetation - changes to its pattern, particularly skyline vegetation.

Landform

The current landform would be substantially modified as a result of the proposed development. The former Maroota Trigonometrical Reserve hill, which has the highest elevation in the general area, is proposed for reduction with the result that its final form would be some 30 metres lower than its current level. The profile of the central part of the site would be changed from a ridge with steep batters to the north and south to a lower landform which is less visually prominent and better integrated with the surrounding topography with shallower batters. The final landform of the site is shown in **Figure 2.6**.

While the landform changes will be observable over a period of time, particularly on the high points of the site, there would come a point when these changes are no longer apparent. Boundary mounding and screen planting measures already in place, will ensure that any visual contrasts developed as a result of the landform changes would be reduced.

Colour contrasts

The most observable contrast of the proposed development would result from the exposure to public view of the yellow coloured sand which could cause a distinct colour contrast with the surrounding landscape. This is currently visible from a small number of locations around the periphery of the site.

While it is an expected contrast of a quarry operation, it is also readily and permanently removed once a grass cover is established. Sensitive mine planning, progressive

rehabilitation and an ongoing maintenance program permanently solves this potential problem.

Vegetation

The greatest visual contrast caused by the removal of sections of vegetation occurs when the site has a uniform tree cover, or when the vegetation removal occurs on the skyline in respect to the observer's viewpoint.

When trees are removed from landscapes that have a diverse vegetation pattern where a mixture of treed and cleared area exists, as on the Hitchcock Road site, the impact or contrast caused by their removal can be regarded as low.

On this basis, the removal of the skyline vegetation from the former Trigonometrical Reserve hill ridge top will result in visual contrasts until the ridge top itself is removed. Vegetation removal from other areas within the site excluding that to be retained for visual reasons would generally not cause a contrast due to the diverse vegetation pattern on the site.

Potential visual contrasts could readily be generated by this development if due care is not undertaken. However these contrasts can be generally minimised, at worst reduced, and at best eliminated, through sensitive planning of mine operations, provision of mitigation measures (such as boundary mounding and screen planting) and the progressive rehabilitation of works areas together with an ongoing maintenance program.

Recovery time

The third key factor in determining the visual impact of a proposed development, relates to the ability of the landscape to either absorb or disguise the contrasts caused, and thus the time frame in which this will occur.

The principal natural elements which determine the site's ability to disguise these contrasts and minimise recovery time include the biophysical elements pertaining to the site itself - that is, its landform, its vegetation screening ability, the ability of the soils to develop new fast growth and the level of rainfall.

Human intervention in the process relates to:

- determining guidelines and design techniques to help and assist absorb or disguise visual contrasts such as mine planning and the retention of existing or development of new screening; and
- influencing prevailing biophysical factors by progressive rehabilitation, improving soil quality and providing continuing maintenance.

As a result of the extensive change proposed at the site, few of the natural biophysical elements will remain to help absorb visual contrasts and minimise recovery time of the landscape. This process is therefore reliant on the provision of mitigation measures, many of which have been implemented as part of the present development.

4.13.7 Conclusions

The site is only visible from publicly accessible areas at a small number of locations. This is due to the topography, peripheral bunds already in place and existing vegetation.

The highest points on the site are visible in the middle distance from Hearses Road. However, this is currently used by few people (it is not a through road) and will soon become part of a major sand extraction operation recently approved. Public access will

be limited or not available depending on site activities and views to the Hitchcock Road site will be across an active sand extraction operation. There are few, isolated, long distance views to the site from Wisemans Ferry Road.

Limited views of the extraction area proposed for Lot 2 DP555184 would be available from a short section of Old Northern Road when travelling to the south. However, the introduction of intervening bunds and additional screening vegetation would eliminate these. Views of the current extraction activities on Lot 1 DP34599 are not visible from Old Northern Road due to the topography which slopes away from the road and intervening dense vegetation which would not be removed as part of the proposal.

Visual impacts of current operations on the site are minimal and the proposed development would result in minor visual changes which are unlikely to be visible to the public.

4.14 Hazard and risk

4.14.1 Assessment of hazard

State Environmental Planning Policy 33 – Hazardous and Offensive Development requires that the safety and pollution impacts of a proposal are addressed at an early stage of the development application process. The policy provides a procedure which links the permissibility of the proposal to its safety and pollution control performance.

If a proposal is either potentially hazardous and/or potentially offensive, the policy applies. *Applying State Environmental Planning Policy 33* (Department of Urban Affairs and Planning 1994) provides a method of determining if a proposal falls into these categories.

The policy specifies screening thresholds based on the quantity of a potentially hazardous substance or on the quantity of the substance relative to the distance from where it will be stored to the nearest site boundary. If the storage quantity proposed exceeds the relevant threshold, the preparation of a preliminary hazard analysis is required.

State Planning Policy 33 defines hazardous materials as substances falling within the classification of the *Australian code for the Transport of Dangerous Goods by Road or Rail* otherwise known as the *Australian Dangerous Goods Code* (Federal Office of Road Safety 1992). Raw materials to be extracted, processed and stockpiled on the site are not classified as hazardous substances under this code. Diesel fuel and lubricating oil are stored at the workshop on Lot 198 in bunded compounds and would not be stored on site. Both of these are combustible liquids, Class C1 and C2 respectively but are not classified as hazardous substances under the *Australian Dangerous Goods Code*.

The application of the screening procedure set out in *Applying State Environmental Planning Policy 33* indicated that as no hazardous materials as defined by the code were stored on site, the development is not classified as hazardous and State Environmental Planning Policy does not apply.

4.14.2 Assessment of offensiveness

A development is potentially offensive if, in the absence of safeguards, it would emit a discharge resulting in significant offence. *Applying State Environmental Planning Policy 33* recommends that the following are considered when determining if a proposal is potentially offensive:

- is a licence required under any pollution control legislation administered by the EPA (now the Department of Environment and Conservation)? If so, the proposal should be considered potentially offensive;
- does the proposal require any pollution control approval required by any legislation or by-law administered by the council? and
- if such a pollution control licence or approval is not required, does the proposal cause offence having regard to the sensitivity of the receiving environment?

The key issue in assessing the potential offensiveness of a proposal is the presence of adequate safeguards to ensure control of emissions from a facility. In the majority of cases, compliance with a pollution control licence under Department of Environment and Conservation legislation is sufficient to demonstrate that a proposal is not offensive. Where the proposal does not require such a licence, additional licence requirements under other consent authorities need to be considered.

The development proposed requires an environmental protection licence from the Department of Environment and Conservation under the *Protection of the Environment Operations Act, 1997* as scheduled works or activities would be carried out on the site. Compliance with the conditions of this licence would ensure minimal offence.

The implementation of safeguards and compliance with the Environment Protection Licence would ensure that the proposal is not offensive.

4.14.3 Assessment of risk

The risks associated with the operations undertaken at the site relate to environmental issues such as landslip and bush fire. The storage and use of dangerous goods is discussed in **Section 4.14.1**.

Land slip

The land slip potential of the site is limited to failure of excavated sand profiles within the operational areas, along the haul road and access roads to the cut faces and within batters associated with detention ponds and acoustic bunds.

Potential hazards of land slip would be mitigated by drainage control measures which divert surface runoff away from excavated areas and the use of appropriately designed batters with intermediate benches during extraction and bund construction. The excavated faces and bunds would be completed to maximum final slopes of 1 vertical to 3 horizontal to reduce their susceptibility to failure. All extraction operations would be undertaken in compliance with standard quarry safety procedures.

Bush fire

Approximately 35 percent of the total area of the site is classified as Vegetation Category 1 on Bush Fire Prone Land map, Sheet 12 (Baulkham Hills Shire Council 2004) while the remaining areas are Vegetation Buffer (100m x 30m) (50%) or unclassified (15%). Vegetation Category 1 includes Groups 1 and 2 vegetation types which are forest, woodlands, heaths and wetlands. Agricultural lands used for annual and/or perennial cropping, orchards, market gardens and nurseries are excluded from these categories.

The site comprises cleared agricultural land which has experienced extensive sand extraction. There remain isolated stands of vegetation within this area and extensive areas of woodland are located in the south eastern parts of the site contiguous with the denser vegetation of Maroota State Forest creating a potential fire hazard downslope of the site.

The proposal would require the removal of isolated stands of trees and shrubs and a proportion of the denser woodland would also be removed where necessary. Access is available via the current haul road and an ample water supply is available for fighting fires from existing dams across the site. The proposal would progressively reduce the bush fire hazard on the site although substantial areas of woodland would remain in the south eastern part of the site together with a small number of dwellings within or adjacent to its boundary.

Bushfire response measures would include:

- provision of training on related hazards and fire control for all site operatives;
- establishment of response procedures for the control of accidental fires;
- identification of potential fire hazards and establishment of coordinated response procedures with Council and the Rural Fire Service;
- provision of well-maintained fire fighting equipment;
- fitting of spark arresters on equipment; and
- provision of fire extinguishers in all on-site vehicles.

A detailed set of bushfire mitigation measures is included in the current Environmental Management Plan for the site. These would be reviewed and amended if necessary.

4.15 Waste management

Waste from the proposed development would comprise:

- vegetable matter from clearing;
- overburden from the initial extraction works;
- tailings from the wash plant;
- used oils, filters and machinery parts;
- wastewater from the existing amenities; and
- general office and administration waste.

The overall waste management objective is to minimise the generation of waste, maximise recycling and ensure that wastes are managed in a way that minimises impacts on the environment.

Trees, shrubs and other plants stripped during site clearing would be reused during rehabilitation to provide a source of seed, organic matter and refuge for fauna.

All overburden would be used in rehabilitation of the previously extracted area or adjacent parts of the site. Tailings, the fine clays and silts that are removed from the sand during washing would be disposed of in tailings ponds on the site.

General waste would be managed at the workshop and offices on Lot 198 which provides separate receptacles for paper, aluminium, glass, plastic and general domestic

waste with the recyclables (paper, aluminium, glass and plastic) collected by a licensed disposal contractor.

Sewage treatment and disposal is provided by an *enviro-cycle* type plant. It is not proposed to install any additional office facilities or amenities on the site.

Waste oil and grease is collected and stored in a bunded tank and periodically removed by a licensed oil recycling contractor. Building waste and putrescible material is also removed from site on a regular basis and this procedure would continue.

4.16 Socio-economic effects

4.16.1 Population profile and future growth

Information on the population of Baulkham Hills Shire has been derived from *Baulkham Hills Demographic Profile* (Nexus Learning Systems 1999) and the 2001 and 2006 Census data (Australian Bureau of Statistics). Maroota is located in the Wisemans Ferry Planning District of the Shire.

