

PF FORMATION



HITCHCOCK ROAD SAND EXTRACTION AND REHABILITATION PROJECT MAROOTA

ANNUAL ENVIRONMENTAL MANAGEMENT REPORT



2009-2010

PF Formation

HITCHCOCK ROAD
Sand Extraction and Rehabilitation Project Maroota

ANNUAL ENVIRONMENTAL MANAGEMENT REPORT 2009-2010

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Hitchcock Road sand extraction and rehabilitation project

Annual Environmental Management Report 2009-2010

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Term	Abbreviation
AEMR	Annual Environmental Management Report
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.
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.
Aquifer	Geologic formation, group of formations, or part of a formation capable of transmitting and yielding economic quantities of water.
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.
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.
Compaction	The process of compressing individual grains in a soil or sediment in response to pressure.
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.

Term	Abbreviation
Contamination	The degradation of the natural environment as a result of human activities.
Council	The Hills Shire Council.
Day	The period from 7.00am to 6.00pm on Monday to Saturday and 8.00am to 6.00pm on Sunday and public holidays.
dBA	Decibels using the A-weighted scale measured according to the frequency of the human ear.
DECC	NSW Department of Environment and Climate Change.
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.
Department	NSW Department of Planning.
Director-General	Director-General of the Department of Planning or delegate.
DPI	NSW Department of Primary Industries
DWE	NSW Department of Water and Energy
EA	Environmental Assessment of the project entitled <i>Hitchcock Road Sand Extraction and Rehabilitation Project Environmental Assessment and Appendices</i> (3 volumes) dated November 2007, prepared by DFA Consultants, including the response to submissions and Preferred Project Report.
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)	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 Climate Change.
EMP	Environmental Management Plan

Term	Abbreviation
EP&A Act	<i>Environmental Planning and Assessment Act 1979.</i>
EP&A Regulation	<i>Environmental Planning and Assessment Regulation 2000.</i>
EPL	Environmental Protection Licence issued under the <i>Protection of the Environment Operations Act 1997</i> .
Equivalent Continuous Sound Level (LAeq)	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.
Evening	The period from 6.00pm to 10.00pm.
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.
Extraction area	The land described as the extraction area in Appendix 1 of the Project Approval.
Evapotranspiration	Loss of water from a land mass through transpiration from plants and evaporation from the soil.
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/m²/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.
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.

Term	Abbreviation
Heritage	Things of value which are inherited from the past.
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.
Land	Land means the whole of a lot or contiguous lots owned by the same landowner in a current plan registered at the Land Titles Office at the date of the approval.
Landform	A specific feature of the landscape or the general shape of the land.
µg/m³	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.
Minister	NSW Minister for Planning or delegate.
Night	The period from 10.00pm to 7.00am on Monday to Saturday and 10.00pm to 8.00am on Sunday and public holidays/
Observation well	A well constructed or utilised for the purpose of observing groundwater parameters such as water levels, pressure changes and water quality.
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.
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	Abbreviation
Piezometer	A pipe in which the elevation of the water level or potentiometric surface can be determined.
Privately owned land	Land not owned by a public agency or the proponent or its related companies.
Preferred Project Report	The proponent's Preferred Project Report dated September 2008 prepared by DFA Consultants as modified in the Proponent's email to the Department of Planning on 18 November 2008.
Process plant	Equipment used to clean and separate sand into various sizes.
Project	The development as described in the EA.
Proponent	PF Formation or its successors in title.
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.
Resource	Potentially usable material in a defined area that can be economically extracted.
Response to Submissions	The proponent's response to issues raised in submissions dated March 2008 prepared by DFA Consultants and subsequent submissions to the Department of Planning dated 27 August 2008.
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).
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.

Term	Abbreviation
SHTW	Sydney Hinterland Transition Woodland
Silt	Sediment comprising most particles between 0.004mm and 0.063mm.
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.
Statement of Commitments	The proponent's commitments in Appendix 3 of the Project Approval.
Stockpile	Mound used to store material.
Stormwater	Rainwater which runs off catchments following rain events. The untreated water is carried into creeks, rivers and lakes.
Strategy A, Strategy B	The alternative rehabilitation proposals described in the Preferred Project Report.
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.
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 (TDS)	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.
Triassic	The earliest of the three periods that constitute the Mesozoic Era. Approximately between 230 and 180 million years before present.
TSC Act	NSW Threatened Species Conservation Act.
Turbidity	A measure of light penetration through a water column containing particles of matter in suspension.
Underflow	The volume of groundwater that flows through a cross sectional area of an aquifer. It depends on permeability and the prevailing gradient.
Unsaturated zone	That part of an aquifer between the land surface and water table.
Vegetation Offset	The conservation and enhancement program described in the Preferred Project Report to occur on the land shown on the plan in Appendix 5 of the Project Approval.
VENM	Virgin Excavated Natural Material as defined in the <i>Protection of the Environment Operations Act 1997</i> .

Term	Abbreviation
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.

Chapter One

INTRODUCTION

Following the lodgement of a Development Application ('DA') and associated Environmental Assessment ('EA') under Part 3A of the Environmental Planning and Assessment Act, the present development was approved by the Minister for Planning on 3 February 2009. The conditions attached to the approval required, among other things, the preparation of five management plans/monitoring programs:

- Environmental Strategy – results in Chapter 3
- Noise Management Plan – results in Chapter 4
- Air Quality Monitoring Program – results in Chapter 5
- Water Management Plan – results in Chapter 6
- Landscape Management Plan – results in Chapter 7

The first four were prepared in association with the Department of Environment and Climate Change (DECC) and submitted to the Department of Planning (DoP) three months from the date of approval. These were approved by the Director-General of the Department of Planning on 8 July 2009. The Landscape Management Plan was prepared by persons approved by the Director-General, in consultation with DECC, and submitted within six months of the date of Project Approval. This Plan was approved by DoP on 26 August 2010.

Each of these documents sets out the various monitoring programs required to comply with the requirements of the approval conditions. The monitoring results are summarised in an annual report known as the Annual Environmental Management Report (AEMP). This is submitted 12 months from the date of approval and every year thereafter to the Director-General, relevant agencies and the Community Consultative Committee (CCC).

The first AEMP was completed September 2009 including 12 months of monitoring to June 2009 under a previous consent. This AEMP (the second) provides 12 months of data in compliance with the requirements of the approved management plans/monitoring programs to June 2010.

This AEMP will:

- identify the standards and performance measures that apply to the project
- describe the works that will be carried out in the next 12 months
- include a summary of the complaints received during the past year and compare this to complaints received in previous years
- include a summary of the monitoring results for the project during the past year
- include an analysis of these results against the relevant
 - impact assessment criteria/limits
 - monitoring results from previous years
 - predictions in the EA
- identify any trends in the monitoring results over the life of the project

- identify any non-compliance during the previous year; and
- describe what actions were, or are being, taken to ensure compliance.

The report will be audited by an independent specialist within 12 months of the date of approval and every three years thereafter. The audit will:

- be conducted by a suitably qualified, experienced and independent person(s) whose appointment has been approved by the Director-General;
- include consultation with the relevant agencies;
- assess the environmental performance of the project and its effects on the surrounding environment;
- assess whether the project is complying with the relevant standards, performance measures and statutory requirements; and
- review the adequacy of any strategy/program required under this approval and, if necessary, recommend measures or actions to improve the environmental performance of the project and/or any strategy/plan/program required under this approval.

Chapter Two

STATUS OF THE PROJECT

The site survey plan attached as **Attachment 2A** shows the current status of the development. This is based on photography flown on 15 April 2009. The location of the various lots that make up the site is shown on Figure 2 at **Attachment 2B**.

The total amount of processed material derived from the Hitchcock Road site over the 12 months to June 2010 was within the limit of 400,000 tonnes of processed material allowed under Condition 7 of Schedule 2 for the Hitchcock Road Project Approval.

Works Carried Out in Last 12 Months

No significant changes have occurred to the areas being worked as noted below:

- Extraction has continued in Lot 214 DP752039 on the southern side of the main clean water dam. (**Attachment 2C – Photo 1**)
- Minor extraction has been undertaken on the south-western side of the slurry plant on Lot 1 DP570966. (**Attachment 2C – Photo 2**)
- Capping of Tailings Pond 5 has commenced during the year. (**Attachment 2C – Photo 3**)
- Tailings Pond 7 stopped being used as a tailings pond during the year. (**Attachment 2C – Photo 4**)
- Previously capped Tailings Ponds 8 has continued to be used as overburden stockpile area.
- Visual bunds have been constructed on the southern side of Lot 214 DP752039.
- Topsoil has been stripped and stockpiled on the southern side of the supplementary (unused) clean water dam and towards the bund along the southern boundary.
- The tailings stream did incorporate Tailings Ponds 5 and 7 in 2009 but during the year the tailings were moved to Tailings Ponds 9 and 10. (**Attachment 2C – Photo 5&6**)

Recent changes to the surface water management system are described in **Chapter 5**.

Works That Will Be Carried Out in the Next 12 Months

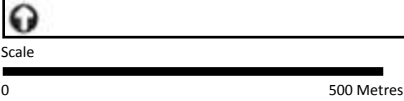
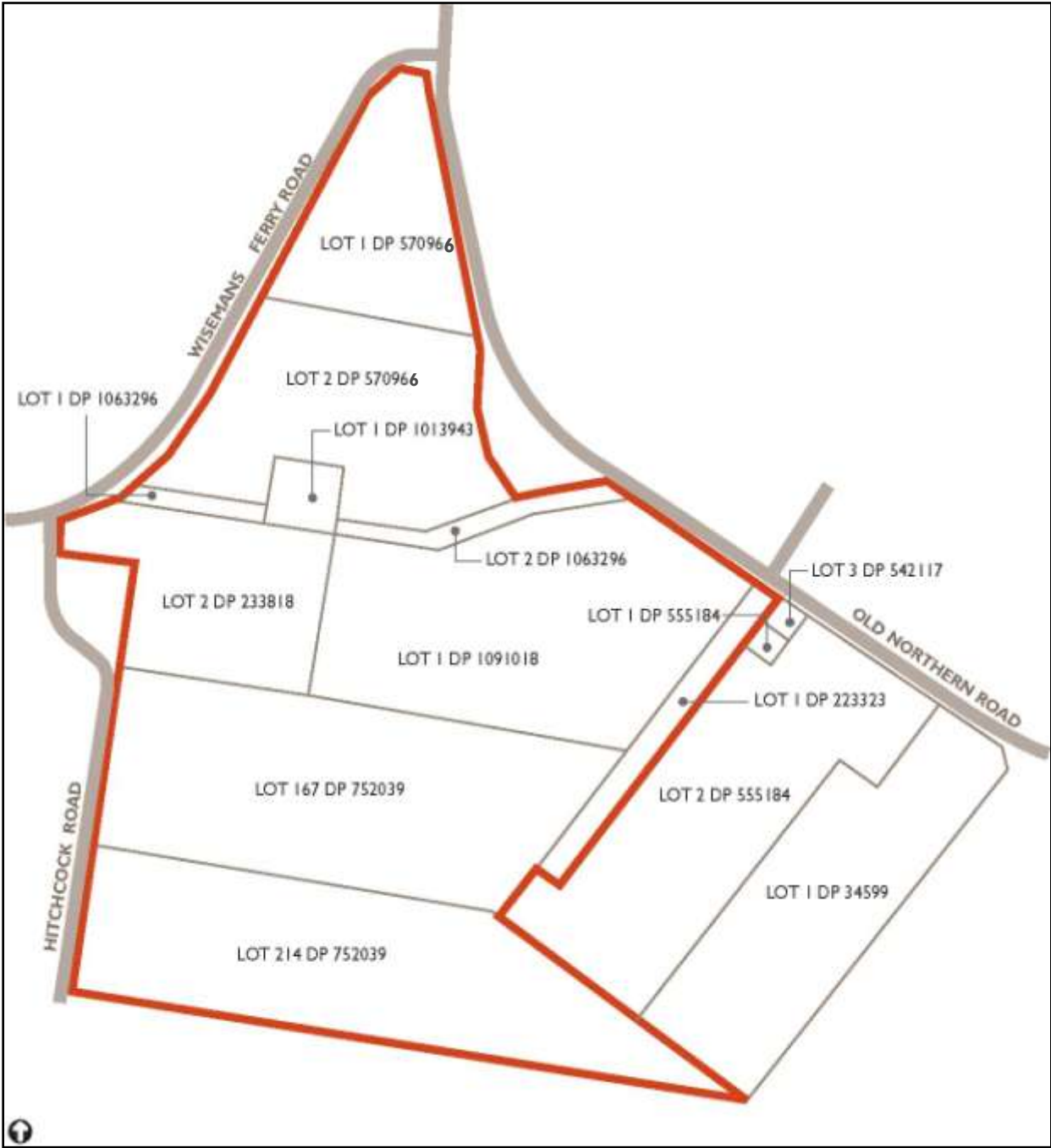
Site activities during the next phase of development will focus on the following:

- Continuation of extraction on Lot 214 DP752039 in a westerly direction and then along the south western side of Lot 167 DP752039
- Extraction in a southerly direction within Lots 1 and 2 DP57096 as a backup to the main extraction area above.
- Progressive capping and consolidation of Tailings Ponds 5 and 7.