The population of Baulkham Hills Shire was 119,545 in 1996. This rose to 139,403 in 2001 and 159,391 in 2006 at an average annual growth rate of 3.3 percent, one of the highest in NSW. The age structure of the local population compared to that in the Sydney Statistical Division and NSW as a whole is shown in **Table 4.20**.

Table 4.20 Population age profile of Baulkham Hills Shire

Age	Baulkham Hills local government area (percentage)		Sydney 2006 (percentage)	NSW 2006 (percentage)
	2001	2006		
0-4	6.4	6.6	6.6	6.4
5-14	15.4	15.0	13.0	13.4
15-24	15.3	14.7	13.8	13.3
25-54	44.2	42.4	44.1	42.0
55-64	10.6	12.2	10.2	11.0
65+	8.0	9.1	12.3	13.8
Total	100	100	100	100

Source: Australian Bureau of Statistics

This growth is taking place in the southern parts of the shire and in the adjacent local government area of Blacktown. Growth is expected to continue at rates similar to those experienced over the past five years resulting in a shire population of 180,000 by 2011. However, this projection was based on a population of 150,000 in 2001 which was not achieved. There are no urban growth areas in the northern parts of the shire. Population growth here is restricted by a limited road network, steep topography and sensitive land uses which are protected by restrictive zoning.

4.16.2 Employment

In 2006, 63.6 percent of the residents of Baulkham Hills over the age of 15 were in full-time employment (27.9 percent were in part-time employment). This showed a decrease over

the percentage for 2001 (68.5 percent) but is higher than that for Sydney (60.8 percent) and for NSW (63.1 percent). The employment profile for the shire in 2006 is shown in **Table 4.21**.

Industries with the highest participation in 2006 in Baulkham Hills were the retail trade, health and social services and professional, scientific and technical services. The proportion employed in the shire in construction, wholesale and retail trade and education exceeded that for Sydney as a whole but a smaller proportion was employed in manufacturing, accommodation and food services, government administration and support and arts and recreational services. Only 0.1 percent was employed in the mining industry compared to the state figure of 0.7 percent.

Table 4.21 Persons employed by industry 2006

Industry	Persons employed (percentage)		
	Baulkham Hills	Sydney	NSW
Agriculture, forestry and fishing	0.6	0.4	2.7
Mining	0.1	0.2	0.7
Manufacturing	9.4	9.7	9.6
Electricity, gas and water supply	0.8	0.8	1.0
Construction	8.0	7.1	7.3
Wholesale trade	7.4	5.6	4.7
Retail trade	11.6	10.4	11.1
Accommodation and food services	4.6	6.0	6.5
Transport, postal and warehousing	3.4	5.3	5.0
Information, media and telecommunications	2.6	3.0	2.4
Finance and insurance services	6.2	6.4	5.0
Rental, hiring and real estate services	2.1	1.8	1.7
Professional, scientific and technical services	9.5	9.9	7.3
Administrative and support services	2.7	3.4	3.1
Public administration and safety	4.7	5.6	6.0
Education and training	8.6	7.2	7.5
Health and social assistance	10.1	9.8	10.5
Arts and recreational services	1.2	1.5	1.4
Other services	4.1	3.7	3.8
Inadequately described/not stated	2.3	2.8	2.7
Total	100.0	100.0	100.0

Source: Australian Bureau of Statistics

4.16.3 Community relations

The Environmental Management Plan prepared for the Hitchcock Road Sand Extraction and Rehabilitation Project (DFA Consultants 1999 updated 2004) provides details of the management procedures adopted for community relations and complaints protocols to

effectively manage and monitor social impacts of sand extraction activities in Maroota. These procedures would be followed for the proposal on Lot 198, including:

- biannual liaison and review committee meetings involving three permanent Maroota residents not associated with PF Formation, two Council representatives, one representative each of the Department of Environment and Conservation and the Department of Infrastructure, Planning and natural Resources, representatives of PF Formation and any other persons considered appropriate by Council;
- telephone complaints line open during operating hours with the telephone number advertised locally;
- all complaints/concerns raised by the community/relevant authorities recorded in the Complaints Register retained at the site office on Lot 198. All complaints are brought to the attention of the site manager within 24 hours of receipt. The site manager is responsible for initiating appropriate action in response to the complaint and contacting the complainant to resolve the issue;
- preparation of articles for the local community newspaper (Living Heritage) including discussion of mining issues of interest; and
- preparation of the annual environmental management plan, the audit section of which is available for public inspection.

The community has been involved in the planning stages of the development proposal and the preparation of the environmental assessment. A newsletter outlining the proposal was distributed to the local community providing a telephone information line and email address to provide a channel for the expression of concerns, obtaining information and discussing issues. A public meeting was held in December 2004 to present the proposed development to the local community, discuss concerns and receive feedback.

All adjacent landowners and residents were notified of progress with the application in August 2006 and responses requested. Details have been included on the PF Formation web site including a freecall telephone number and a link to the Major Project application and its supporting documentation on the Department of Planning web site.

4.16.4 Community impacts

The proposed sand extraction will service the same market as previous operations undertaken by PF Formation at Maroota, will employ the same number of staff and use the same fixed and ancillary plant. Negative effects on local employment and the economy are therefore unlikely.

Socio-economic benefits of the proposal include the continuation of local employment, continuing supply of high quality sand to the Sydney market and continuing flow-on effects to the local and regional economy.

4.17 Sustainability

4.17.1 Assessment method

Ecologically sustainable development is the use, conservation and enhancement of community resources so that ecological processes, and hence the quality of life, are sustained and improved for present and future generations. It is based on four principles:

- the precautionary principle;
- social equity and intergenerational equity;
- conservation of biological diversity and ecological integrity; and
- improved valuation and pricing of environmental resources.

Applying these principles to the proposed development at Hitchcock Road would involve:

4.17.2 Precautionary principle

The precautionary principle posits that threats of serious or irreversible damage, which lack full scientific certainty, are not to be used as a reason for postponing measures to prevent environmental degradation (*Environmental Planning and Assessment Regulation, 1994*). In the application of this principle, decisions should be guided by careful evaluation to avoid, wherever practicable, serious or irreversible damage to the environment and an assessment of the consequences of various options (*Inter-Government Agreement on the Environment, 1992*).

Emphasis must be placed on anticipation and prevention of environmental damage and the environmental consequences of all site procedures. Any action likely to involve serious or irreversible environmental damage should be avoided and other options assessed.

A team of specialist consultants was engaged to examine the existing environment, predict potential impacts and design mitigation measures to ensure that the environment was protected to the satisfaction of statutory requirements and reasonable community expectations.

In order to avoid serious or irreversible damage to the environment all facets of the development have been carefully evaluated and environmental management techniques proposed. Environmental monitoring has been undertaken over the last six years in compliance with the consent orders for the current development. Environmental safeguards have been planned with a comprehensive knowledge of the existing environment and an appreciation of potentially harmful environmental impacts. Relevant Government authorities were consulted in the preparation of the environmental assessment to enable interested parties to comment on activities with the potential for environment degradation.

Where results may alter over time, influencing the extraction operation, these will continue to be monitored during the operation. For example, groundwater levels will be monitored to ensure that extraction does not reach the groundwater table. Noise and air quality monitoring will continue throughout the life of the development.

4.17.3 Social and intergenerational equity

Social equity involves fairer distribution of costs and benefits to improve the well being and welfare of the community. Social equity also includes intergenerational considerations which require the present generation to ensure that the health, diversity and productivity of the environment is maintained or enhanced, for the benefit of future generations.

Social equity within the current generation requires that the economic and social benefits of the proposed development are distributed appropriately among all members of the community. It is also necessary that environmental safeguards against degradation of flora and fauna, groundwater, surface water, cultural heritage, socio-economics, visual, acoustic and air amenity be implemented to ensure that no part of the community would be unacceptably disadvantaged.

The potentially adverse impacts on environmental resources likely to affect social equity have been assessed and mitigation measures recommended. These measures relate to erosion and sediment control, surface and groundwater management, air quality controls, noise controls, traffic and waste management. Implementation of the mitigation measures would result in a reduction in effects on social and intergenerational equity.

The proposed development would result in efficient resource recovery and contribute to local and regional economic growth promoting community well being through the provision of income, employment and construction resources. It is anticipated that the development would continue to contribute to the local and regional economy. The final landform would be integrated as far as possible into the local landscape, considering the needs of the future community and fauna populations in the Maroota area.

Social impacts of the proposal are assessed in **Section 4.15** and strategies outlined to ensure that the community is well informed about the project and has an effective means of voicing concerns and receiving feedback.

The sand would be used to produce a high quality product with a wide range of uses in the construction and building industries. The products used in the construction of roads and infrastructure would benefit both present and future generations given the extended life of infrastructure such as roads and buildings. In addition, the conversion of construction materials such as sand into finished infrastructure is a process of value adding to the resource and can be seen as a long-term investment in the material.

4.17.4 Ecological integrity and conservation of biological diversity

Biological diversity refers to the variety of genes, species, populations, communities and ecosystems and the linkages between them. Biological resources provide food, many medicines, fibres and industrial products. They are also responsible for vital ecological functions such as maintaining soil fertility and the supply of clean and fresh water. Maintenance of biodiversity will ensure life support functions and the provision of environmental resources for future generations.

The quarry plan aims to maximise the protection of biological diversity and ecological integrity by:

- progressive rehabilitation of the extracted areas;
- rehabilitation of the site with native species to maximise native fauna habitats and encourage their return to the site after quarrying;
- implementation of hazard controls to ensure risks such as fire on the site are minimised;
- ongoing monitoring of flora and fauna communities on the site to monitor viability; and
- providing a final landform that integrates elements of the local area.

4.17.5 Valuation of environmental resources

This principle involves consideration of all environmental resources, which may be affected by the proposal, including air, water, land and living things. It is a component of Intergenerational Equity as improved valuation and pricing of resources is paramount in achieving conservation of the natural environment for future generations. Applying standard methods of valuation and pricing to environmental resources is a difficult process given the intangible nature of much of the natural environment, for example visual amenity, cultural values and the atmosphere's ability to receive gaseous emissions. The environment has conventionally been considered to be a free resource and environmental factors have been excluded from determining the real cost of an activity. The real cost to the environment will become apparent using improved valuation and pricing and can be included in the costs of any development.

The value placed on environmental resources on and around the site is evident in the extent of environmental investigations, planning and design of impact mitigation measures to prevent irreversible damage of those resources. PF Formation currently undertakes environmental monitoring of its existing development and this would continue for the proposed development. The cost of this monitoring, ongoing investigations, planning, design and implementation of the mitigation measures has been factored into the company's economic analysis of the project.

4.17.6 Energy consumption and efficiency

Energy consumption relates predominantly to the use of machinery and equipment required to extract and process the sand produced on the site and transport it to market. This includes excavators, articulated trucks, bulldozers and pumps of various kinds. Reductions in energy use can be achieved by the introduction of more energy-efficient equipment and the regular replacement of high-use machinery by newer models with greater fuel economy.

Annual electricity consumption is approximately one million kilowatt hours which equates to 985 tonnes of greenhouse gas emissions per year. Approximately 400,000 litres of fuel, mainly diesel is consumed per year. PF Formation regularly updates its equipment and, where possible replaces petrol/diesel pumps with electric models and older equipment with more fuel efficient models.

There is a large maintenance workshop located on Lot 198 and all equipment and vehicles are regularly serviced to ensure that they are operating as efficiently as possible. This is undertaken in compliance with the requirements of the current environmental management plan.

4.18 Cumulative impacts

Cumulative effects of the proposal are those that need to be considered in conjunction with other developments in the Maroota area. The area has a number of sand extraction operations and as other major sources in the metropolitan area are exhausted, more sites in the area defined in Sydney Regional Environmental Plan 9 are likely to be opened up for development. The cumulative effects of extractive industries may include increases in noise and dust generation, decreases in surface and groundwater quality or quantity, reduction in flora and fauna species diversity and habitat, increased traffic, especially heavy trucks and a reduction in visual amenity.

Cumulative impacts would occur as a result of developments of two types:

- contemporary sand extraction operations currently underway. In addition to PF Formation's operations in Baulkham Hill and Hornsby, there are three other operators in the Maroota area: Dixon Sand, Sun-A-Rise (HB Maroota Pty Ltd) and Maroota Mining Pty Ltd (F Vella); and
- future sand extraction proposals either awaiting assessment or under preparation.

The baseline studies necessary for the technical investigations reported in the environmental assessment include the impacts of all sand extraction activities currently undertaken in the Maroota area. These include truck movements, noise, air quality and surface and groundwater quality. It is not, however possible in the context of a single development application to assess potential future cumulative impacts as the extent and location of new sand mining operations is unpredictable. Controls on the extent and scope of future development of this kind in the area are ultimately the responsibility of the Department of Planning.

The purpose of Sydney Regional Environmental Plan 9 is to assist in the development of extractive resources close to the Sydney metropolitan area so that the cost of supplying materials to the community could be kept at a reasonable level. The plan takes precedence over local planning instruments. It is inevitable therefore, that proposals will continue to be submitted for the continuation of existing extraction operations and new ones in the area designated for such activities in Maroota. This area will become increasingly significant as alternative sources become exhausted.

There are currently three sand extraction proposals at various stages in the approval and development process in the Maroota area which could result in cumulative impacts. These are:

- Sand extraction on Lots 1 and 2 DP 547255, Old Northern Road, Maroota using the existing process plant on Lot 196 DP 752025. This development has a life of 18 years from the date of consent and is currently underway. Production from the existing quarry and its extension is not to exceed 495,000 tonnes per year.
- Sand extraction on Lot 198 DP 752025, Wisemans Ferry Road, Maroota. The development application supported by an EIS was recently approved by Baulkham Hills Shire Council and extraction has commenced. Production would be expected to average 35,000 tonnes per year over a ten year life.
- Sand extraction on Lot 170 DP 664767, Lots A and B DP 407341 and Lots 176 and 177 DP 752039, Haerses Road, Maroota. The development application supported by an environmental assessment was recently approved by the Minister for Planning. The development would have a life of 25 years with an annual extraction rate of 250,000 tonnes. The proposal would use empty trucks returning to Lot 196 DP 752025 to transport the extracted material to the process plant. The annual production rate on Lot 196 would be in accordance with the approved maximum of 495,000 tonnes per year.

Each of these proposals has been assessed, in terms of its cumulative impact in relation to existing and future development in the Maroota area. The existing operations at the Hitchcock Road site are included in these assessments. As the proposal described and assessed in this environmental assessment would result in no change to environmental impacts with the exception of the final topography of the site, any additional cumulative impacts can be considered to be minimal.

Existing vehicle movements (quarry movements only) are approximately 160 vehicles per day on both Old Northern Road and Wisemans Ferry Road. This is less than half of approved quarry related movements in the Maroota area (Department of Infrastructure, Planning and Natural Resources 2004). No net increase in truck movements on the road network is expected to result following the approval of the Haerses Road development.

5

CHAPTER

ENVIRONMENTAL MANAGEMENT



Chapter Five Environmental management

5.1 Introduction

An environmental management plan (EMP) is in place and is implemented in compliance with the current consent orders. This comprises four main parts:

- Environmental Management System.

This section details the components of overall environmental management for the project including the environmental policies of Baulkham Hills Shire Council, relevant environmental legislation, the principles of ESD and the environmental objectives developed for the project.

- EMP Framework.

This provides the framework for the operational EMP including responsibilities, implementation, monitoring and auditing of the management procedures.

- Operational and Rehabilitation Phase Environmental Issues.

This section sets out the procedures to be undertaken during the operation of the project and its subsequent rehabilitation to ensure that environmental considerations are appropriately incorporated.

- Environmental Management Procedures – Operations and Rehabilitation.

This provides details of the procedures to be applied for management of environmental issues during the operational and rehabilitation phases of the development.

An environmental audit is conducted each year to determine the level of compliance with the standards and criteria set out in the consent orders and other relevant controlling documents. This includes detailed reports derived from monitoring over the previous year including:

- project status including site survey and volume of material extracted per month;
- air quality;
- noise;
- surface and groundwater;
- rehabilitation;
- social impact management; and
- ecological sustainability.

The existing EMP and the annual audit would remain as the principal components of the environmental management system operated at the site.

This chapter provides a summary of relevant mitigation measures. These have been implemented for each stage of development: pre-extraction, operations and rehabilitation, to date and would continue to be introduced during the following stages of development. The final part of the chapter contains the Draft Statement of Commitments.

5.2 Mitigation measures

5.2.1 Pre-extraction

Environmental monitoring

The existing environmental monitoring program would be reviewed to determine if any additional parameters are required to comply with the consent conditions. This may include installation of additional equipment or the need for further survey work in those areas not so far subject to extraction activities.

Water management and erosion/sediment control

Prior to extraction, the preliminary water management controls would be constructed for the initial works. These include temporary sediment controls in drainage lines to detain any sediment laden runoff from the clearing works and the initial silt pond draining to the existing clean water dam on Portion 167. The return water pipeline would be extended to complete the system.

Acoustic bunds

Bunds have been constructed on the perimeter of the site where extraction activities have been undertaken. Additional acoustic bunds are not required.

Flora and fauna

The following mitigation measures would be implemented prior to the start of sand extraction:

- preparation and implementation of a clearing management plan. The clearing protocols would include the following:
 - > shaking the tree using a bulldozer;
 - > slowly pushing the tree to the ground so that it largely remains intact;
 - > inspection of hollows and removal of any animals if possible (this should be discussed with the Department of Environment and Conservation)
 - > leaving the tree in place once felled for at least one day/night before removing to allow animals to relocate to nearby vegetation; and
 - > undertaking vegetation clearing during September/October or in March/May to avoid summer breeding seasons and the winter hibernation for hollow dependent species.
- installation of sediment control devices prior to clearing vegetation; and
- removal of topsoil from areas of native vegetation that are free of weeds and stockpiling for use in rehabilitation.

Traffic

No additional traffic controls are required as all traffic would enter and leave the site via the existing access from Wisemans Ferry Road. Infrequent use would be made of the existing access to Old Northern Road from Lot 1 DP34599 for the transport of friable

sandstone which does not require processing at the central wash plant. All delivery traffic would use the main access road from the weighbridge on Lot 198.

Community relations and complaints management

The local community would be notified of the start of the works under the new consent. This would include a reminder of the current complaints procedure.

Staff training

Staff would receive training on any specific environmental requirements pertaining to the areas where extraction is to commence within the scope of the training program included in the EMP.

5.2.2 Operations

Extraction operations include topsoil and overburden stripping, extraction of the resource, trucking to the slurry plant via the internal haul roads and backfilling for rehabilitation.

Water management and erosion/sediment control

Water management and erosion/sediment controls would be implemented as described in **Chapter Two**. These would continue and expand the controls already operating on the site.

Regular surveys of extraction depth and the monitoring of groundwater level on a regular basis would ensure that extraction does not intrude within two metres of the wet weather high groundwater table.

Noise mitigation

All extraction activities would be undertaken behind acoustic bunds three metres high. Annual reporting of monthly monitoring of noise levels at the closest sensitive receivers would determine compliance with the relevant criteria.

Air quality

Air quality mitigation measures would include:

- suppression of dust on all active extraction areas and the haul roads using a water cart;
- monthly air quality monitoring reported annually; and
- minimising the area of active extraction.

Flora and fauna

The following mitigation measures would be implemented during the operational stage of the development:

- preparation of a detailed Site Rehabilitation Plan including a vegetation offset strategy indicating the replacement of Shale Sandstone Transition Forest removed as part of the current proposal on the basis of two square metres replanted with seed or seedlings derived from the existing community where this is feasible for every one square metre removed. Other native vegetation removed would be replaced on an equivalent basis (one square metre for one square metre removed);

- the rehabilitation plan would include an integrated strategy of methods such as the direct seeding of local native grasses, transplanting or translocating native vegetation and maintenance weeding along constructed batter slopes and drainage lines. Salvaged materials such as dead wood and tree hollows would be considered for use in rehabilitation areas along with the use of artificial nest boxes.
- locally indigenous species would be used in landscaping and revegetation works;
- monitoring of groundwater would have regard to potential impacts on groundwater dependent ecosystems, in particular the Maroota Sand Swamp forest. If significant changes in groundwater levels and quality are noted appropriate corrective action would be taken; and
- a flora and fauna monitoring program would be prepared to assess the health and condition of vegetation communities and fauna habitats adjacent to the proposed extraction sites as well as the success of rehabilitation program.

Archaeology

No archaeological items have been located during the surveys of the site. If any are identified, work in its vicinity would cease until the National Parks and Wildlife Service or the NSW Heritage Office has been notified and advice sought.

Traffic

No additional traffic controls would be required as all traffic would use the existing access on Wisemans Ferry Road.

Waste management

Trees, shrubs and other plants stripped during site clearing would be reused during rehabilitation to provide a source of seed, organic matter and refuge for fauna.

All overburden would be used in rehabilitation of the previously extracted area or adjacent parts of the site. Tailings, the fine clays and silts removed from the sand during washing would be disposed of in tailings ponds on the site.

General waste would be managed at the workshop and offices on Lot 198 which provides separate receptacles for paper, aluminium, glass, plastic and general domestic waste with the recyclables (paper, aluminium, glass and plastic) collected by a licensed disposal contractor.

Sewage treatment and disposal is provided by an *enviro-cycle* type plant. It is not proposed to install any additional office facilities or amenities on the site.