- Construction of a new tailings pond in the centre of Lot 1 DP1091018. This pond will be Tailings Pond 11 immediately north of Tailings Ponds 7.
- Overburden removal on Lot 2 DP 570966 will commence.
- Continuation of revegetation in the completed areas of Lot 2 DP233818 (**Attachment 2C – Photo 10, 11 & 12**). An additional area of 1.5 hectares will be reshaped and planted.

These activities will be initiated or continued over the next 12 months and be progressively completed over three years.

There have been no complaints recorded over the past 12 months. This is consistent with previous year.



LOTS INCLUDED IN THE DEVELOPMENT

Boundary of the proposed extraction area



Photo 1: Extraction area - Lot 214 DP572039



Photo 2: Extraction Area - Lot 1 DP570966



Photo 3: Tailings Pond 5



Photo 4: Tailings Pond 7



Photo 5: Tailings Pond 9 (in current use)



Photo 6: Tailings Pond 10 (in current use)



Photo 7: clean water dam, Lot 167



Photo 8: Lot 198 Dam being cleaned out in January 2010



Photo 9: Lot 198 Dam after clean out



Photo 10: Rehabilitation Area



Photo 11: Rehabilitation Area



Photo 12: Rehabilitation Area

Chapter Three

ENVIRONMENTAL MONITORING PROGRAM & RESULTS

Operational Monitoring Program

The Environmental Operational Procedures are set out in the appendix to the Environmental Strategy. A Summary of the Monitoring Results is in **Attachment 3A**.

The Environmental Operational Procedures detail actions and responsibilities, performance indicators, monitoring and reporting requirements.

To document the adherence to this environmental monitoring from an operational viewpoint:

- Monthly, the Environmental Manager has a checklist that is reviewed and signed, see **Attachment 3B**
- Annually the actions required by the Environmental Operational Procedures are reviewed and signed, see **Attachment 3C**.
- The specific monitoring of Noise Management is detailed in **Chapter 4**, Air Quality in **Chapter 5**, Water Management in **Chapter 6** and Landscape Management in **Chapter 7**

Analysis of Monitoring Results

All monitoring indicated that quarry operations were within any defined limits and no indicators of new potential issues were identified.

From the procedures conducted there are no trends identified as yet and no areas of non-compliance.

The only changes to the monitoring program for next year are:

- Quarterly noise testing will recommence from July 2010 and
- Parsons Brinkerhoff will undertake the rehabilitation monitoring in two years time in accordance with their recommendations rather than in the next year.

Summary of Monitoring Results

Noise Monitoring	2010	2009
→ Noise from operational activities exceed guidelines	NIL	NIL
→ Complaints received	NIL	NIL
Air Quality		
Monthly dust deposit - average g/m ² /month (from all sources)		
→ Location 1 - behind Maroota Primary School	2.27	4.05 ①
→ Location 2 - Hitchcock & Wisemans Ferry Roads	2.18	6.04 ① ②
→ Location 3 - Jurd's Residence	2.55	3.14
① results impacted by back burning in September 2008 (10.66, 12.60 respectful)		
② results impacted by ploughing in July 2008 (21.97)		
→ Complaints received	NIL	NIL
→ Plant exhaust deficiency when vehicles serviced	NIL	NIL
Access & Traffic		
→ Traffic movements within limits	YES	YES
Erosion & Sediment Control		
→ Sediment leaving site	NIL	NIL
Water Management		
→ Evidence of issue with groundwater quality	NIL	NIL
Rehabilitation		
→ Area vegetated	2.4 hectares	2.4 hectares
Overall number of complaints received	NIL	NIL

Attachment 3B

Environmental Manager's Monthly Checklists

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HITCHCOCK ROAD MAROOTA - Sand Extraction and Rehabilitation Project
EMP MANAGEMENT CONTROLS OPERATIONAL CHECKLIST - ENVIRONMENTAL MANAGER

June 2010

STRATEGY POINT	PAGE NO	DESCRIPTION	STATUS ✓ or ✗	COMPLAINTS RECEIVED	COMMENTS
A2	A3-A5	Noise	✓	Nil	Noise monitoring has been undertaken by Koikas Acoustics and a report will be prepared for the 2009-2010 AEMR
A3	A6-A10	Air Quality	✓	Nil	Deposited dust results for May 2010 show low levels at all locations.
A4	A11-A12	Access and Traffic	✓	Nil	Audit of trucks leaving site was undertaken on 10th June 2010. 7 trucks recorded leaving site between 6:00 and 7:00 am.
A5	A13-A16	Erosion & Sediment Control	✓	Nil	No water or sediment left site during this month. Downstream Lot 198 water samples were collected and sent to laboratory for analysis.
A6	A17-A20	Water	✓	Nil	URS attended site to collect bore monitoring data and groundwater samples. A groundwater report will be prepared for the AEMR.
A7	A21-A25	Rehabilitation & Vegetation offset	✓	Nil	A proposed rehabilitation plan has been received from Greening Australia and is being reviewed. PB also attended site to inspect
A8	A26-A27	Social Impact	✓	Nil	existing rehabilitation areas and advise of further action that may be required. A report from PB to be included in the AEMR.
A9	A28-A29	Heritage	✓	Nil	
A10	A30-A32	Visual Amenity	✓	Nil	
A11	A33-A35	Waste Management	✓	Nil	
A12	A36-A37	Emergency Response	✓	Nil	
A13	A38-A41	Hazard, Risk and Safety	✓	Nil	

Key:

✓ = Satisfactory

✗ = Unsatisfactory

Completed by Environmental Manager (Josh Graham)

Signed:

Adam

Date: 30th June 2010

PF FORMATION

HITCHCOCK ROAD MAROOTA - Sand Extraction and Rehabilitation Project
EMP MANAGEMENT CONTROLS OPERATIONAL CHECKLIST - ENVIRONMENTAL MANAGER

May 2010

STRATEGY POINT	PAGE NO	DESCRIPTION	STATUS ✓ or ✗	COMPLAINTS RECEIVED	COMMENTS
A2	A3-A5	Noise	✓	Nil	Koikas Acoustics will be preparing a Noise Report to be included in the 2009 - 2010 AEMR.
A3	A6-A10	Air Quality	✓	Nil	Deposited dust results for April 2010 show low levels at all locations.
A4	A11-A12	Access and Traffic	✓	Nil	Audit of trucks leaving site was undertaken on 29th May 2010. 6 trucks recorded leaving site between 6:00 and 7:00 am.
A5	A13-A16	Erosion & Sediment Control	✓	Nil	No water or sediment left site during this month despite heavy rain.
A6	A17-A20	Water	✓	Nil	BH02 is still not in use due to iron incrustation problems. URS will be preparing a Groundwater Report for the 09-10 AEMR.
A7	A21-A25	Rehabilitation & Vegetation offset	✓	Nil	An industrial weed sprayer has been purchased to spray weeds in topsoil so it can be used to rehabilitate more area.(1.5 ha)
A8	A26-A27	Social Impact	✓	Nil	Community Consultative Meeting held on 17th May 2010. Minutes are available on website.
A9	A28-A29	Heritage	✓	Nil	
A10	A30-A32	Visual Amenity	✓	Nil	
A11	A33-A35	Waste Management	✓	Nil	
A12	A36-A37	Emergency Response	✓	Nil	
A13	A38-A41	Hazard, Risk and Safety	✓	Nil	

Key:

✓ = Satisfactory

✗ = Unsatisfactory

Completed by Environmental Manager (Josh Graham)

Signed: 

Date: 31st May 2010

PF FORMATION

HITCHCOCK ROAD MAROOTA - Sand Extraction and Rehabilitation Project
EMP MANAGEMENT CONTROLS OPERATIONAL CHECKLIST - ENVIRONMENTAL MANAGER

April 2010

STRATEGY POINT	PAGE NO	DESCRIPTION	STATUS ✓ or ✗	COMPLAINTS RECEIVED	COMMENTS
A2	A3-A5	Noise	✓	Nil	An annual report by noise consultants will be prepared for the EMP.
A3	A6-A10	Air Quality	✓	Nil	Deposited dust results for March 2010 show low levels at all locations.
A4	A11-A12	Access and Traffic	✓	Nil	Audit of trucks leaving site was undertaken on 13th April 2010. 7 trucks recorded leaving site between 6:00 and 7:00 am
A5	A13-A16	Erosion & Sediment Control	✓	Nil	No water or sediment left site during this month.
A6	A17-A20	Water	✓	Nil	BH02 is still not in use due to iron incrustation problems. Pumping volumes for 10SL055663 have been forwarded to DWE as requested.
A7	A21-A25	Rehabilitation & Vegetation offset	✓	Nil	The Landscape Management Plan has yet to be approved by DOP.
A8	A26-A27	Social Impact	✓	Nil	
A9	A28-A29	Heritage	✓	Nil	
A10	A30-A32	Visual Amenity	✓	Nil	
A11	A33-A35	Waste Management	✓	Nil	
A12	A36-A37	Emergency Response	✓	Nil	
A13	A38-A41	Hazard, Risk and Safety	✓	Nil	

Key:

✓ = Satisfactory

✗ = Unsatisfactory

Completed by Environmental Manager (Josh Graham)

Signed:

Josh Graham

Date: 30th April 2010

PF FORMATION

HITCHCOCK ROAD MAROOTA - Sand Extraction and Rehabilitation Project
EMP MANAGEMENT CONTROLS OPERATIONAL CHECKLIST - ENVIRONMENTAL MANAGER

MARCH 2010

STRATEGY POINT	PAGE NO	DESCRIPTION	STATUS ✓ or ✗	COMPLAINTS RECEIVED	COMMENTS
A2	A3-A5	Noise	✓	Nil	No monitoring undertaken this month. An annual report by noise consultants will be prepared for the EMP.
A3	A6-A10	Air Quality	✓	Nil	Deposited dust results for Feb 2010 show low levels at Sites 2,3 & 4 but high results at Site 1. This is probably due to construction activity at MPS.
A4	A11-A12	Access and Traffic	✓	Nil	Audit of trucks leaving site was undertaken on 18th March 2010. 4 trucks recorded leaving site between 6:00 and 7:00 am
A5	A13-A16	Erosion & Sediment Control	✓	Nil	No water or sediment left site during this month. Downstream Lot 198 water samples were taken and results recorded. 178mm Rainfall for Feb 2010
A6	A17-A20	Water	✓	Nil	BH02 is still not in use due to iron incrustation problems.
A7	A21-A25	Rehabilitation & Vegetation offset	✓	Nil	The Landscape Management plan has yet to be finalised with DOP. DFA Consultants are handling recent RFI from the department.
A8	A26-A27	Social Impact	✓	Nil	
A9	A28-A29	Heritage	✓	Nil	
A10	A30-A32	Visual Amenity	✓	Nil	
A11	A33-A35	Waste Management	✓	Nil	
A12	A36-A37	Emergency Response	✓	Nil	
A13	A38-A41	Hazard, Risk and Safety	✓	Nil	

Key:

✓ = Satisfactory

✗ = Unsatisfactory

Completed by Environmental Manager (Josh Graham)

Signed: 

Date: 31st March 2010

PF FORMATION

HITCHCOCK ROAD MAROOTA - Sand Extraction and Rehabilitation Project
EMP MANAGEMENT CONTROLS OPERATIONAL CHECKLIST - ENVIRONMENTAL MANAGER

FEBRUARY 2010

STRATEGY POINT	PAGE NO	DESCRIPTION	STATUS ✓ or ✗	COMPLAINTS RECEIVED	COMMENTS
A2	A3-A5	Noise	✓	Nil	No monitoring undertaken this month. An annual report by noise consultants will be prepared for the EMP.
A3	A6-A10	Air Quality	✓	Nil	Deposited dust results for January 2010 show low levels at all locations.
A4	A11-A12	Access and Traffic	✓	Nil	Audit of trucks leaving site between 6-7am was undertaken on 1st February 2010. Five trucks recorded leaving leaving site.
A5	A13-A16	Erosion & Sediment Control	✓	Nil	No water or sediment left site during this month. De silting of the main clean water dam has been completed.
A6	A17-A20	Water	✓	Nil	BH02 is still not in use due to iron incrustation problems.
A7	A21-A25	Rehabilitation & Vegetation offset	✓	Nil	Greening Australia has undertaken an assessment of our new area to rehabilitate. (6/02/10) Recommendations have been noted.
A8	A26-A27	Social Impact	✓	Nil	
A9	A28-A29	Heritage	✓	Nil	
A10	A30-A32	Visual Amenity	✓	Nil	
A11	A33-A35	Waste Management	✓	Nil	
A12	A36-A37	Emergency Response	✓	Nil	
A13	A38-A41	hazard, Risk and Safet	✓	Nil	

Key:

✓ = Satisfactory

✗ = Unsatisfactory

Completed by Environmental Manager (Josh Graham)

Signed:

Josh Graham

Date: 26th February 2010

PF FORMATION

HITCHCOCK ROAD MAROOTA - Sand Extraction and Rehabilitation Project
EMP MANAGEMENT CONTROLS OPERATIONAL CHECKLIST - ENVIRONMENTAL MANAGER

January 2010

STRATEGY POINT	PAGE NO	DESCRIPTION	STATUS ✓ or ✗	COMPLAINTS RECEIVED	COMMENTS
A2	A3-A5	Noise	✓	Nil	No monitoring undertaken this month. An annual report by noise consultants will be prepared for the EMP.
A3	A6-A10	Air Quality	✓	Nil	Deposited dust results for December 2009 show low levels at all locations.
A4	A11-A12	Access and Traffic	✓	Nil	Audit of trucks leaving site between 6-7 am was undertaken on 14th January 2009. Five trucks recorded leaving site.
A5	A13-A16	Erosion & Sediment Control	✓	Nil	No water or sediment left site during this month. De silting of the main clean water dam has commenced. This will increase capacity for water storage.
A6	A17-A20	Water	✓	Nil	BH02 is still not in use due to iron incrustation problems.
A7	A21-A25	Rehabilitation & Vegetation offset	✓	Nil	A meeting with Greening Australia has been arranged for February to inspect current rehab sites and discuss methods for new rehab areas.
A8	A26-A27	Social Impact	✓	Nil	Normal
A9	A28-A29	Heritage	✓	Nil	Normal
A10	A30-A32	Visual Amenity	✓	Nil	Normal
A11	A33-A35	Waste Management	✓	Nil	Normal
A12	A36-A37	Emergency Response	✓	Nil	Normal
A13	A38-A41	Hazard, Risk and Safety	✓	Nil	Normal

Key:

✓ = Satisfactory
✗ = Unsatisfactory

Completed by Environmental Manager (Josh Graham)

Signed:



Date: 29th January 2010

PF FORMATION

HITCHCOCK ROAD MAROOTA - Sand Extraction and Rehabilitation Project
EMP MANAGEMENT CONTROLS OPERATIONAL CHECKLIST - ENVIRONMENTAL MANAGER

DECEMBER 2009

STRATEGY POINT	PAGE NO	DESCRIPTION	STATUS ✓ or x	COMPLAINTS RECEIVED	COMMENTS
A2	A3-A5	Noise	✓	Nil	No monitoring undertaken this month. An annual report by noise consultants will be prepared for the EMP.
A3	A6-A10	Air Quality	✓	Nil	Deposited dust results for November show low levels at Sites 1,2 and 3. Site 4 was unusually high. This site is not related to the Hitchcock Rd site.
A4	A11-A12	Access and Traffic	✓	Nil	Audit of trucks leaving site between 6 - 7 am was undertaken on 14th December 2009. Four trucks recorded leaving site.
A5	A13-A16	Erosion & Sediment Control	✓	Nil	No water or sediment left site during this month. Rubber lined steel pipe has replaced a large section of the sand line.
A6	A17-A20	Water	✓	Nil	Pumping has ceased in BH 02 due to iron incrustation problems.
A7	A21-A25	Rehabilitation & Vegetation offset	✓	Nil	Normal
A8	A26-A27	Social Impact	✓	Nil	Normal
A9	A28-A29	Heritage	✓	Nil	Normal
A10	A30-A32	Visual Amenity	✓	Nil	Normal
A11	A33-A35	Waste Management	✓	Nil	Normal
A12	A36-A37	Emergency Response	✓	Nil	Normal
A13	A38-A41	Hazard, Risk and Safety	✓	Nil	Normal

Key:

✓ = Satisfactory
x = Unsatisfactory

Completed by Environmental Manager (Josh Graham)

Signed:



Date: 24th December 2009

PF FORMATION

HITCHCOCK ROAD MAROOTA - Sand Extraction and Rehabilitation Project
EMP MANAGEMENT CONTROLS OPERATIONAL CHECKLIST - ENVIRONMENTAL MANAGER

NOVEMBER 2009

STRATEGY POINT	PAGE NO	DESCRIPTION	STATUS ✓ or x	COMPLAINTS RECEIVED	COMMENTS
A2	A3-A5	Noise	✓	Nil	Noise monitoring procedures are being reviewed. An annual report by noise consultants is being discussed. No monitoring undertaken this month.
A3	A6-A10	Air Quality	✓	Nil	Report on TEOM has been prepared by pae holmes and forwarded to DECC. Deposited dust results show low levels at all locations.
A4	A11-A12	Access and Traffic	✓	Nil	Audit of trucks leaving site between 6 - 7am was undertaken on 8th November 2009. Six trucks recorded leaving site.
A5	A13-A16	Erosion & Sediment Control	✓	Nil	Sediment fencing repaired in various areas within Lot 198. No sediment leaving site.
A6	A17-A20	Water	✓	Nil	Pumping has recommenced in bi-wash dam within Lot 198. BH01 & BH02 pumped 19.039MGL in last reporting period. (max = 50MGL)
A7	A21-A25	Rehabilitation & Vegetation offset	✓	Nil	Normal
A8	A26-A27	Social Impact	✓	Nil	Normal
A9	A28-A29	Heritage	✓	Nil	Normal
A10	A30-A32	Visual Amenity	✓	Nil	Normal
A11	A33-A35	Waste Management	✓	Nil	Normal
A12	A36-A37	Emergency Response	✓	Nil	None - No incidents
A13	A38-A41	Hazard, Risk and Safety	✓	Nil	Normal

Key:

✓ = Satisfactory
x = Unsatisfactory

Completed by Environmental Manager (Josh Graham)

Signed: 

Date: 30th November 2009

PF FORMATION

HITCHCOCK ROAD MAROOTA - Sand Extraction and Rehabilitation Project
EMP MANAGEMENT CONTROLS OPERATIONAL CHECKLIST - ENVIRONMENTAL MANAGER

October 2009

STRATEGY POINT	PAGE NO	DESCRIPTION	STATUS ✓ or ✗	COMPLAINTS RECEIVED	COMMENTS
A2	A3-A5	Noise	✓	nil	Noise Monitoring procedures are being reviewed. An annual report by noise consultants is being discussed. No monitoring undertaken this month.
A3	A6-A10	Air Quality	✓	nil	Deposited Dust results for September have been received and show low dust levels at all locations despite severe dust storms.
A4	A11-A12	Access and Traffic	✓	nil	Audit of trucks leaving site between 6 - 7am was undertaken on 29th October 2009. Six trucks recorded leaving site.
A5	A13-A16	Erosion & Sediment Control	✓	nil	Normal - No sediment leaving site.
A6	A17-A20	Water	✓	nil	Normal
A7	A21-A25	Rehabilitation & Vegetation offset	✓	nil	Normal
A8	A26-A27	Social Impact	✓	nil	Normal
A9	A28-A29	Heritage	✓	nil	Normal
A10	A30-A32	Visual Amenity	✓	nil	Normal
A11	A33-A35	Waste Management	✓	nil	Normal
A12	A36-A37	Emergency Response	✓	nil	None - No Incidents
A13	A38-A41	Hazard, Risk and Safety	✓	nil	Normal

Key:

✓ = Satisfactory

✗ = Unsatisfactory

Completed by Environmental Manager (Josh Graham)

Signed:

Josh Graham

Date: 30th October 2009

PF FORMATION

HITCHCOCK ROAD MAROOTA - Sand Extraction and Rehabilitation Project
EMP MANAGEMENT CONTROLS OPERATIONAL CHECKLIST - ENVIRONMENTAL MANAGER

September 2009

STRATEGY POINT	PAGE NO	DESCRIPTION	STATUS ✓ or ✗	COMPLAINTS RECEIVED	COMMENTS
A2	A3-A5	Noise	✓	nil	Noise monitoring was unable to be undertaken this month due to faulty sound monitoring equipment.
A3	A6-A10	Air Quality	✓	nil	High dust readings expected due to dust storms.
A4	A11-A12	Access and Traffic	✓	nil	Audit of trucks leaving site undertaken on 30-09-09 4 trucks left site between 6 & 7am.
A5	A13-A16	Erosion & Sediment Control	✓	nil	Normal
A6	A17-A20	Water	✓	nil	Pumping has recommenced in Por 167 spring.
A7	A21-A25	Rehabilitation & Vegetation offset	✓	nil	Normal
A8	A26-A27	Social Impact	✓	nil	Normal
A9	A28-A29	Heritage	✓	nil	Normal
A10	A30-A32	Visual Amenity	✓	nil	Normal
A11	A33-A35	Waste Management	✓	nil	Normal
A12	A36-A37	Emergency Response	✓	nil	None - No incidents.
A13	A38-A41	Hazard, Risk and Safety	✓	nil	Normal

Key:

✓ = Satisfactory

✗ = Unsatisfactory

Completed by Environmental Manager (Josh Graham)

Signed: 

Date: 30-09-09.