Waste oil and grease is collected and stored in a bunded tank and periodically removed by a licensed oil recycling contractor. Building waste and putrescible material is also removed from site on a regular basis and this procedure would continue.

Hazard

All fuels and oils would be stored on Lot 198 within approved bunded storage areas.

5.2.3 Site rehabilitation

Rehabilitation works include capping of silt ponds, backfilling, spreading of topsoil, seeding and planting and maintenance including weed control and watering until establishment. Mitigation measures during this period include:

- retention of erosion and sediment controls until the rehabilitation works are complete;
- completion of an annual survey of the rehabilitation to assess floristic structure and diversity, robustness and fauna species diversity;
- watering of areas where backfilling is occurring;
- maintenance of rehabilitated areas until sufficiently established including watering, weed control and feral animal protection; and
- continuation of noise and air monitoring during earthworks undertaken as part of the rehabilitation program.

5.3 Environmental management plan

5.3.1 Introduction

An environmental management plan has been prepared for the existing operation on the site in compliance with the consent orders. The management strategy set out in this document will be reviewed and amended, as necessary, to include the environmental management requirements of the new development and respond to the consent conditions.

5.3.2 Environmental objectives

The existing environmental strategy has the following objectives:

- extract the available sand in a manner conforming with all relevant environmental legislation, regulations and guidelines
- rehabilitate the site and return the land to at least its present state of agricultural productivity
- re-establish existing vegetation communities on the site
- create a final landform aimed at maximising the charging and recharging of local groundwater resources

Targets for meeting the objectives are listed as performance criteria and summarised in **Table 5.1**.

Table 5.1 Summary of environmental objectives and targets

Environmental Issue	Objective	Target
Noise and Vibration	Minimise the impact of operational noise and vibration and achieve compliance with all relevant legislation and guidelines	Operational noise does not exceed DEC guideline limits and vibration does not result in complaints or cause structural damage to local buildings and structures
Air Quality	Minimise and control all emissions to the air	Dust from site operations and maintenance complies with DEC specified air quality criteria. Vehicle and plant emissions comply with regulations

Access and Traffic	Minimise the impact of operational traffic on the local community	Total truck movements generated by all PF Formation operations in Baulkham Hills Shire are not to exceed 200 laden vehicle movements per day via the intersection of Wisemans Ferry Road and the haulage road
Erosion and Sediment Control	Minimise erosion, sedimentation and impacts on water quality of the local watercourses	Soil erosion control measures are incorporated in the site operational procedures. As the site is internally draining, operations will have no impact on the hydrologic regime of downstream waterways
Water Management	Protection of local groundwater resources	The final maximum depth of extraction will be limited to 2m above the wet weather high groundwater level
Flora and Fauna	Minimise the risk of impacts to the natural environment (especially threatened species) and rehabilitate the site with an appropriate mix of local species	Areas of significant flora and fauna are protected. The site is successfully revegetated with the appropriate species in conformity with the approved rehabilitation plan
Rehabilitation	Complete staged rehabilitation in conformity with the approved plan	The site plus other land listed in the consent orders is successfully rehabilitated within three years of the cessation of extraction.
Social Impact Management	Ensure that the impacts of the project on the local community are understood and where feasible minimised	Establish a consultation program to inform members of the community and provide for community participation in decision making
Heritage	Ensure that items of Aboriginal archaeological or European heritage significance are recognised and protected or conserved during operations	Heritage items identified are protected
Visual Amenity	Minimise visual and amenity impacts on the community during project operations	No complaints received regarding visual impacts during project operations
Waste Management	Manage waste generated during operations in accordance with the preferred hierarchy of minimisation, reuse, recycling and disposal	Quantities of waste to disposal reduced and those to reuse increased. Wastes for disposal stored in appropriate areas and removed on a regular basis
Emergency Response	Ensure that appropriate procedures and training are in place to deal with emergencies	Maintain emergency response procedures and training up to date

Hazard, Risk and Safety	Ensure that the handling and storage of dangerous goods on site does not result in pollution of the environment or cause harm to individuals	Storage and handling of hazardous materials complies with legislative requirements. All pollution incidents contained and cleaned up without impact on the environment or injury to personnel. All incidents recorded.
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The environmental objectives of the proposed development are generally the same as those listed in **Table 5.1**. However, as a Major Development, the works will also need to satisfy the requirements of the Director-General of the Department of Planning.

5.3.3 Environmental procedures

Environmental procedures provide:

- objectives;
- actions or procedures to be undertaken;
- monitoring requirements;
- reporting requirements;
- persons responsible for carrying out the required actions; and
- reference information including consent conditions and relevant legislation and guidelines.

Procedures for the existing development include the following:

- induction and training;
- incident management;
- management of complaints;
- environmental review and reporting;
- hours of operation;
- permissible extraction program;
- buffer zones and protection of adjoining lands;
- water management;
- erosion and sediment control;
- acoustic management;
- air quality management;
- flora and fauna management;

- visual amenity;
- access and traffic;
- heritage;
- rehabilitation and revegetation;
- emergency response;
- hazard, risk and safety;
- social impact management; and
- waste management.

The strategy would be revised to incorporate additional environmental management requirements for the development area in response to the consent conditions.

5.4 Draft statement of commitments

The draft Statement of Commitments is set out in **Table 5.2**. Many of these are in place in relation to the current operations at the site.

Table 5.2 Draft statement of commitments

Issue	Commitment	Location in the EA	
		Main Volume	Technical Paper
Noise and Vibration	Site activities will be managed so that any necessary high noise and vibration levels occur at times of least impact.	4.8	TP4
	All site activities will be undertaken incorporating noise attenuation measures such as restricting working hours for certain works required in the proximity of sensitive receptors.	4.8.4	TP4
	All equipment used on site will be certified in relation to noise performance.	4.8.4	TP4
	Panels and covers of silenced plant will be kept shut and plant and equipment switched off when not in use.	4.8.4	TP4
	All mechanical equipment will be silenced by the best practical means using current technology, prior to use. Noise suppression devices will be fitted according to manufacturer's instructions. Noise control kits will be fitted to noisy mobile equipment and shrouds provided around stationary equipment where necessary.	4.8.4	TP4

	Working will be limited to 07.00 to 18.00 hours, Monday to Saturday and at no time on Sundays and public holidays. A maximum of 15 laden vehicles will be permitted to enter and leave the site between the 06.00 and 07.00 hours, Monday to Saturday, excluding Sundays and public holidays.	2.4.8 And 4.8.3	TP4
	All plant and equipment will be inspected regularly to ensure that it is well maintained to minimise noise emissions.	4.8.4	TP4
	The L ₁₀ noise level at the boundary of adjacent receivers where baseline data has been obtained will not normally exceed the background level by more than 5 dB(A).	4.8.3	TP4
	Compliance monitoring of noise levels will be undertaken and appropriate records of measurements kept.	4.8.4	TP4
	The local community will be informed of the level and duration of noise to be expected during specific activities and phases of development when necessary. Communication of concerns to the Environmental Manager will be invited.	4.16.3	TP4
Air Quality and greenhouse gas emissions	Ambient air quality monitoring will be conducted at identified sites.	4.9.3	TP5
	Dust suppression equipment will be fitted to all processing plant on the site. This will be regularly inspected and maintained in good working order at all times.	4.9.4	TP5
	Trafficable areas will be defined to prevent unnecessary vehicle movement into other parts of the site.	4.9.4	TP5
	All unsealed trafficable areas and working areas will be kept damp by spraying regularly with a water cart, water sprays or sprinklers to minimise dust emissions. Frequency of spraying to be determined based on weather conditions, soil erodibility and the observation of any visible dust.	4.9.4	TP5
	Speed controls will be applied to all unsealed areas (maximum speed of 20 km/h) and signposted accordingly.	4.9.4	TP5
	All semi-permanent stockpiles will be vegetated with suitable groundcover and regularly watered until the vegetation is well established.	4.9.4	TP5
	Work on any extraction activity producing dust will cease due to high winds if control cannot be achieved by watering or other means. Work will not resume until the wind velocity decreases and any dust generation can be controlled by normal means.	4.9.4	TP5

	All loaded trucks leaving the central processing plant on Lot 198 DP 752025 will have their payloads fully covered by a suitable material to prevent spillage.	4.9.4	TP5
	No fires will be permitted on-site without a permit.	4.9.4	TP5
	A mechanical road sweeping unit and water cart will be maintained for use as required to keep all roads including the intersection of the haul road and Wisemans Ferry Road free from deposited material.	4.9.4	TP5
	Exhausts from all vehicles and plant/equipment will be inspected to ensure that they are maintained at an acceptable level.	4.9.4	TP5
	All vehicles will be regularly serviced to ensure that exhaust emissions comply with the regulations. Appropriate service records will be maintained.	4.9.4	TP5
	Any opportunities to minimise machinery use and ensure that all equipment used on the site is energy efficient will be identified.	4.9.4	TP5
Access and Traffic	If the sand slurry plant and transport system is unusable due to breakdown or during maintenance periods, trucks will be used for the transport of extractive material on a temporary basis. This will cease once the system is operating satisfactorily.	2.4.6 and 2.4.7	TP3
	The number of laden vehicle movements will not exceed a combined total of two hundred per day via the intersection of the haulage road and Wisemans Ferry Road. This is the total of laden vehicle movements allowed for PF Formation's combined extractive industry operations in Baulkham Hills Shire.	2.4.7	TP3
	Operations involving the transportation of material on the site will only be undertaken between 07.00 and 18.00 hours, Monday to Saturday.	2.4.8	TP3
	A maximum of 15 laden vehicles will be allowed to enter and leave the site between 06.00 and 07.00 hours, Monday to Saturday only. Vehicles will not be allowed to arrive at the site prior to 05.45 hours on any day.	2.4.8	TP3
Erosion and Sediment Control	Soil and Water Management Plan will be reviewed and revised, if required.	4.6.3	TP1
	Temporary erosion and sedimentation control structures such as detention basins and catch drains will be constructed as appropriate to collect runoff from cleared land including extraction areas and access roads.	2.7	
	Silt traps and erosion control fencing will be erected as appropriate along extraction area boundaries and drainage lines.	2.7	