PF FORMATION

HITCHCOCK ROAD MAROOTA - Sand Extraction and Rehabilitation Project
EMP MANAGEMENT CONTROLS OPERATIONAL CHECKLIST - ENVIRONMENTAL MANAGER

August 2009

STRATEGY POINT	PAGE NO	DESCRIPTION	STATUS ✓ or x	COMPLAINTS RECEIVED	COMMENTS
A2	A3-A5	Noise	✓	nil	Normal
A3	A6-A10	Air Quality	✓	nil	Dust monitoring results from July were low.
A4	A11-A12	Access and Traffic	✓	nil	Audit of trucks leaving site undertaken on 24-08-09. 3 trucks left site between 6-7am
A5	A13-A16	Erosion & Sediment Control	✓	nil	Inspection Report from Douglas Partners has been received and recommendations noted.
A6	A17-A20	Water	✓	nil	Normal - Dry conditions, low rainfall
A7	A21-A25	Rehabilitation & Vegetation offset	✓	nil	Normal
A8	A26-A27	Social Impact	✓	nil	Normal
A9	A28-A29	Heritage	✓	nil	Normal
A10	A30-A32	Visual Amenity	✓	nil	Normal
A11	A33-A35	Waste Management	✓	nil	Normal
A12	A36-A37	Emergency Response	✓	nil	None - No incidents.
A13	A38-A41	Hazard, Risk and Safety	✓	nil	Normal

Key:

✓ = Satisfactory
x = Unsatisfactory

Completed by Environmental Manager (Josh Graham)

Signed:

Josh Graham

Date: 31-08-09.

PF FORMATION

HITCHCOCK ROAD MAROOTA - Sand Extraction and Rehabilitation Project
EMP MANAGEMENT CONTROLS OPERATIONAL CHECKLIST - ENVIRONMENTAL MANAGER

July 2009

STRATEGY POINT	PAGE NO	DESCRIPTION	STATUS ✓ or x	COMPLAINTS RECEIVED	COMMENTS
A2	A3-A5	Noise	✓	nil	Noise testing undertaken in June. No quarry noise was recorded.
A3	A6-A10	Air Quality	✓	nil	Dust monitoring results from June were low.
A4	A11-A12	Access and Traffic	✓	nil	Audit of trucks leaving site undertaken on 29-07-09. 4 trucks left site between 6-7am.
A5	A13-A16	Erosion & Sediment Control	✓	nil	Excavation of pipeline trenching has commenced. Silt traps are satisfactory.
A6	A17-A20	Water	✓	nil	Downstream water sampling undertaken in June. Results are satisfactory.
A7	A21-A25	Rehabilitation & Vegetation offset	✓	nil	Normal
A8	A26-A27	Social Impact	✓	nil	Normal
A9	A28-A29	Heritage	✓	nil	Normal
A10	A30-A32	Visual Amenity	✓	nil	Normal
A11	A33-A35	Waste Management	✓	nil	Normal
A12	A36-A37	Emergency Response	✓	nil	None - No incidents.
A13	A38-A41	Hazard, Risk and Safety	✓	nil	Normal

Key:

✓ = Satisfactory
x = Unsatisfactory

Completed by Environmental Manager (Josh Graham)

Signed:

Josh Graham

Date: 30th July 2009.

Attachment 3C

Annual Environmental Operations Procedures Checklist

2.3 Management controls

OPERATIONAL PHASE

Strategy 2.1: Ensure that the site operations are undertaken in a manner that minimises the impacts of noise and vibration.

Actions	Responsibility	Date/Initials	Comments
2.1.1 Manage site activities so that any necessary high noise and vibration levels occur at times of least impact.	Site Manager		
2.1.2 Advise neighbouring properties at least 24 hours in advance of the extent and expected duration of especially noisy activities.	Site Manager/ Environmental Manager	1/04/10 JB	
2.1.3 Undertake all site activities incorporating noise attenuation measures such as restricting working hours for certain works required close to sensitive receptors	Site Manager	13-4-10	
2.1.4 Ensure that panels and covers of silenced plant are kept shut and plant and equipment switched off when not in use.	Site Manager	13.4.10	
2.1.5 Ensure that mechanical equipment is silenced by the best practical means using current technology, prior to use. Noise suppression devices should be fitted according to manufacturer's instructions. Residential class mufflers should be used where possible. Noise control kits should be fitted to noisy mobile equipment and shrouds provided around stationary equipment where necessary.	Site Manager	13.4.10	
2.1.6 Working hours will be limited to 7.00am to 6.00pm, Monday to Saturday and at no time on Sundays and public holidays. A maximum of ten laden vehicles will be permitted to enter and leave the site between the hours of 6.00am and 7.00am, Monday to Saturday, excluding Sundays and public holidays.	Site Manager		SALE AS PER 6.00AM CONDITION. OPERATOR START AT 6.00 BUT CHECK EQUIP IN COMPOUND PRIOR TO COMMENCING PRODUCTION.
2.1.7 Arrange for all plant and equipment to be inspected regularly to ensure that it is well maintained to minimise noise emissions.	Site Manager	13.4.10	
2.1.8 Conduct compliance monitoring of noise levels at the defined locations and keep records of measurements.	Environmental Manager	1/04/10 JB	AS per monthly EMP operational checklist.
Performance indicator	Noise from operational activities does not exceed the guideline limits.		
	Number of complaints received	1/04/10 JB	No complaints received.

3.3 Management controls

OPERATIONAL PHASE

Strategy 3.1: Ensure that the site operations are undertaken in a manner that minimises and controls dust and vehicle emissions.

Actions		Responsibility
3.1.1	Conduct ambient air quality monitoring at identified sites	Environmental Manager
3.1.2	Fit dust suppression equipment to all processing plant on the site. This is to be regularly inspected and maintained in good working order at all times.	Site Manager/ Environmental Manager
3.1.3	Define trafficable areas to prevent unnecessary vehicle movement into others	Site Manager
3.1.4	Keep all unsealed trafficable areas and working areas damp to minimise dust emissions by spraying regularly with a water cart, water sprays or sprinklers. Frequency of spraying to be determined based on weather conditions, soil erodibility and the observation of any visible dust.	Site Manager/ Environmental Manager
3.1.5	Apply speed controls to all unsealed areas (maximum speed of 20 km/h) and signpost accordingly.	Site Manager
3.1.6	Vegetate all semi-permanent stockpiles with suitable groundcover and regularly water until the vegetation is well established.	Site Manager
3.1.7	Cease work on any extraction activity producing dust due to high winds that cannot be controlled by watering or other means. Work will not resume until the wind velocity decreases and any dust generation can be controlled by normal means.	Site Manager
3.1.8	Ensure that all loaded trucks leaving the central processing plant on Lot 198 DP595538 have their payloads fully covered by a suitable material to prevent spillage.	Site Manager
3.1.9	Construct dust screens such as earth bunds and vegetated barriers.	Site Manager
3.1.10	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.	Site Manager
3.1.11	No fires to be permitted on-site.	Site Manager

Performance indicator Ambient air quality data compiled.

Dust generated from site activities to comply at all times with DECC specified air quality criteria.

1/04/10 JB Refer to EMP Operational Checklist

1/04/10 JB Monthly reporting
Refer to EMP Checklist

1/04/10 JB

1/04/10 JB
Haul roads and working
areas are kept damp at
all times.

13.4.10 RW.

13.4.10 RW.

13.4.10 RW.

13.4.10 RW.

13.4.10 RW.

13.4.10 RW.

13.4.10 RW.

Monitoring	Dust monitoring at identified locations.
	Compilation of a complaints register.

Reporting	Documentation of air quality in a monthly report on dust emissions.
	Annual reporting in the AEMR. Monitoring results will be suitably summarised for posting on the PF Formation website.

JB 1/04/10.

Strategy 3.2: Minimise and control vehicle and plant exhaust emissions.

Actions		Responsibility
3.2.1	Inspect all exhausts from vehicles and plant/equipment to ensure that they are maintained at an acceptable level.	Environmental Manager
3.2.2	Regularly service all vehicles to ensure that exhaust emissions comply with the regulations. Maintain appropriate service records.	Site Manager
3.2.3	Identify any opportunities to minimise machinery use and ensure that all equipment used on the site is energy efficient.	Site Manager

JB 1/04/10. Refer to weekly checklists.
 13.4.10 VEHICLES REGULARLY SERVICED
 NO WAY TO TEST EXHAUST
 13.4.10 RW-

Performance Indicator	Vehicle and plant emissions comply with the regulations.
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Monitoring	Regular vehicle and plant inspections.
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Reporting	Annual reporting of inspection results in the AEMR.
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1.3 Management controls**OPERATIONAL PHASE****Strategy 4.1: Minimise the impact of operational traffic on the local community.**

Actions	Responsibility
4.1.1 Ensure that the number of laden vehicle movements does 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.	Site Manager/ Environmental Manager <i>Jb 1/04/10.</i>
4.1.2 Undertake operations involving the transportation of material on the site only between 6.00am and 6.00pm, Monday to Saturday.	Site Manager/ Environmental Manager <i>Jb 1/04/10</i>
4.1.3 Allow a maximum of ten laden vehicles to enter and leave the site between 6.00am and 7.00am, Monday to Saturday only. Ensure that vehicles do not arrive at the site prior to 5.45am on any day.	Site Manager/ Environmental Manager <i>Jb 1/04/10 Refer to Monthly EMP Checklist.</i>
4.1.4 Ensure that all vehicle loads leaving the site are suitably covered.	Site Manager <i>h/ 13.4.10</i>

Performance Indicator	Minimum of complaints from the community.
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Monitoring	Number and type of complaints received.
	Weighbridge records of arrival and departure times.

Reporting	Bi-annual report on complaints received.
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1.4 Monitoring and reporting

The Site Manager will be responsible for the monitoring of complaints on traffic issues from the community. Annual reports will be compiled on community complaints and reported in the AEMR.

OPERATIONAL PHASE**Strategy 5.1: Provide for treatment of stormwater runoff from extraction areas, stockpiles and access roads.**

Actions	Responsibility
5.1.1 Construct temporary erosion and sedimentation control structures such as detention basins and catch drains as appropriate to collect runoff from cleared land including extraction areas and access roads.	Site Manager/ Environmental Manager <i>JB 1/04/10 Refer to EMP checklist.</i>
5.1.2 Erect silt traps and erosion control fencing as appropriate along extraction area boundaries and drainage lines.	Site Manager/ Environmental Manager <i>JB 1/04/10 Refer to EMP checklist.</i>
5.1.3 Design sediment basins with a minimum storage capacity of 400 m ³ per hectare of catchment. Spillway capacity and stability will be designed as follows: <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 • life greater than 10 years, adopt the 100 year t_c event. 	Site Manager <i>RW 13.4.10</i>
5.1.4 Undertake regular inspections to assess stormwater control measures and conduct routine inspections to ensure that compliance with best practice guidelines and relevant legislation is achieved.	Site Manager/ Environmental Manager <i>JB 1/04/10 Refer to EMP checklist.</i>
Performance indicator	Stormwater control measures are in place prior to commencement of extraction in the particular phase of development and are effective in reducing sedimentation to acceptable levels.
Monitoring	Review effectiveness of the stormwater basins and treatment methods during and following major rainfall events.
Reporting	Report on effectiveness of control measures once sedimentation works completed and then on an annual basis.

Strategy 5.2: Plan site operations to minimise opportunities for soil erosion and sedimentation.

Actions	Responsibility
5.2.1 Select locations for topsoil and material stockpiles on level ground and away from drainage lines. Install diversion drains up slope and sediment filter fences as appropriate	Site Manager/ Environmental Manager <i>JB 1/04/10</i>
5.2.2 Provide training to operational personnel on the importance of erosion control measures and inform drivers of the damage that can be caused by to the environment by heavy vehicles	Site Manager/ Environmental Manager <i>JB 1/04/10</i>

Performance Indicator	Soil erosion control measures are incorporated in the operational activities on the site and are effective in reducing soil erosion.
Monitoring	Monitor suspended solid concentrations in stormwater runoff from the undisturbed parts of the site.
Reporting	Report on the effectiveness of soil erosion control measures prior to extraction.

Strategy 5.3: Ensure that suspended solid levels in stormwater discharging from the site meets the guidelines for the protection of aquatic ecosystems (ANZECC 2000)

Actions	Responsibility
5.3.1 Keep areas of exposed land to a minimum compatible with operational requirements.	Site Manager
5.3.2 Where practicable, provide silt fences to minimise erosion and sedimentation from exposed areas.	Site Manager/ Environmental Manager
5.3.3 Stabilise exposed areas that are not in use with an appropriate cover crop and water until well established.	Site Manager/ Environmental Manager
5.3.4 Construct sediment retention basins with a capacity of at least 300m ³ per hectare of catchment, which will necessitate regular cleaning out, and a minimum freeboard of one metre.	Site Manager
5.3.5 Monitor erosion and sediment controls regularly and immediately following a rainfall event. Monitoring will take place initially on a weekly basis, then monthly once operating correctly. Clear sediment when the traps have collected 60% of the capacity of the basin or where sediment build-up is less than 300mm below the spillway crest. Remove sediment to a location where further pollution to downslope lands and waterways will not occur.	Site Manager/ Environmental Manager
5.3.6 Undertake maintenance of erosion and sediment controls when any deterioration is identified or when replacement is necessary.	Site Manager/ Environmental Manager
5.3.7 Reuse stored stormwater for dust control and the watering of site vegetation.	Site Manager/ Environmental Manager
5.3.8 Seed material stockpiles where these are to remain unused for a period in excess of four weeks. Water the area until the vegetation is well established.	Site Manager/ Environmental Manager
5.3.9 Control vehicle movement on the site by the identification of the haul road and current working areas.	Site Manager

Refer to EMP Checklist.

JG 1/04/10

RW 13.4.10

JG 1/04/10

JG 1/04/10

JG 1/04/10




JG 1/04/10

RW 13.4.10

3.3 Management controls

OPERATIONAL PHASE

Strategy 6.1: Plan site operations to minimise potential impacts on groundwater

Actions	Responsibility
6.1.1 Restrict maximum depth of extraction to 2 metres above the wet weather high groundwater level as determined following at least 12 months site specific groundwater monitoring data.	Site Manager 
6.1.2 Ensure that the groundwater is not breached or contaminated. In the event that either should occur, operations are to cease and the Department of Water and Energy and the Department of Planning consulted to determine the basis on which extraction may recommence.	Site Manager 
6.1.3 Design the sediment retention basins to accommodate the 100-year t_c event. The minimum basin capacities are as follows: <ul style="list-style-type: none"> Southern catchment (Basin 1) 19,400 m³ Northern catchment (Basin 2) 7,800 m³ The volume of these basins can be varied depending on the extent of the area exposed for extraction within each catchment.	Site Manager 
6.1.4 Arrange for regular inspection of the capacity and stability of all retention basins and report on their effectiveness.	Site Manager/ Environmental Manager 1/04/10 JB
6.1.5 Install a minimum of two groundwater monitoring bores. One should 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 is to meet the requirements of the Department of Water and Energy and the Department of Planning.	Site Manager/ Environmental Manager 1/04/10 JB refer to URS reports.

Performance indicator	Maintenance of groundwater quality. Existing water levels and groundwater quality will be determined from data derived from the bores on the site.
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Monitoring	Regular monitoring of water levels and water quality data from the on-site bores. Assessment in relation to the conclusions of the Maroota Groundwater Study when this becomes available.
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7.3 Management controls**OPERATIONAL PHASE****Strategy 7.1: Implement measures to ensure the protection of native vegetation, including threatened species.**

Actions	Responsibility
7.1.1 Clearly identify and mark out all areas which are not to be disturbed.	Site Manager/ Environmental Manager 1/04/10 JB
7.1.2 Assess areas where trees are to be removed to determine the commercial value of any which are too large to mulch. Any with commercial value are to be marked and arrangements made for removal.	Environmental Manager 1/04/10 JB
7.1.3 Prepare an assessment of the species mix of the Sydney Hinterland Transition Woodland and arrange for collection of seeds from the vegetation to be removed and adjacent areas. Mulch vegetation removed from the area and stockpile 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. Protect young plants from predation by feral pests.	Environmental Manager 1/04/10 JB Assisted by Greening Australia.
7.1.5 Restrict access to bushland to minimise the potential for damage. Suitably identify and mark out these areas to ensure that this prohibition is made clear.	Site Manager/ Environmental Manager 1/04/10 JB
7.1.6 Separate topsoil for use in rehabilitation works.	Site Manager/ Environmental Manager 1/04/10 JB
7.1.7 Incorporate flora and fauna issues in the education program so that the site operatives are aware of the requirements of this EMP.	Environmental Manager 1/04/10 JB
7.1.8 Once each extraction phase is complete, initiate the rehabilitation and revegetation program as set out in the Landscape management Plan.	Site Manager/ Environmental Manager 1/04/10 JB
Performance indicator	All areas of significant flora and fauna habitat are protected prior to the start of extraction.
Monitoring	Ensure that all the above are implemented prior to the commencement of extraction activities in the area. Monitor condition of flora and fauna habitats on a regular basis.

Reporting

A report with appropriate maps identifying the areas fenced and defined areas for access and extraction activity is to be prepared.

Map disturbed areas on an annual basis and report on any impacts on bushland and rehabilitated areas.

Prepare an annual report on the status of the flora of the site for inclusion in the AEMR.

Strategy 7.2: Undertake the rehabilitation of the site to achieve an agreed and acceptable landform with appropriate planting.

Actions	Responsibility
7.2.1 Review and amend the Landscape Management Plan as necessary to reflect changing operational conditions. This should include a revised phasing plan and implementation program.	Site Manager/ Environmental Manager 1/04/10 JB
7.2.2 Define setbacks to all roads and adjacent properties taking account of existing trees and other features. Undertake the construction of the peripheral mounding focussing initially on those areas where views are available from external roads and where houses on adjacent property are close to the site boundary. Carry out programs of screen planting in these areas. All plant material used should reflect the species mix existing in the area.	Environmental Manager 1/04/10 JB
7.2.3 Mulch all suitable plant material for reuse on the site as a seed and planting medium. Store all topsoil in appropriately marked low stockpiles for reuse in locations as close as possible to their source. Care should be taken to ensure that this does not become contaminated with the seeds of exotic species and weeds.	Environmental Manager 1/04/10 JB
7.2.5 Rehabilitate the site in stages leaving areas exposed for as short a time as possible. This should 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 should be as gentle as possible depending on the availability of fill material.	Site Manager/ Environmental Manager 1/04/10 JB
7.2.6 Sow all stockpiles and exposed areas where no activity is to take place for more than four weeks with an appropriate vegetation cover.	Site Manager/ Environmental Manager 1/04/10 JB
7.2.7 Undertake revegetation of the site on the following basis: <ul style="list-style-type: none"> re-establish the Sydney Hinterland Transition Woodland using seed and mulch collected from the area rehabilitate other areas to native species with a light sowing of cereal and allowing natural regeneration lime, fertilise and sow areas where improved grass cover is required suitably turf surfaces expected to experience high surface flows leaving the site 	Environmental Manager 1/04/10 JB Assisted by Greening Australia

7.2.8	Establish a maintenance program aimed at promoting and protecting the growth of the rehabilitated areas.	Site Manager/ Environmental Manager
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Performance Indicator	Completion of site rehabilitation in conformity with the approved Landscape Management Plan.
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Monitoring	Regular site inspections to ensure that the following is achieved: <ul style="list-style-type: none">• rate of rehabilitation is in conformity with the staging program• conservation zones and rehabilitated areas are being appropriately maintained• vegetative covers are being established• site works such as bunding and the establishment of re-vegetated areas are progressing in accordance with the Landscape Management Plan• all sensitive flora and fauna habitat is being adequately protected from damage
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Reporting	Reports of site inspections and annual reviews in the AEMR.
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7.4 **Monitoring and reporting**

The Environmental Manager will be responsible for monitoring the effectiveness of the measures included for the protection of native vegetation on the site and the progress of site rehabilitation. Bi-annual reports will be prepared by the Environmental Manager and annual reports prepared for inclusion in the AEMR.

3.3 Management controls

OPERATIONAL PHASE

Strategy 8.1: Consider community feedback in determining operating procedures to minimise negative impacts.

Actions	Responsibility
3.1.1 Provide material concerning activities at the site for publication in existing community newsletters which receive wide dissemination in the Maroota area.	Site Manager/ Environmental Manager 1/04/10 SG
3.1.2 Maintain an open door policy . Widely publish contact phone number and provide an early response to all queries, comments and requests for information.	Site Manager/ Environmental Manager 1/04/10 SG
3.1.3 Provide access to all relevant environmental management documentation and monitoring results on the PF Formation web site.	Environmental Manager 1/04/10 SG
3.1.4 Organise and manage bi-annual meetings of the Community Consultative Committee to discuss issues in relation to environmental management of sand extraction on the site.	Environmental Manager 1/04/10 SG
3.1.5 Establish a complaints register incorporating date and time, type of communication, contact details of the complainant, nature of the complaint and response taken.	Site Manager/ Environmental Manager 1/04/10 SG

Performance indicator Minimal complaints from the community.

Monitoring Number and type of responses and complaints raised by the community and improved performance.

Reporting Annual reporting of community responses and complaints together with an assessment of any changes put in place to minimise any future difficulties for inclusion in the AEMR.

3.3 Management controls

OPERATIONAL PHASE

Strategy 9.1: Protect items of heritage value during site operations.

Actions		Responsibility
9.1.1	Cease all work if an archaeological or heritage item is identified during extraction operations and consult the National Parks and Wildlife Service, the Deerubbin Aboriginal Land Council or the Heritage Office to determine any appropriate course of action prior to recommencement of the work. Obtain any required permits and submit together with supporting information. Notify Baulkham Hills Shire Council to ensure compliance with the conditions of approval.	Site Manager/ Environmental Manager 1/04/10 JB
9.1.2	Undertake additional survey work required for submittal of application to destroy artefact scatters located in the later stages of the development. Comply with the reasonable requirements of the National Parks and Wildlife Service, the Deerubbin Aboriginal Land Council and the Heritage Office arising out of any additional studies and notify Baulkham Hills Shire Council to ensure compliance with the conditions of the approval.	Environmental Manager 1/04/10 JB
Performance Indicator		Any item of heritage significance is protected during site operations.
Monitoring		The protection of any heritage items identified during site operations is to be monitored. Access to the Trig Reserve site is to be monitored.
Reporting		Any heritage item identified during site operations is to be documented.

3.4 Monitoring and reporting

The Environmental Manager will be responsible for the reporting of any heritage items identified during the course of site activities. Annual reports will be prepared by the Environmental Manager.