	<p>Sediment basins with a minimum storage capacity of 400 m³ per hectare of catchment will be constructed. Spillway capacity and stability will be designed as follows:</p> <ul style="list-style-type: none"> • life of less than 5 years, adopt the 20 year t_c event; • life between 5 and 10 years, adopt the 50 year t_c event; and • life greater than 10 years, adopt the 100 year t_c event. 	2.7 and 4.7.5	
	Stormwater control measures will be assessed and routine inspections conducted to ensure that compliance with best practice guidelines and relevant legislation is achieved.	4.7.5	
	Locations for topsoil and material stockpiles will be selected on level ground and away from drainage lines. Diversion drains and sediment filter fences will be installed up slope as appropriate.	4.6.3	
	Training will be provided to operational personnel on the importance of erosion control measures and drivers informed of the damage that can be caused to the environment by heavy vehicles.	4.6.3	
	Areas of exposed land will be kept to a minimum compatible with operational requirements.	4.6.3	
	Exposed areas not in use will be stabilized with an appropriate cover crop and watered until well established.	4.6.3	
	Erosion and sediment controls will be monitored regularly and immediately following a rainfall event. Monitoring will take place initially on a weekly basis, then monthly once operating correctly. Sediment will be cleared when the traps have collected 60% of the capacity of the basin or where sediment buildup is less than 300 mm below the spillway crest. Sediment will be removed to a location where further pollution to downslope lands and waterways will not occur.	4.6.3	
	Maintenance of erosion and sediment controls will be undertaken when any deterioration is identified or when replacement is necessary.	4.6.3	
	Stored stormwater will be reused for dust control and the watering of site vegetation.	4.6.3	
	Soil stockpiles will be seeded where these are to remain unused for a period in excess of four weeks. The area will be watered until the vegetation is well established.	4.6.3	
Water Management	Maximum depth of extraction will be restricted to not less than two metres above the wet weather high groundwater level. (nominally 181 mAHD).	2.4.3	TP2

Flora and Fauna	The groundwater will not be breached or contaminated. In the event that either should occur, operations will cease in the affected area and the Department of Environment and Climate Change consulted to determine the basis on which extraction may recommence.	4.5.7	TP2
	Retention basins will be designed to accommodate the 100-year t_c event. The minimum basin capacities are:	2.5.3	
	<ul style="list-style-type: none"> Northern catchment 10,000 m³ Southern catchment 38,000 m³ Eastern catchment 19,500 m³ <p>The retention basin serving the eastern catchment is expected to be located on Lot 2 DP555184.</p>		
	The volume of these basins can be varied depending on the extent of the area exposed for extraction within each catchment.		
	All retention basins will be regularly inspected and an annual report prepared on their effectiveness.	2.5.2	
	A minimum of two groundwater monitoring bores will be installed. One will be located within or near the extraction area and another at some location within the site beyond the area of any direct extraction influence. The location of these bores will meet the requirements of the Department of Environment and Conservation and Baulkham Hills Shire Council.	4.5.2	TP2
	All areas which are not to be disturbed will be clearly marked. These will be fenced and access limited. All fences will be regularly inspected and maintained as required.	2.82	TP6
	Areas where trees are to be removed will be assessed to determine the commercial value of any which are too large to mulch. Any with commercial value will be marked and arrangements made for removal.	2.8	TP6
	A Rehabilitation Plan including a Biodiversity Offset Strategy will be prepared and implemented. This will include the replacement of the area of Shale/Sandstone Transition Forest to be removed on the basis of two hectares for every hectare of the current community removed. Other native forest communities removed would be replaced on an agreed basis.	2.8	TP6
	An assessment of the species mix of the Shale/Sandstone Transition Forest will be made and seeds collected from the vegetation to be removed. Vegetation removed from the area will be mulched and stockpiled for later use. This will initially be used on the peripheral bunds followed by other areas of the site where the regrowth of the species mix is to be undertaken.	2.8.2	

	Access to bushland will be restricted to minimise the potential for damage. These areas will be fenced and signs erected to ensure that this prohibition is made clear.	2.4.2	TP6
	Topsoil will be separated and stored or use in rehabilitation works.	2.6	
	Flora and fauna issues will be incorporated in the education programme so that site operatives are aware of the requirements of the EMP.	5.2.1	TP6
	Once each extraction phase is complete, the rehabilitation and revegetation programme will be initiated as set out in the Rehabilitation Strategy.	2.8.2	
Rehabilitation	The Rehabilitation Plan will be reviewed and amended as necessary to reflect changing operational conditions. This will include a revised phasing plan and implementation programme.	2.8.1	
	Setbacks to all roads and adjacent properties will be defined taking account of existing trees and other features. Programmes of mound construction and screen planting will be undertaken as required in the Rehabilitation Plan. All plant material used will reflect the species mix existing in the area.	2.8.1	
	A staged seeding and planting programme will be undertaken as areas become available following completion of extraction and capping of sediment basins. This will be aimed at producing a dense plantation on the steeper slopes derived from the flora resources already established. The aim is to replicate as far as possible the mix and density of planting which is currently present.	2.8.2 and 2.8.3	
	All suitable plant material will be used on the site as a seed and planting medium. Topsoil will be stored in appropriately marked low stockpiles for reuse in locations as close as possible to their source. Care will be taken to ensure that this does not become contaminated with the seeds of exotic species and weeds.	2.8.2	
	The site will be rehabilitated in stages leaving areas exposed for as short a time as possible. This will be undertaken in conformity with the approved Rehabilitation Plan with maximum final batter grades of 4(H):1 (V) on north and west facing slopes and 3(H):1 (V) on those facing south and east. Final slopes will be as gentle as possible depending on the availability of fill material.	2.8.1 and 2.8.2	
	All soil stockpiles and exposed areas will be seeded with an appropriate vegetation cover where no activity is to take place for more than four weeks.	2.8.2	
	Revegetation of the site will be undertaken on the following basis:	2.8.2 and 2.8.3	

	<ul style="list-style-type: none"> as far as possible re-establish the Shale/Sandstone Transition Forest using seed and mulch collected from the area ; rehabilitate other areas to native species with a light sowing of cereal and allowing natural regeneration; rehabilitate the soil to achieve a full profile; lime, fertilise and sow areas where improved grass cover is required; and suitably turf surfaces expected to experience high surface flows leaving the site. 		
	A maintenance programme aimed at promoting and protecting the growth of the rehabilitated areas will be established.	2.8.3	
Social Impact Management	Material concerning activities at the site will be prepared for publication in existing community newsletters which receive wide dissemination in the Maroota area.	4.16.3	
	Regular bi-annual meetings of community representatives will be established to discuss issues in relation to sand extraction on the site.	1.3.2 and 5.2.1	
	A Complaints Register will be established incorporating date and time, type of communication, contact details of the complainant, nature of the complaint and response taken.	1.3.2	
Heritage	All work will cease in the area if an archaeological or heritage item is identified during extraction operations and the National Parks and Wildlife Service, the Deerubbin Aboriginal Land Council or the Heritage Office consulted to determine any appropriate course of action prior to recommencement of the work.	4.11.3 And 5.2.2	TP7
	Any additional survey work required for submittal of application to destroy artifact scatters located in the later stages of the development will be undertaken. Reasonable requirements of the National Parks and Wildlife Service, the Deerubbin Aboriginal Land Council and the Heritage Office arising out of any additional studies will be implemented.	5.2.2	TP7
Visual Amenity	All vegetation to be retained will be clearly marked and protected with temporary fencing of an appropriate material and height.	2.4.2	TP8
	Peripheral bunds will be constructed within the established setbacks where necessary to screen extraction activities. These will be a minimum of three metres high with slopes ranging from 3(H):1 (V) to 6(H):1 (V) depending on the location using overburden stripped from the site. Bunds will be completed around the whole area to be worked.	2.4.3	TP8

	Screen planting works will be undertaken in the peripheral areas to an agreed specification using mulch to allow for native plant regeneration. This species mix will be reinforced using appropriate plantings at specified intervals.	2.4.3	TP8
	A tree planting programme will be undertaken within the ten metre buffer zones and in other defined parts of the site to establish a dense plantation using an appropriate mix of species reflecting that of the existing community.	2.8.2 and 2.8.3	TP8
	The final rehabilitated landform will be established in conformity with the Rehabilitation Plan.	2.8.1	TP8
	All temporary fencing will be removed when no longer required.	2.8.2	
	Vegetation in areas suitable for agricultural/horticultural uses will be re-established.	2.8.3	
	All site infrastructure including the slurry plant and its associated pipelines will be removed. Those areas affected by the plant will be restored and rehabilitated.	2.8.2	
	All waste materials will be removed and disposed of in an appropriate manner.	4.15	
	The final Rehabilitation Plan will be reviewed and proposals for future use of the site prepared.	2.8.1	
Waste Management	Waste handling areas will be clearly delineated.	4.15	
	Specific areas for the collection of materials for reuse and recycling will be defined and clearly labelled.	4.15	
	Cleared vegetation will be used within the landscape programme.	2.8.2	
	All topsoil will be stored in stockpiles for later use in site rehabilitation.	2.8.2	
	Bins or skips will be provided for the collection and storage of recyclable material and waste. General construction waste will be stored in a skip located at the workshop on Lot 198 DP752025. Waste food will be removed and stored in a vermin proof bin for collection by a waste contractor. Paper waste generated from site offices, plastics and glass will be collected separately for recycling.	5.2.2	
	Hazardous wastes (including empty drums, rags, soil contaminated with oil) will be separated from non-hazardous wastes and managed in accordance with the relevant legislation.	5.2.2	

	Liquid wastes (chemicals, oils and greases) will be temporarily stored in an appropriately bunded area and disposed of via a licensed contractor. Washdown water will be directed to an appropriate settlement basin if quality is acceptable.	5.2.2
	Copies of current licences of all waste removal contractors on site will be retained.	5.2.2
	All documentation relating to waste removal and disposal will be retained on file at the site. This documentation will include dockets for the removal and disposal of waste at a licensed facility.	5.2.2
	Waste material will be progressively separated and stockpiled in designated areas for collection. Adequately secure waste disposal areas to prevent access by wildlife.	5.2.2
	All waste licences will be reviewed and terms and conditions for compliance monitored.	5.2.2
	Any materials and waste remaining on the site following completion of extraction operations will be recycled or sent of disposal. This will be either recycled or disposed of in an appropriate manner.	5.2.2
Emergency Response	All personnel on site during operations will be trained in appropriate procedures including site induction, materials handling and response procedures.	5.2.1
	Emergency response procedures will be developed and put in place. Appropriate individuals will be appointed as emergency services liaison officers.	5.3.3
	An emergency response table listing contact details of all relevant parties required in an environmental emergency will be prepared.	5.3.3
	A Register of Environmentally Hazardous Materials to be stored and used on site will be established.	5.3.3
	Appropriate safety and spill response equipment will be made available on site.	5.3.3
	All materials to be used and stored on site will be clearly labelled.	5.3.3
	Emergency response procedures will be reviewed and updated bi-annually.	5.3.3
	Appropriate safety and response equipment will be available at all times.	5.3.3
Hazard, Risk and Safety	A licence to keep dangerous goods will be obtained from WorkCover NSW for all materials stored on site which require licensing.	5.3.3