10.3 Management controls**OPERATIONAL PHASE**

Strategy 10.1: Ensure that impacts on visual amenity are minimised during site activities and following completion.






Actions	Responsibility
10.1.1 Clearly mark all vegetation to be retained.	Site Manager/ Environmental Manager 1/04/10 JB
10.1.2 Construct peripheral bunding within the established setbacks. These should 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	Site Manager/ Environmental Manager 1/04/10 JB
10.1.3 Undertake screen planting works to the peripheral areas to an agreed specification using mulch to allow for native plant regeneration. Reinforce this species mix using appropriate plantings at specified intervals.	Environmental Manager 1/04/10 JB
10.1.4 Undertake a tree planting program within areas defined in the Landscape Management Plan to establish a dense plantation using an appropriate mix of species reflecting that of the existing community.	Environmental Manager 1/04/10 JB Assisted by Greening Australia.
10.1.5 Re-establish the landform of the extraction areas to that shown in the Landscape Management Plan.	Site Manager RW 13.4.10
10.1.6 Complete the rehabilitation of the site in conformity with the proposals set out in the Landscape Management Plan.	Site Manager RW 13.4.10
10.1.7 Remove all temporary fencing when no longer required.	Site Manager RW 13.4.10
10.1.8 Re-establish vegetation in areas suitable for agricultural/horticultural uses.	Site Manager RW 13.4.10
10.1.9 Remove all site infrastructure including the slurry plant and its associated pipelines. Restore those areas affected by the plant and rehabilitate.	Site Manager RW 13.4.10
10.1.10 Remove all waste materials and dispose of in an appropriate manner.	Site Manager RW 13.4.10
10.1.11 Review Quarry Closure Plan and prepare proposals for future use of the area.	Site Manager

Performance Indicator

No complaints received regarding visual amenity during site operations and following completion.

Completion of the development in conformity with the requirements of the Rehabilitation Plan.

11.3 Management controls**OPERATIONAL PHASE****Strategy 11.1: Appropriate management and disposal of wastes generated during site operations.**

Actions	Responsibility	
11.1.1 Clearly delineate waste handling areas.	Site Manager	RW 13.4.10 RUBBISH BIN SCRAP BIN MTMAGNAN
11.1.2 Define specific areas for the collection of materials for reuse and recycling and clearly label.	Site Manager	RW 13.4.10
11.1.3 Process cleared vegetation on site for use as mulch within the landscape program.	Environmental Manager	1/04/10 JG
11.1.4 Store all topsoil in stockpiles for later use in site rehabilitation.	Environmental Manager	1/04/10 JG
11.1.5 Provide bins or skips 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 DP595538. Waste food will be removed on a daily basis and stored in a vermin proof bin for collection by waste contractor. Paper waste generated from site offices, plastics and glass are to be collected separately for recycling.	Site Manager	RW 13.4.10
11.1.6 Separate hazardous wastes (including empty drums, rags, soil contaminated with oil) from non-hazardous wastes and manage in accordance with the relevant legislation.	Site Manager	RW 13.4.10
11.1.7 Temporarily store liquid wastes (chemicals, oils and greases) in an appropriately bunded area and dispose of via a licensed contractor. Direct washdown water to an appropriate settlement basin if quality is acceptable. Otherwise, store and dispose as a liquid waste.	Site Manager	RW 13.4.10
11.1.8 Retain copies of current licences of all waste removal contractors on site.	Site Manager	
11.1.9 Keep all documentation relating to waste removal and disposal on file at the site. This documentation includes dockets for the removal and disposal of waste at a licensed facility.	Site Manager	
11.1.10 Progressively separate and stockpile waste material in designated areas for collection. Adequately secure waste disposal areas to prevent access by wildlife.	Site Manager	
11.1.11 Review all waste licences and monitor terms and conditions for compliance.	Site Manager	
11.1.12 Recycle or dispose of any materials and waste remaining on the site following completion of extraction operations. All should be disposed of in an appropriate manner.	Site Manager	

12.3 Management controls**OPERATIONAL PHASE****Strategy 12.1: Ensure that procedures and controls are implemented to prevent, or if necessary, control any potential environmental emergency**

Actions	Responsibility
12.1.1 Ensure that all personnel on site during operations have been trained in appropriate procedures including site induction, materials handling and response procedures.	Site Manager
12.1.2 Develop and put in place emergency response procedures. Appoint appropriate individuals as emergency services liaison officers.	Site Manager
12.1.3 Establish an emergency response table listing contact details of all relevant parties required in an environmental emergency.	Site Manager
12.1.4 Establish a Register of Environmentally Hazardous Materials to be stored and used on site.	Site Manager
12.1.5 Ensure that appropriate safety and spill response equipment has been made available.	Site Manager
12.1.6 Clearly label all materials to be used and stored on site.	Site Manager
12.1.7 Review and update emergency response procedures bi-annually.	Site Manager
12.1.8 Ensure that appropriate safety and response equipment is available at all times.	Site Manager

13.4.10

IN SAFETY BOOK & INSTRUCTIONS

SPILL KIT AT BATCH HUT

SAFETY.

Performance indicator Emergency response procedures, controls and training adequate for potential emergencies.


Monitoring Regular monitoring of response procedures and equipment.

Reporting Annual report on incidents.

12.4 Monitoring and reporting

The Site Manager will be responsible for maintaining the currency of the emergency procedures and reporting on incidents.

13.3 Management controls**OPERATIONAL PHASE****Strategy 13.1: Minimise the risks associated with the storage and handling of hazardous materials.**

Actions	Responsibility
13.1.1 Obtain a licence to keep dangerous goods from WorkCover NSW for all materials stored on site which require licensing	Site Manager <i>None required. RB. 27/4/10.</i>
13.1.2 Establish a Register of Hazardous Materials setting out details of quantities, storage and specific handling requirements for all relevant materials stored on site.	Site Manager/ Environmental Manager <i>1/04/10 JG</i>
13.1.3 Obtain Material Safety Data Sheets for all hazardous materials stored on site.	Site Manager/ Environmental Manager <i>1/04/10 JG</i>
13.1.4 Provide appropriate storage and secondary containment facilities for all hazardous materials stored on site. All bunded areas must be designed to contain at least 110% of the volume of materials stored within the area.	Site Manager 
13.1.5 Appoint a Safety Officer for the development.	Site Manager
13.1.6 Locate all flammable material storage areas at least ten metres from possible ignition sources.	Site Manager/ Environmental Manager <i>1/04/10 JG</i>
14.1.7 Clearly label the contents of all above ground storage areas.	Site Manager/ Environmental Manager <i>1/04/10 JG</i>
13.1.8 Secure all hazardous and dangerous goods storage areas and display appropriate signage. Segregate all incompatible material.	Site Manager/ Environmental Manager <i>1/04/10 JG</i>
13.1.9 Train all personnel in the handling and safety procedures required for the hazardous materials stored and used on site.	Site Manager/ Environmental Manager <i>1/04/10 JG</i>

Performance Indicator	Storage and handling of hazardous materials complies with legislative requirements and demonstrates due diligence.
Monitoring	Regular audit of compliance with legislative requirements for the storage and handling of hazardous materials.
Reporting	Regular audit reports.

Strategy 13.2: Ensure that procedures are implemented and facilities made available for clean up in the event of a pollution incident.

Actions		Responsibility
13.2.1	Emergency Response Plan in place (see Chapter 12).	Site Manager
13.2.2	Provide a mobile spill control kit containing appropriate absorbent materials, neutralising chemicals and other spill containment equipment.	Site Manager
13.2.3	Provide personal protective equipment and instruct personnel on its use.	Site Manager
13.2.4	Clean up any spills beyond the bunded area immediately and dispose of the contaminated material in an appropriate manner.	Site Manager
13.2.5	Contact the relevant authorities in the event of a leak or spill. Follow any instructions provided. Remediate any contamination to the satisfaction of the regulatory authorities.	Site Manager
13.2.6	Collect any spills or hazardous wastes that cannot be recycled and arrange for disposal by a licensed waste contractor. Maintain all records of waste removal on site.	Site Manager
Performance Indicator		All pollution incidents contained and cleaned up without impact on the environment or injury to personnel. All incidents recorded.
Monitoring		Stormwater and soil contamination monitoring undertaken following any spill and subsequent clean up.
Reporting		Report on all pollution events and the results of any clean up.

[Handwritten signatures and notes]
Baren HVT

Chapter Four NOISE MANAGEMENT

Introduction

The Project Approval (**Schedule 3 Condition 8**) for the Hitchcock Road development requires the preparation and implementation of a Noise Management Plan in order to demonstrate that compliance with the relevant noise impact assessment listed in the approval has been achieved. The objectives of the Annual Environmental Management Report on noise issues are therefore;

- identify the environmental noise emission criteria nominated in the relevant approval documents
- document the results of environmental noise monitoring conducted in the 12 months ended June 2010
- assess the measured noise emissions levels against the relevant criteria; and
- nominate existing noise emission monitoring methodology and establish routine measurement procedures.

Noise emission criteria

The Noise Management Plan requires the noise criteria set out in **Table 4.1** to be applied to the impact assessment. These assessment locations as shown on **Attachment 4A** were selected because they are representative or closer to the quarry than the Noise Assessment Locations identified in Table 1 of Schedule 3 to the Notice of Project Approval.

Table 4.1 Noise impact assessment monitoring locations

Noise assessment location	Other locations covered	Day	Night ¹	
		LAeq (15 minute)	LAeq (15 minute)	LA1 (1 minute)
1. R9 – Young, Hitchcock Road	R10- Tornatola	39	35	45
2. R5 - Pignataro	R6 Camilleri	42	35	45
3. R3 – Firestation/Jurd	R1 Hammond & R2 Hitchcock	40	35	45
4. R7 – Maroota Public School	R6 Camilleri & R8 Portelli	36(LAeq(1 hour))	N/A	N/A

Note 1: Night time is defined as the period between 10.00pm and 7.00am. Activities on the site start at 6.00am and are completed by 6.00pm. There is no activity on the site during the evening period

The following noise parameters are measured at the nominated monitoring locations.

- LAeq(15 minute) noise level measured at an appropriate free-field location close to the façade of the relevant residence or other building during day time and evening hours.
- LAeq(1 minute) noise level measured at an appropriate free-field location close to the façade of the relevant residence during night time hours.