A Register of Hazardous Materials setting out details of quantities, storage and specific handling requirements for all relevant materials stored on site will be established.	5.3.3
Material Safety Data Sheets for all hazardous materials stored on site will be obtained.	5.3.3
Appropriate storage and secondary containment facilities for all hazardous materials stored on site will be provided. All bunded areas will be designed to contain at least 110% of the volume of materials stored within the area.	5.3.3
A Safety Officer will be appointed for the development.	5.3.3
All flammable material storage areas will be located at least ten metres from possible ignition sources.	5.3.3
Contents of all above ground storage areas will be clearly labelled.	5.3.3
All hazardous and dangerous goods storage areas will be secured and appropriate signage displayed. All incompatible material will be segregated.	5.3.3
All personnel will be trained in the handling and safety procedures required for the hazardous materials stored and used on site.	5.3.3
An Emergency Response Plan will be developed and put in place.	5.3.3
A mobile spill control kit containing appropriate absorbent materials, neutralising chemicals and other spill containment equipment will be provided.	5.3.3
Personal protective equipment will be provided and personnel instructed in its use.	5.3.3
Any spills beyond the bunded area will be cleaned up immediately and the contaminated material disposed of in an appropriate manner.	5.3.3
The relevant authorities will be contacted in the event of a leak or spill and any instructions followed. Any contamination will be remediated to the satisfaction of the regulatory authorities.	5.3.3
Any spills or hazardous wastes that cannot be recycled will be collected and disposal by a licensed waste contractor arranged. All records of waste removal on site will be retained.	5.3.3

6

CHAPTER

JUSTIFICATION OF THE PROPOSAL



Chapter Six Justification of the proposal

6.1 Introduction

Schedule 2(6) of the *Environmental Planning and Assessment Regulation 2000* requires that the proposal is justified in terms of biophysical, economic and social considerations and the principles of ecologically sustainable development. These issues are considered in detail in **Chapter 4**. This chapter provides a summary of the key considerations affecting the justification of the proposal.

The justification of the proposal is based on:

- biophysical, economic and social considerations;
- assessment of the compliance of the proposal with the principles of ecologically sustainable development;
- need to maintain a continuing supply of high quality construction sand to the Sydney market; and
- consideration of alternatives.

6.2 Biophysical impacts

The proposal would have some impacts on the biophysical environment. These are discussed in detail in **Chapter 4** and the principal effects are summarised in the following section.

- There would be additional modification of the topography of the site as a result of the extension of sand extraction to the central area and the increase in its depth. These activities would result in the lowering of the area containing the former Trigonometrical Reserve by about 20 metres with the formation of one large bowl gently sloping towards the north and south. The final landform would be rehabilitated with native forest on the batters and the setbacks from the surrounding roads. The flatter areas would be suitable for agricultural/horticultural activities.
- Surface water is captured in a series of sedimentation ponds on site and directed to the clean water dam for reuse in the transport and processing of the sand product. The ponds are progressively capped and rehabilitated as they fill with silt derived from the process water. The clean water dam would be retained in the long term to support future agricultural/horticultural uses on the site.
- Noise increases are predicted at a small number of adjacent non-mining related residential receptors under the worst case operating scenario. As this would be unlikely to occur in practice, these impacts are considered to be overstated. However, if noise impacts result in unacceptable levels at these locations, additional monitoring would be undertaken and appropriate mitigation measures agreed.
- Dust levels beyond the site boundary are predicted to be within Department of Environment and Conservation criteria for deposited dust, particulates (PM₁₀) and Total Suspended Particles (TSP) at the nearest non-mining related receptor.

- Much of the vegetation on the site has been degraded as a result of previous agricultural activities or removed due to sand extraction. The proposal would result in the removal of remnants of Shale Sandstone Transition Forest, an endangered ecological community. Seed has been collected from the area for several years and the community would be recreated as far as possible in suitable areas of the site as part of the rehabilitation process. The area to be planted with this community would be at least twice as extensive as that removed as part of the present proposal.
- Some 42 individual *Tetratheca glandulosa*, a threatened plant listed on both the *TSC Act* and the *EPBC Act*, would be removed. The assessment concluded that the proposal is unlikely to have a significant impact on this species.

The impacts of the proposal would be similar to those associated with existing extraction operations with the exception of visual impacts resulting from the changes to the topography of the site and the removal of the forest remnant. However, the resulting impacts would be limited as there are relatively few views of the centre of the site from areas with public access and the regeneration of native forest cover would gradually transform the view. Overall, the impacts of the proposal would be minimal with the adoption of the proposed safeguards and operational procedures.

6.3 Economic effects

6.3.1 The market for construction sand

High quality construction sand is a limited resource in the Sydney region especially when located relatively close to the main markets. As a number of large sources of supply become exhausted over the next ten years or are subject to increasingly stringent environmental controls (Penrith Lakes and Kurnell respectively), a secure supply of Tertiary sand will become increasingly valuable to the NSW economy. Alternative sources are at considerably greater distances from the main markets resulting in increased transport costs and environmental impacts.

The predicted demand for medium to coarse grained sand of the type available at Hitchcock Road during the period from 2000 to 2010 is 25.4 million tonnes with a predicted supply from the region of 22.5 million tonnes over the same period. The potential shortfall of three million tonnes would need to be satisfied by increasing imports or by increasing production within the region (Department of Mineral Resources 2001).

In the medium term (2010 to 2020) the predicted demand for medium to coarse grained sand is expected to increase to 30.6 million tonnes. There will be no dominant secure supply of this material in the Sydney region following the closure of the Penrith Lakes scheme, expected in 2010. Current sand supplies from Maroota and elsewhere in the region are approximately 800,000 tonnes per year. This will increase when recently approved developments start which, in part, will compensate for the reduction in production resulting from the closure of other sites. The remainder of the annual requirement of three million tonnes would need to be derived from elsewhere, and, as a result, sand produced from sources such as Maroota will have an increasing importance in supplying the Sydney market for construction sand.

There is clearly a need for additional sources of medium to coarse grained sand within the Sydney region in both the short and medium terms. Importation would both increase its price due to the additional transport costs involved and result in additional environmental impacts as new sources are exploited. It is therefore important to enable the maximum

available resource to be obtained from existing sources of sand in the Sydney region while ensuring that appropriate environmental standards are maintained.

6.3.2 Local employment

The increased volume of material available for extraction as a result of the approval of the proposal would result in the continuing employment of the 20 to 22 full-time employees at Maroota. This would offer long term employment security over the next 20 years.

Continuing activity at the Hitchcock Road site would also support employment in the product transport industry in addition to equipment supply and maintenance.

The development would also make a contribution to economic development in the local community through the purchase of services and various consumables.

6.3.3 Long term land use

The ultimate land use to be established on the site on cessation of extraction would be agriculture/horticulture. The retained water management structures would support medium intensity activities of this kind ensuring that some form of economic activity continues beyond sand extraction.

6.4 Social impacts

6.4.1 Land use

Community concerns relate to the final landform of the site particularly in relation to impacts on the central area which would be lowered reducing its significance as the highest point in the area. The impacts of this change would be minor as this part of the site is only visible from a small number of locations accessible to the public and its location on private property would restrict access both during extraction operations over the next 20 years and following cessation of operations. The ultimate land use would result from the re-establishment of a large part of the site to Class 3 agricultural land with areas of native vegetation endemic to the area on the steeper slopes within the site and around the periphery. This would further restrict public views of the centre of the site.

Potential impacts on groundwater have also been of concern to the community. This issue has been extensively investigated by the Department of Natural Resources (formerly the Department of Infrastructure, Planning and Natural Resources) and is discussed in detail in **Section 4.4** and **Technical Paper 2**. The retention of a two metre buffer above the wet weather high water table would have no impact on yields for other users and groundwater recharge would be improved by the removal of the clay lenses. Recent improvements to the central process plant on Lot 198 have reduced the volume of water required for normal operations.

The changes to the extraction operations at the Hitchcock Road site included in the development application are predominantly within the existing site boundaries and are unlikely to result in any changed impacts on neighbouring landholders. The inclusion of Lot 2 DP752039 would result in an extension of the site to the south. The southern boundary of this lot represents the edge of the Maroota area defined for sand extraction in *Sydney Regional Environmental Plan 9 – Extractive Industry*. Uncleared land is located to the south and there are no adjacent residences which might be disturbed by extraction activities.

6.4.2 Cultural values

Heritage investigations have failed to identify any Aboriginal or European cultural values on the site which are worthy of retention. This applies to the former Maroota Trigonometrical Reserve which accommodates a standard concrete pillar less than 50 years old. There are many similar examples at other locations.

6.4.3 Visual changes

The most obvious impact of the proposal would be the lowering of the central part of the site to remove a large volume of Tertiary Sand located below the clay lens. This area is currently visible from a small number of locations along Old Northern Road, Hitchcock Road and Wisemans Ferry Road and from a small number of adjacent private properties. It is screened from view from all of the area to the north by the intervening topography and from the south by the topography and the intervening vegetation.

The principal views of the highest point on the site are gained from Hearses Road, a minor cul-de-sac. This is the location of a recently approved major sand extraction operation. Views to the Hitchcock Road site would therefore be across a foreground of extraction activities and any public access would be restricted. Local views will therefore change and access to the area limited for a considerable period.

6.4.4 Traffic

Truck traffic generated by the proposal would use Wisemans Ferry Road and Old Northern Road equally to transport the product to market. Truck movements currently make up less than ten percent of all traffic on both these roads. The proposal would not increase movements except as a result of the importation of material for recycling at the site. This would be a small increase on existing movements and in most cases would make use of the trucks otherwise returning empty to reduce total impacts.

The majority of truck movements take place outside peak hours and their traffic impacts can be considered to be insignificant. Total traffic movements in the area have remained static over the past three years or have declined slightly.

6.5 Cumulative impacts

The impacts of the current extraction operations on the Hitchcock Road site are managed via the Environmental Management Plan and an annual audit procedure managed by Baulkham Hills Shire Council in compliance with the consent orders of the Land and Environment Court.

The proposal described in the environmental assessment would result in the extraction of a larger total volume of material from the site than is currently accessible under the current consent. However, this would be undertaken at a similar rate of extraction to that currently taking place over the same period as the consent allows. There would therefore be no overall net change in impacts from that currently experienced and managed under the operating license. Approval of the proposal would therefore result in minimal cumulative impacts in addition to those experienced at present.

The only change would result from the lowering of the ground profile in the central part of the site resulting from the extraction of additional Tertiary Sand from this area. The steeper slopes in this area would be progressively rehabilitated using local native forest species.

6.6 Sustainability

6.6.1 Ecologically sustainable development

The principles of ecologically sustainable development have been taken into account throughout the process of generating the proposal and assessing its benefits and effects. In addition, the preparation of the environmental impact assessment itself contributes to operating in accordance with these principles as it makes detailed information about the proposal available to inform public discussion in coming to a decision on whether it should proceed.

The precautionary principle has been applied by reliance on comprehensive scientific data throughout the planning and assessment of the proposal leading to the identification of mitigation measures and environmental safeguards. Wherever a potential impact has been identified, mitigation measures have been proposed to reduce the impact as far as practicable.

The proposal would provide access to a large volume of high quality sand which would not otherwise be accessible. Any substitution of sand from other sources to compensate for the sterilisation of the material available at Hitchcock Road would result in additional environmental impacts. The proposal would have long term benefits for future generations by providing a secure resource close to market with a minimal environmental impact.

The principle of conservation of biological diversity and ecological integrity has been considered throughout the assessment process. Access to a large mass of Tertiary Sand close to the centre of the site will require the removal of a small remnant of Shale/Sandstone Transition Forest (Ridge Top Open Forest) which is listed as Threatened. Seed has been collected from this community over the past three years and has been used in the site rehabilitation which has been implemented to date. This process will continue and a large stock of seed stored for future use.

The value of environmental resources on and adjacent to the site is determined by a large number of factors. These include the extent of detailed investigations and studies and planning and design of mitigation measures to prevent any irreparable damage to these resources. Regular monitoring of the existing development is undertaken on the Hitchcock Road site and this would continue for the proposed development. The cost of these activities has been included in the proponent's assessment of the proposal.

6.6.2 Supply of construction sand

A key consideration in the justification of the proposal is the need to maximise the recovery of the sand resource from the site within the constraints imposed by environmental and economic considerations. This is required to secure the continuing supply of high quality construction sand while minimising undesirable environmental impacts and restraining costs. Failure to extract the available volume of Tertiary Sand from the Hitchcock Road site would lead to the development of similar sites elsewhere resulting in additional cumulative environmental impacts in Maroota and along transport routes from more distant locations.

6.6.3 Alternatives

The only realistic alternative to the proposal is the continuation of the current consent which would result in the sterilisation of substantial volumes of extractable sand. As the

proposal would result in minor environmental impacts on the biophysical environment, this approach is not considered to be effective or realistic. The proposal would lead to the removal of a small area of a protected woodland community, assessed as not in a viable state, and an adjustment to the local topography which would have limited visual impacts. The removal of the former Trigonometrical Reserve site would have no heritage impacts as the existing concrete pillar is less than 50 years old and is of a common type.

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APPENDICES





DIRECTOR-GENERAL'S REQUIREMENTS





NSW GOVERNMENT
Department of Planning

Contact: Mike Young
Phone: (02) 9228 6481
Fax: (02) 9228 6466
Email: mike.young@planning.nsw.gov.au

Mr David Fingland
DFA Consultants
30 Cumberland Avenue
CASTLE HILL NSW 2154

Our ref: S02/00696

Dear Mr Fingland

**Director-General's Requirements
Hitchcock Road Sand Extraction and Rehabilitation Project**

The Department has received your application for the proposed Hitchcock Road Sand Extraction and Rehabilitation Project at Maroota in the Baulkham Hills local government area (Application No. 06_0104).

I have attached a copy of the Director-General's requirements for the project. These requirements have been prepared in consultation with relevant government authorities and are based on the information that you have provided to date.

Please note that under section 75F(3) of the *Environmental Planning and Assessment Act 1979*, the Director-General may alter these requirements at any time.

I would appreciate it if you would contact the Department at least 2 weeks before you propose to submit the draft Environmental Assessment for the project to determine the:

- fees applicable to the application;
- consultation and public exhibition arrangements that will apply; and
- number and format (hard-copy or CD-ROM) of the Environmental Assessment that will be required.


As you may know, the Department will review the draft Environmental Assessment in consultation with the relevant authorities to determine if it adequately addresses the Director-General's requirements. If the Director-General considers the Environmental Assessment to be inadequate, you will be required to revise it prior to public exhibition.

The Director-General's requirements will be placed on the Department's website along with other relevant information which becomes available during the assessment of the project. As a result, the Department would appreciate it if all documents that are subsequently submitted to the Department are in a suitable format for the web, and if you would arrange for an electronic version of the Environmental Assessment for the project to be hosted on a suitable website with a link to the Department's website.

Finally, if your proposal contains any actions that could have a significant impact on Matters of National Environmental Significance, it will require an additional approval under the Commonwealth *Environment Protection Biodiversity Conservation Act 1999* (EPBC Act). This approval would be in addition to any approvals required under NSW legislation. If you have any questions about the application of the EPBC Act to your proposal, you should contact the Commonwealth Department of Environment and Heritage in Canberra (02 6274 1111 or <http://www.deh.gov.au>).

If you have any enquiries about these requirements, please contact Mike Young, Manager Mining and Extractive Industries, on (02) 9228 6481.

Yours sincerely

A handwritten signature in black ink, appearing to read 'Chris Wilson', with a long horizontal stroke extending to the right.

9.5.6.

Chris Wilson

A/Executive Director

As delegate of the Director-General

Director-General's Requirements

Section 75F of the *Environmental Planning and Assessment Act 1979*

Project	<p>The proposed Hitchcock Road Sand Extraction and Rehabilitation Project, which includes:</p> <ul style="list-style-type: none"> expanding the existing quarry in depth and area to produce up to 400,000 tonnes of sand a year for the next 22 years; using the existing on and off-site quarry infrastructure; importing up to 20 truck loads a day of clean material for recycling; and progressively rehabilitating the site.
Site	Hitchcock Road, Wisemans Ferry Road and Old Northern Road, Maroota
Proponent	PF Formation
Date of Issue	9 May 2006
Date of Expiration	9 May 2008
General Requirements	<p>The Environmental Assessment (EA) must include</p> <ul style="list-style-type: none"> an executive summary; a detailed description of the project including the: <ul style="list-style-type: none"> need for the project; alternatives considered; and various components and stages of the project; consideration of any relevant statutory provisions; an overview of all the environmental impacts of the project (including an environmental risk analysis) and identification of the key issues for further assessment, taking into consideration the issues raised during consultation; a detailed assessment of the key issues specified below and any other significant issues identified in the environmental risk analysis (see above), which includes: <ul style="list-style-type: none"> a description of the existing environment; an assessment of the potential impacts of the project, including any cumulative impacts that may be associated with the concurrent operation of the quarry with the recently approved Hitchcock Road Quarry and other existing quarry operations in Maroota; a description of the measures that would be implemented to avoid, minimise, mitigate, offset, manage, and/or monitor the impacts of the project; a draft Statement of Commitments, outlining environmental management, mitigation and monitoring measures; a conclusion justifying the project, taking into consideration the environmental impacts of the proposal, the suitability of the site, and whether or not the project is in the public interest; a signed statement from the author of the Environmental Assessment certifying that the information contained in the report is neither false nor misleading.
Key Issues	<ul style="list-style-type: none"> Surface and Groundwater – including detailed modelling of surface and groundwater impacts, a site water balance, and explicit consideration of the project against the relevant findings of the Maroota Groundwater Study; a detailed description of the proposed water management system, including any creek diversions and sediment/water supply dams; and a surface and groundwater contingency strategy setting out the measures that would be implemented in some circumstances to protect the water supply of surrounding landowners and the environment; Traffic and Transport – including details of traffic volumes generated by the project and an assessment of the capacity and safety of the proposed transport route; Flora and Fauna – including impacts on threatened species, endangered

	<p>ecological communities and groundwater dependent ecosystems; and details of any vegetation offsets to ensure that there would be no net loss of flora and fauna values in the area in the medium to long term;</p> <ul style="list-style-type: none"> • Noise – including construction, operation and off-site road noise impacts; • Air Quality; • Visual; • Heritage – including Aboriginal and non-Aboriginal heritage; and • Rehabilitation and Final Land Form - including a justification for the proposed final land form and use in relation to the strategic land use objectives; a detailed description of how the site would be progressively rehabilitated and integrated into the surrounding landscape; and a detailed description of the measures that would be put in place to ensure that sufficient resources are available to implement the proposed rehabilitation measures, and for the ongoing management of the site following the cessation of quarrying activities.
References	The Environmental Assessment must take into account relevant State government technical and policy guidelines. While not exhaustive, guidelines which may be relevant to the project are included in the attached list.
Consultation	During the preparation of the Environmental Assessment, you must consult with the relevant local, State or Commonwealth government authorities, service providers, community groups or affected landowners. The consultation process and the issues raised must be described in the Environmental Assessment.
Deemed refusal period	60 days

State Government Technical and Policy Guidelines - For Reference

Aspect	Policy /Methodology
Soil and Water	
	<ul style="list-style-type: none"> • <i>Managing Urban Stormwater: Soils and Construction Volume 1 4th Edition</i> (Landcom); • <i>Acid Sulfate Soil Manual</i> (NSW Acid Sulfate Soil Advisory Committee 1998); • <i>Guidelines for Fresh and Marine Water Quality and Guidelines for Water Quality Monitoring and Reporting</i> (ANZECC); • <i>Rehabilitation Manual for Australian Streams</i> (Land and Water Resources Research and Development Corporation); • the various <i>State Groundwater Policy</i> documents (DNR); • <i>Approved Methods for the Sampling and Analysis of Water Pollutants in NSW</i> (DEC); • <i>Environmental Guidelines: Use of Effluent by Irrigation</i> (DEC);
Flora and Fauna	
	<ul style="list-style-type: none"> • draft <i>Guidelines for Threatened Species Assessment</i> (DEC); • <i>Threatened Biodiversity Survey and Assessment: Guidelines for Development and Activities</i> (DEC); • <i>Guidelines for the Assessment of Aquatic Ecology in EIA</i> (DoP); • <i>Policy and Guidelines Aquatic Habitat Management and Fish Conservation</i> (DPI); • <i>NSW Groundwater Dependent Ecosystem Policy</i> (DNR); • <i>Policy and Guidelines for Fish Friendly Waterway Crossings</i> (DPI);
Noise	
	<ul style="list-style-type: none"> • <i>NSW Industrial Noise Policy</i> (DEC); • <i>Environmental Criteria for Road Traffic Noise</i> (DEC); • <i>Construction Site Noise - Environmental Noise Control Manual</i> (DEC);
Air Quality	
	<ul style="list-style-type: none"> • <i>Approved Methods for the Modelling and Assessment of Air Pollutants in NSW</i> (DEC);
Heritage	
	<ul style="list-style-type: none"> • draft <i>Guidelines for Aboriginal Cultural Heritage Assessment and Community Consultation</i> (DEC); • <i>Assessing Heritage Significance</i> (NSW Heritage Office); • <i>NSW Heritage Manual</i> (NSW Heritage Office);
Traffic	
	<ul style="list-style-type: none"> • <i>Guide to Traffic Generating Development and Road Design Guide (RTA)</i>; • relevant Austroad standards;
Rehabilitation	
	<ul style="list-style-type: none"> • <i>Guidelines for Rehabilitation of Land for Agricultural End Use</i> (DPI);
Waste	
	<ul style="list-style-type: none"> • <i>Environmental Guidelines: Assessment and Classification and Management of Liquid and Non-Liquid Wastes</i> (DEC).