Operator-attended noise survey results

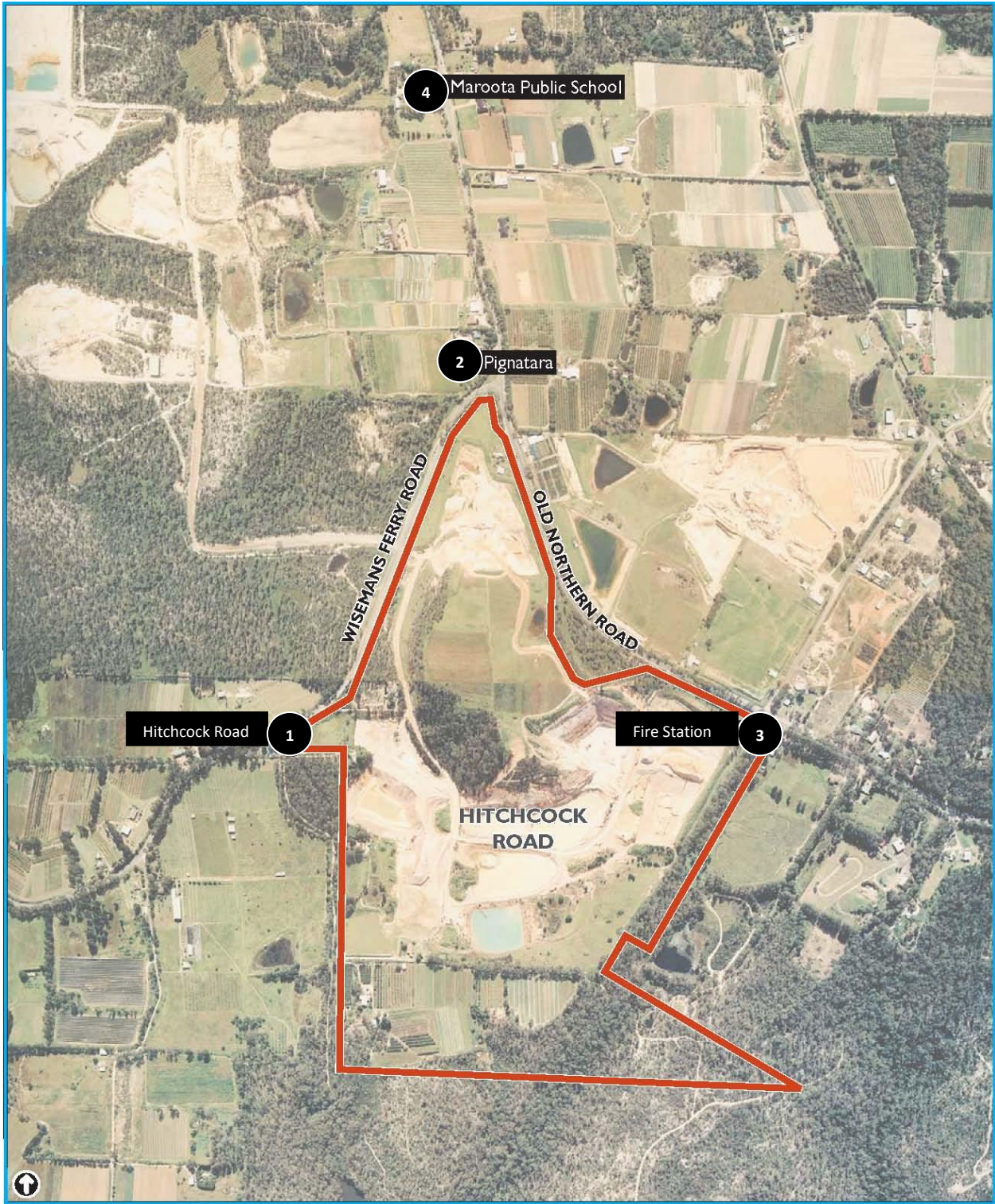
In accordance with the Noise Management Plan PF Formation conducted its quarterly operator attended daytime noise surveys at each of the four test locations above for the September 2009 quarter. The readings were not consistent with previous records and the recording device was returned to get recalibrated. After the recording equipment was returned to PF Formation it still was not working properly. Given the time that had elapsed it was decided to replace the noise meter and not conduct operator attended noise surveys for the 2010 AERS. An external Noise Consultant was employed to prepare a report to assess the noise criteria. The report prepared by Koikas Acoustics Pty Ltd is attached as **Attachment 4B**.

The first four locations used by Koikas Acoustics correspond to the locations above. Locations 5 & 6 in the Koikas Acoustics Report relate to other areas in Maroota not included in this AEMP.

Conclusion

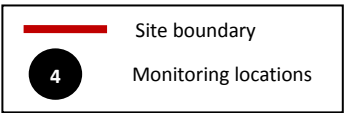
Koikas Acoustics concluded that at most sites the quarry noise was either just audible or inaudible. The site complies with the nominated noise criteria.

Quarterly operator attended noise monitoring has recommenced from July 2010.



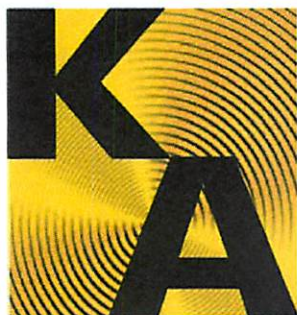
Scale
0 500 Metres

NOISE IMPACT ASSESSMENT MONITORING LOCATIONS



Attachment 4B

Noise Survey Results



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ACOUSTIC ASSESSMENT HITCHCOCK ROAD SAND PROJECT, MAROOTA NSW

Project No.: 1933

Date: 2 September 2010

Report Reference: C020910nk1933.docx

Prepared For: Peter Cummins
General Manager

PF Formation Trust
1774 Wisemans Ferry Road
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Prepared By: Koikas Acoustics Pty Ltd

Nick Koikas
Principal Consultant

**ACOUSTIC ASSESSMENT
HITCHCOCK ROAD SAND PROJECT,
MAROOTA NSW**

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ACOUSTIC ASSESSMENT HITCHCOCK ROAD SAND PROJECT, MAROOTA NSW

1.0 CONSULTANT'S BRIEF

Koikas Acoustics Pty Ltd was engaged by PF Formation Trust to undertake noise compliance testing during the sand extraction operations at various sites in the Maroota area adjacent to Hitchcock Road Sand Project.

The assessment provides the following:

- a discussion of the applicable noise criteria at each site, and
- attended noise monitoring survey results.

Koikas Acoustics has been advised that sand extraction has been undertaken in this area for many years and that there have been no complaints received from the local community regarding noise from the sand mining extraction works since periodic noise surveys have been undertaken.

All monitoring procedures were done in accordance with the requirements of the Project Approval of 3rd February 2009. Some measurements, for example the assessment of sleep disturbance, could not be taken 1 metre from a bedroom window and therefore, sound level measurements were taken from the boundary. Measurements taken from the boundary were under those circumstances closer to the noise source and therefore noise levels would have been higher than when taken outside a bedroom window.

2.0 SITE DESCRIPTION

2.1 SITE ADDRESSES

The southern sand mining extraction and processing site is bounded by:

- Old Northern Road along the east,
- Wisemans Ferry Road to the west (intersecting with the Old Northern Road to the north), and
- other rural properties to the south.

Details of the topography are attached as a rendered aerial photograph in the Hitchcock Road Sand Extraction and Rehabilitation Project, Maroota Noise Management Plan prepared by DFA Consultants Pty Ltd (undated) and a document called Project Approval dated 3rd February 2009 signed by the NSW Minister for Planning.

2.2 HOURS OF OPERATION

Activity	Day	Time [Hours]
Construction	Monday to Friday Saturday Sunday and Public Holiday	0700 – 1800 0800 – 1300 None
Quarrying and processing including overburden removal	Monday to Saturday Sunday and Public Holiday	0700 – 1800 None
Product Transportation	Monday to Saturday Sunday and Public Holiday	0600 – 1800 None
Maintenance	Monday to Saturday Sunday and Public Holiday	0700 – 1800 None

2.3 AMBIENT NOISE PROFILE OF THE NOISE MONITORING SITES (RECEIVERS)

The assessment site is located in a rural-residential area. The main roads passing through this area being Old Northern Road and Wisemans Ferry Road carry light and heavy vehicles.

During the daytime, the perceived intrusiveness of noise of cars and trucks traversing along these roads whilst residents are inside or outside their homes would be significantly greater compared to the noise of sand mining extraction activities.

The rustling of leaves with slight wind speeds would normally raise background noise levels. For periods when the wind is calm, background noise levels would be that of distant noise from cars, and the sound of insects and birds.

On account of the large distances which sound travels from the sand mining extraction activities to the surrounding residential premises, it is often not measureable because it is either less than the prevailing background noise or because it is inaudible.

The noise criterion derived from ambient background noise levels measured and pertaining for the hours of operation is therefore not exceeded.

2.4 MONITORING LOCATIONS

Noise monitoring was conducted in the Maroota area at the following locations on 28th June 2010:

1. Young property Hitchcock Road (@ driveway);
2. Pignataro property, corner of Wisemans Ferry Road and Old Northern Road;
3. Jurds property – back of fire shed, adjacent to Old Northern Road;
4. Maroota Public School, rear of school, and
5. Old Telegraph Road.

Noise monitoring was also conducted on 6th July 2010 at the following locations:

1. Young property, Hitchcock Road (@ driveway);
2. Pignataro property, corner of Wisemans Ferry Road and Old Northern Road;
3. Jurds property – back of fire shed, adjacent to Old Northern Road;
6. Western boundary 4713 Old Northern Road

The site locations are attached as an aerial photo in Appendix A.

3.0 NOISE CRITERIA

3.1 EPA INDUSTRIAL NOISE POLICY

The INP defines two criteria, the Intrusive Noise Criterion and the Amenity Noise Criterion. The EPA requires that compliance with both the intrusive and amenity criteria be achieved for the purpose of controlling the intrusive nature of the industrial noise in the short term and also maintaining the noise level amenity of the area for residences and other land uses.

For the purpose of applying the INP the following time periods apply:

- Daytime 7am to 6pm Monday to Saturday
8am to 6pm Sunday
- Evening 6pm to 10pm Monday to Sunday
- Night-time 10pm to 7am Monday to Saturday
10pm to 8am Sunday

3.1.1 Intrusive Noise Criterion

The intrusiveness of an industrial noise source is generally considered acceptable by people if the equivalent continuous (A-weighted) noise level ($L_{Aeq, 15 \text{ minutes}}$) does not exceed the background noise level by more than 5 dB. The intrusive noise criterion is defined as:

$$L_{Aeq, 15 \text{ minutes}} = (\text{rating background level}) L_{90, \text{Period}} + 5\text{dB}$$

When the noise source contains annoying characteristics such as prominent tonal, impulsive, intermittent, irregular and dominant low frequency components, adjustments are made.

3.1.2 Noise Amenity Criterion

In order to limit the continuing increase in noise, the EPA has nominated recommended acceptable and maximum ambient noise levels for various receiver sites from industrial noise.

Table 2.1 of the EPA's INP (below) specifies the following acceptable and maximum recommended $L_{Aeq, Period}$ noise levels for this project specific type area. In this case, the area is described as being Rural.

The EPA refers to 'rural' as:

Rural—means an area with an acoustical environment that is dominated by natural sounds, having little or no road traffic. Such areas may include:

- an agricultural area, except those used for intensive agricultural activities
- a rural recreational area such as resort areas
- a wilderness area or national park
- an area generally characterised by low background noise levels (except in the immediate vicinity of industrial noise sources).

This area may be located in either a **rural, rural-residential, environment protection zone or scenic protection zone**, as defined on a council zoning map (Local Environmental Plan (LEP) or other planning instrument).

Table 2.1 of the EPA INP

Type of Receiver	Indicative Noise Amenity	Time of Day	Recommended $L_{Aeq, Period}$	
			Acceptable	Recommended Maximum
Residential	Rural	Day	50	55
		Evening	45	50
		Night	40	45
Schools	All	Noisiest 1 hour period when in use	35	40
Commercial	All Areas	Day	65	70
		Evening		
		Night		
Industrial	All Areas	Day	70	75
		Evening		
		Night		

Table 2.2 of the EPA INP (below) specifies the modification to the acceptable noise level to account for the existing level of industrial noise when additional industrial noise sources are proposed for the site:

Table 2.2 of the EPA INP

Total existing L_{Aeq} noise level from industrial sources, dB(A)	Maximum L_{Aeq} noise level from new sources alone, dB(A)
Acceptable noise level plus 2	If existing noise level is <i>likely</i> to decrease in future: acceptable noise level minus 10 If existing noise level is <i>unlikely</i> to decrease in future: existing level minus 10
Acceptable noise level plus 1	Acceptable noise level minus 8
Acceptable noise level	Acceptable noise level minus 8
Acceptable noise level minus 1	Acceptable noise level minus 6
Acceptable noise level minus 2	Acceptable noise level minus 4
Acceptable noise level minus 3	Acceptable noise level minus 3
Acceptable noise level minus 4	Acceptable noise level minus 2
Acceptable noise level minus 5	Acceptable noise level minus 2
Acceptable noise level minus 6	Acceptable noise level minus 1
< Acceptable noise level minus 6	Acceptable noise level

The amendments to the EPA INP (2006) state that both the predicted amenity noise level criterion and the intrusive noise level criteria need to be satisfied, which supersedes the requirement of assessing only the most stringent of the two noise criterion. In clearly obvious cases, one or the other noise criterion is considered. In this case, the intrusive noise criterion has been considered as it is clearly the most stringent due to the low Rating Background Level (RBL).