NSW GOVERNMENT
Department of Planning

**Mining & Extractive Industries
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Mr David Fingland
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Dear Mr Fingland

Hitchcock Road Sand Extraction and Rehabilitation Project

I refer to your letter of 14 June 2006 about the Director-General's requirements for the assessment of surface and groundwater impacts of the Hitchcock Road Sand Extraction and Rehabilitation Project.

The Department has considered your request for approval of an alternative method of assessing the groundwater impacts of sand extraction at Hitchcock Road, using historical data recorded from the monitoring bores on the site, instead of conducting groundwater modelling. The Department agrees in principle to the proposed groundwater assessment method, as extraction has occurred at the site since 1998, there is no change to the production output, and the proposed extraction depth complies with Baulkham Hill Council's Development Control Plan 16 - Extractive Industries. The approval is granted subject to you providing the Department with a more detailed explanation of the use of the groundwater monitoring data in assessing the sustainability of the proposed extraction, demonstrating the accuracy and reliability of the assessment data, and ensuring the groundwater assessment covers all phases of the development, including rehabilitation of the site. I also suggest that you discuss your proposed groundwater assessment methodology with the Department of Natural Resources (contact Greg Russell on 9895-6273).

The adoption of this assessment methodology does not preclude the requirement for you to prepare a site water balance for the proposal and develop contingency plans to protect the water supply of surrounding uses and the environment in the event of drawdown of groundwater levels from sand extraction. The Department does not believe that the Director-General's Requirements need to be amended to permit the proposed groundwater assessment method.

Please contact Michael Young on 9228 6437 if you have any questions on the above.

Yours sincerely


Mike Young
Manager
Mining and Extractive Industries
31/8/06

B

CHECKLIST OF KEY ISSUES TO BE ADDRESSED IN THE EA



Appendix B; Checklist of key issues to be addressed in the environmental assessment

Table B1 provides a checklist of key issues that are required to be addressed in the EA in accordance with the requirements of the Director-General of the Department of Planning. That section of the EA or the technical papers where they are addressed is also identified.

Table B1: Requirements of the Director-General of the Department of Planning

Issue	Location in EA	
	Chapter/section	Technical paper
General requirements		
The Environmental Assessment (EA) must include:		
<ul style="list-style-type: none"> an executive summary; a detailed description of the proposal including the: <ul style="list-style-type: none"> need for the proposal; alternatives considered; and various components and stages of the project; consideration of any relevant statutory provisions; an overview of all the environmental impacts of the project (including an environmental risk analysis) and identification of the key issues for further assessment, taking into consideration the issues raised during consultation; a detailed assessment of the key issues specified below and any other significant issues identified in the environmental risk analysis (see above), which includes: <ul style="list-style-type: none"> a description of the existing environment; an assessment of the potential impacts of the project, including any cumulative impacts that may be associated with the concurrent operation of the quarry with the recently approved Haerses Road Quarry and other existing quarry operations in Maroota; a description of the measures that would be implemented to avoid, minimise, mitigate, offset, manage, and/or monitor the impacts of the project; a draft Statement of Commitments, outlining environmental management, mitigation and monitoring measures; a conclusion justifying the project, taking into consideration the environmental impacts of the proposal, the suitability of the site, and whether or not the project is in the public interest; a signed statement from the author of the Environmental Assessment certifying that the information contained in the report is neither false nor misleading. 	<p>Summary</p> <p>Section 2.10</p> <p>Section 2.9</p> <p>Chapter 2</p> <p>Chapter 3</p> <p>Chapter 1</p>	
	Chapter 4	Technical Papers 1, 2, 3, 4, 5, 6, 7 and 8
	Chapter 5	Technical Papers 1,2, 3, 4, 5, 6, 7 and 8
	Section 5.4	
	Chapter 6	
	Appendix C	

Key issues

<ul style="list-style-type: none"> • Surface and groundwater – including detailed modelling of surface and groundwater impacts, a site water balance, and explicit consideration of the project against the findings of the Maroota Groundwater Study; a detailed description of the proposed water management system, including any creek diversions and sediment/water supply dams; and a surface and groundwater contingency strategy setting out the measures that would be implemented in some circumstances to protect the water supply of surrounding landowners and the environment. 	Sections 4.5 and 4.7	Technical Paper 2
(See note below)		
<ul style="list-style-type: none"> • Traffic and transport – including details of traffic volumes generated by the project and an assessment of the capacity and safety of the proposed transport route; 	Section 4.12	Technical Paper 3
<ul style="list-style-type: none"> • Flora and Fauna – including impacts on threatened species, endangered ecological communities and groundwater dependent ecosystems; and details of any vegetation offsets to ensure that there would be no net loss of flora and fauna values in the area in the medium to long term; 	Section 4.10	Technical Paper 6
<ul style="list-style-type: none"> • Noise – including construction, operation and off-site road noise impacts; 	Section 4.8	Technical Paper 4
<ul style="list-style-type: none"> • Air quality; 	Section 4.9	Technical Paper 5
<ul style="list-style-type: none"> • Visual; 	Section 4.13	Technical Paper 8
<ul style="list-style-type: none"> • Heritage – including Aboriginal and non-Aboriginal heritage; and 	Section 4.11	Technical paper 7
<ul style="list-style-type: none"> • Rehabilitation and Final Land Form – including a justification for the proposed final land form and use in relation to the strategic land use objectives; a detailed description of how the site would be progressively integrated into the surrounding landscape; and a detailed description of the measures that would be put in place to ensure that sufficient resources are available to implement the proposed rehabilitation measures, and for the ongoing management of the site following cessation of quarrying activities. 	Sections 2.8 and 4.13	Technical Paper 8

References

The Environmental Assessment must take into account relevant State government technical and policy guidelines. While not exhaustive, guidelines which may be relevant to the project are included in the attached list

Consultation

During the preparation of the Environmental Assessment, you must consult the relevant local, State and Commonwealth government authorities, service providers, community groups or affected landowners. The consultation process and the issues raised must be described in the Environmental Assessment.

State government technical and policy guidelines

Aspect	Policy/methodology
Soil and water	<ul style="list-style-type: none"> • <i>Managing Urban Stormwater: Soils and Construction Volume 1 4th Edition</i> (Landcom); • <i>Acid Sulfate Soil Manual</i> (NSW Acid Sulfate Soil Advisory Committee 1998); • <i>Guidelines for Fresh and Marine Water Quality and Guidelines for Water Quality Monitoring and Reporting</i> (ANZECC); • <i>Rehabilitation Manual for Australian Streams</i> (Land and Water Resources Research and Development Corporation); • various <i>State Groundwater Policy</i> documents (DNR); • <i>Approved Methods for the Sampling and Analysis of Water Pollutants in NSW</i> (DEC); • <i>Environmental Guidelines: Use of Effluent by Irrigation</i> (DEC);
Flora and Fauna	<ul style="list-style-type: none"> • draft <i>Guidelines for Threatened Species Assessment</i> (DEC); • <i>Threatened Biodiversity Survey and Assessment: Guidelines for Development and Activities</i> (DEC); • <i>Guidelines for the Assessment of Aquatic Ecology in EIA</i> (DoP); • <i>Policy and Guidelines for Aquatic Habitat Management and Fish Conservation</i> (DPI); • <i>NSW Groundwater Dependent Ecosystem Policy</i> (DNR); • <i>Policy and Guidelines for Fish Friendly Waterway Crossings</i> (DPI);
Noise	<ul style="list-style-type: none"> • <i>NSW Industrial Noise Policy</i> (DEC); • <i>Environmental Criteria for Road Traffic Noise</i> (DEC); • <i>Construction Site Noise – Environmental Noise Control Manual</i> (DEC);
Air quality	<ul style="list-style-type: none"> • <i>Approved Methods for the Modelling and Assessment of Air Pollutants in NSW</i> (DEC);
Heritage	<ul style="list-style-type: none"> • draft <i>Guidelines for Aboriginal Cultural Heritage Assessment and Community Consultation</i> (DEC); • <i>Assessing Heritage Significance</i> (NSW Heritage Office); • <i>NSW Heritage Manual</i> (NSW Heritage Office);
Traffic	<ul style="list-style-type: none"> • <i>Guide to Traffic Generating Development and Road Design Guide</i> (RTA); • relevant Austroad standards;
Rehabilitation	<ul style="list-style-type: none"> • <i>Guidelines for Rehabilitation of Land for Agricultural End Use</i> (DPI);
Waste	<ul style="list-style-type: none"> • <i>Environmental Guidelines: Assessment and Classification and Management of Liquid and Non-Liquid Wastes</i> (DEC).

Note in relation to requirements for surface and groundwater.

Following reconsideration of the original requirement for surface and groundwater modelling due to the absence of data relating to groundwater extraction by agricultural users in the Maroota area, the Department of Planning amended the proposed method of assessing the impacts of sand mining on the aquifer to one using the monitoring data accumulated since the start of sand extraction at the site. A copy of the relevant letter from the Department follows.



ASSESSMENT VALIDATION



Statement of Validity

Submission of Environmental Assessment

Prepared under Part 3A of the *Environmental Planning and Assessment Act 1979*

Environmental Assessment prepared by

Name:	David Fingland
Qualifications:	BArch(Hons) Dip TP MEIA
Address:	DFA Consultants PO Box 707 Windsor NSW 2756
In respect of:	Hitchcock Road Sand Extraction and Rehabilitation Project, Maroota

Applicant and land details

Applicant name:	PF Formation
Applicant address:	1774 Wisemans Ferry Road Maroota NSW 2756
Land to be developed:	Land as listed in Table 4.1 and shown in Figure 1.2 of the Environmental Assessment

Environmental Assessment

Statement of Validity	I certify that I have prepared the contents of the environmental assessment in accordance with the Director General's requirements dated 9 May 2006 and that to the best of my knowledge, the information contained in the Environmental Assessment is neither false nor misleading.
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Signature: _____

Date:

D

STUDY TEAM



Appendix D: Study Team

PF Formation

John Graham
Peter Cummins

Director
General Manager

Environmental Assessment Study Team

DFA Consultants

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Project Manager and
Environmental Planner

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Botanist
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Mark Latal BE(Elec)

Principal Acoustic Engineer
Acoustic Engineer

Navin Officer Heritage Consultants

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Matthew Barber BA(Hons)

Principal Archaeologist
Archaeologist

Integral Design

Alastair Moir CertPlanDrafting DipGraphDes

Graphic Artist