3.1.3 Background Noise

Both the Intrusive and Amenity noise criterion have been derived from previous noise surveys (DFA Consultants – Hitchcock Road Sand Extraction and Rehabilitation Project Noise Management Plan) undertaking ‘long term’ ambient noise level measurements at a representative site. The background noise level was determined over consecutive 15 minute periods for a duration of at least one week. From this data of $L_{A90, 15 \text{ minutes}}$ noise levels, the 10 percentile lowest background noise levels were determined for each of the days. The *rating background level* was then determined by calculating the median value of the daily 10 percentile background noise levels for each of the three specific time periods: daytime, evening and night time.

The rating background level result is used to determine the noise criteria applicable for the surrounding residential properties in accordance with the EPA’s (INP) assessment procedures.

The background noise level $L_{A90, 15 \text{ minutes}}$ is normally determined in the absence of extraneous noise such as traffic, wind, rain, conversation, birds chirping, insect noise and unnatural increases in noise from distant sources due to local air movement. The EPA defines such sources as *incidental noise* which can cause the masking of offensive noise from a specific source. When traffic or other incidental noises cannot be excluded, then it is considered that these noise sources are part of the background noise.

3.2 NOMINATED NOISE CRITERIA

The criterion that applies at each of the sites is based on unattended surveys conducted over a week long period. These surveys were previously conducted by other acoustic consultants and have been included in Environmental Reports.

The Operational Noise Assessment criterion levels are summarised below in Table 3.

Table 3 Operational Criterion Levels (Ref.: The Department of Planning Development Consent – Project Approval)

<u>Site Location</u>	<u>Day</u> L _{Aeq} , 15 min	<u>Night</u> L _{Aeq} , 15 min	<u>Night</u> L _{A1} , 1 min
1. Young property Hitchcock Rd (@ driveway)	40	35	45
2. Pignatara property	42	35	45
3. Jurds property – Back of fire shed	40	35	45
4. Maroota Public School	36 L _{Aeq} , 1 hr	N/A	N/A
5. Old Telegraph Road	35	35	45
6. Western boundary 4713 Old Northern Road	35	35	45

4.0 NOISE SURVEYS

4.1 NOISE MONITORING PROCEDURES

All measurement methodologies and equipment used comply with the relevant Australian Standards:

AS1259.2-1990 “Acoustics - Sound Level Meters - Integrating - Averaging”, and
AS1055 “Acoustics - Description and measurement of environmental noise”.

All sound and noise level measurements were A-frequency and Fast-time weighted.

4.2 ATTENDED NOISE MONITORING

Attended noise monitoring was conducted on the afternoon of 28th June 2010, and the early morning of 8th July 2010 to quantify the existing operational noise levels.

The measurements were conducted with a 01dB Stell Integrating Sound Level Meter and calibrated with a Luton – 94 dB/1000 Hertz Sound Level Calibrator.

5.0 NOISE SURVEY RESULTS

Table 4 refers to the measured noise levels obtained at each of the locations on Monday 28th June 2010.

Table 4. **Daytime** Noise Survey Results
Monday 28th June 2010
[dB(A)]

Site Location	Leq, 15min Criterion	Leq Measured	L90 Measured
Young Hitchcock Road (@ driveway)	40	54 Note 1	45
Pignataro	42	59 Note 2	37
Jurds – Back of fire shed	40	45.6 Note 3	34
Maroota Public School [Leq, 1 hour]	36	42.3 Note 4	38
Old Telegraph Road	35	37.5 Note 5	31
Western boundary 4713 Old Northern Road	35	46 Note 6	37

Note 1. Dominant noise source is that of traffic and birds chirping. Quarry noise was just audible during lulls in traffic, but not measurable. Therefore the noise from quarry was less than the noise criterion.

Note 2. Dominant noise source is that of traffic. Quarry noise was just audible during lulls in traffic, but not measurable. Therefore the noise from quarry was less than the noise criterion.

Note 3. Dominant noise source is that of traffic. Water pump noise between 31 – 33 dB(A) during lulls in traffic. Therefore the noise from quarry was less than the noise criterion.

Note 4. Dominant noise source is that of traffic. Trucks between 41 – 44 dBA, engine brakes about 46 dB(A), overhead aircraft about 38 dB(A). Quarry noise was just audible during lulls in traffic, but not measurable. Therefore the noise from quarry was less than the noise criterion.

Note 5. Dominant noise source is that of birds chirping. Road traffic noise was audible. Quarry noise was just audible only during lulls in traffic, but not measurable. Therefore the noise from quarry was less than the noise criterion.

Note 6. Noise level measurements were taken during the day on 6th July 2010. Road traffic noise was about 53 dB(A). Natural sound was about 37 dB(A) and included birds chirping and rustling of leaves. Quarry noise was just audible during lulls in traffic, but not measurable. Therefore the noise from quarry was less than the noise criterion.

At all the noise monitoring sites, the noise emanating from the Hitchcock Sand Project currently is less than the nominated noise criterion during the daytime.

Table 5 refers to the measured noise levels obtained at each of the locations on Tuesday 6th July 2010 during the night time.

Table 5. **Night Time** Noise Survey Results
Tuesday 6th July 2010
[dB(A)]

Site Location	Leq,15min Criterion	Leq Measured	L90 Measured	L1 Criterion	L1 Measured
Young Hitchcock Road (@ driveway)	35	51 Note 7	37	45	62 Note 7
Pignatara	35	59 Note 8	42	45	57 Note 8
Jurds – Back of fire shed	35	46 Note 9	39	45	53 Note 9
Maroota Public School [Leq, 1 hour]	N/A	N/A	N/A	N/A	N/A
Old Telegraph Road	35	-	-	45	-
Western boundary 4713 Old Northern Rd	35	-	-	45	-

Note 7. Dominant noise source is that of traffic. Quarry noise was not audible even during lulls in traffic. Therefore quarry noise was not measurable. Therefore the noise from quarry was less than the noise criterion.

Note 8. Dominant noise source is that of traffic. Quarry noise was inaudible during lulls in traffic. Insect noise was about 40 dB(A). Birds chirping and roosters crowing about 48 dB(A). Therefore the noise from quarry was less than the noise criterion.

Note 9. Dominant noise source is that of traffic around 53 dB(A). Natural sound including birds chirping, leaves rustling about 41 dB(A). Water pump noise was just audible but not measurable during lulls in traffic. Therefore the noise from quarry was less than the noise criterion.

At all the noise monitoring sites, the noise emanating from the Hitchcock Sand Project currently is less than the nominated noise criterion during the night time.

6.0 CONCLUSIONS

Koikas Acoustics was requested to undertake noise level surveys around the Maroota sand mining extraction and processing quarry and ascertain whether the noise from the extraction and processing works currently exceed the nominated noise criteria as determined from previous unattended noise surveys at various site locations near the subject quarries.

The results of the noise surveys clearly show that the site currently complies with the nominated noise criteria.

At most sites, quarry activities are either just audible or inaudible and in both cases, the noise emanating from the site was found not to be measureable on account of that the natural noise (which includes birds chirping, insects, rustling of leaves) and un-natural noise (being cars and trucks traversing along the main roads).

There are no noise mitigation measures necessary to be implemented to any of the subject quarry sites.

Koikas Acoustics therefore certifies that the subject Maroota Quarries currently comply with the nominated noise criteria despite that the measured noise levels (predominantly that of traffic and other natural sound sources) are currently producing sound levels in-excess of the nominated noise criteria.

APPENDIX A

A P P E N D I X A

APPENDIX A



1. Young property Hitchcock Road (@ driveway);
2. Pignatara property, corner of Wisemans Ferry Road and Old Northern Road;
3. Jurds property - back of fire shed, adjacent to Old Northern Road;
4. Maroota Public School, rear of school, and
5. Old Telegraph Road.
6. Western boundary 4713 Old Northern Road

Chapter Five AIR QUALITY

Introduction

The Project Approval (**Schedule 3 Condition 12**) for the Hitchcock Road development required the preparation and implementation of an Air Quality Monitoring Program. This Program was approved by the Department of Planning on 8 July 2009. The objectives of the Annual Environmental Management Report on air quality issues are therefore:

- identify the dust deposition criteria nominated in the relevant approval documents and listed in the Air Quality Monitoring Program;
- document the results of dust deposition monitoring conducted in the 12 months ended June 2010;
- assess the measured dust deposition levels against the relevant amenity criteria; and
- nominate existing dust deposition monitoring methodology and establish routine measurement procedures.

Dust impact assessment criteria

The proponent will ensure that dust generated by the project does not cause exceedances of the criteria listed in **Tables 5.1** and **5.2** at any residence or on more than 25 per cent of any privately owned land.

Table 5.1 Impact Assessment Criteria for Particulate Matter		
Pollutant	Averaging period	Criterion
Total suspended particulate (TSP) matter	Annual	90µg/m ³
Particulate matter < 10µm (PM ₁₀)	Annual	30µg/m ³
	24 hour	50µg/m ³

Table 5.2 Impact Assessment Criteria for deposited dust			
Pollutant	Averaging period	Maximum increase in deposited dust level	Maximum total deposited dust level
Deposited dust	Annual	2g/m ² /month	4g/m ² /month

Notes

Deposited dust is assessed as insoluble solids as defined by Standards Australia 1991 AS 3580.10.1-1991: Methods for Sampling and Analysis of Ambient Air – Determination of Particulates – Deposited Matter – Gravimetric

Dust monitoring

During the reporting period to the end of June 2010, PF Formation maintained a program of continuous monthly dust deposition monitoring. This will remain in compliance with the requirements of the Air Quality Monitoring Program approved by the Director-General of the Department of Planning on 8 July 2009. The locations of the monitoring stations are shown on **Attachment 5A**. Location 2 was intended to be located on the Tornatola property but the landowner advised that the property is vacant and he did not want the monitoring station on his property. It then decided to move it across Wisemans Ferry Road on the back of the Dixon property near the intersection of Wisemans Ferry Road and Hitchcock Road Maroota.

Analysis of the dust composition measurements was carried out independently by Boral Materials Testing and Environmental Services. The analysis procedure was in accordance with AS3580.10.1-1991 *Methods for Sampling and Analysis of Ambient Air Method 10.1: Determination of Particulate Deposited Matter – Gravimetric Method*.

Monitoring results

A summary of the monthly dust deposition monitoring results is provided at **Attachment 5B**. The detailed measurement and analysis results by month as prepared by Boral Materials Testing and Environmental Services are summarised in **Attachment 5C**. Location 4 in the Test Reports is not relevant to the Hitchcock Road site.

In general, dust monitoring procedures were guided by the requirements of AS2724.1-1984 *Ambient Air Particulate Matter, Part 1 – Determination of Deposited Matter Expressed as Insoluble Solids, Ash, Combustible Matter, Soluble Solids and Total Solids*.

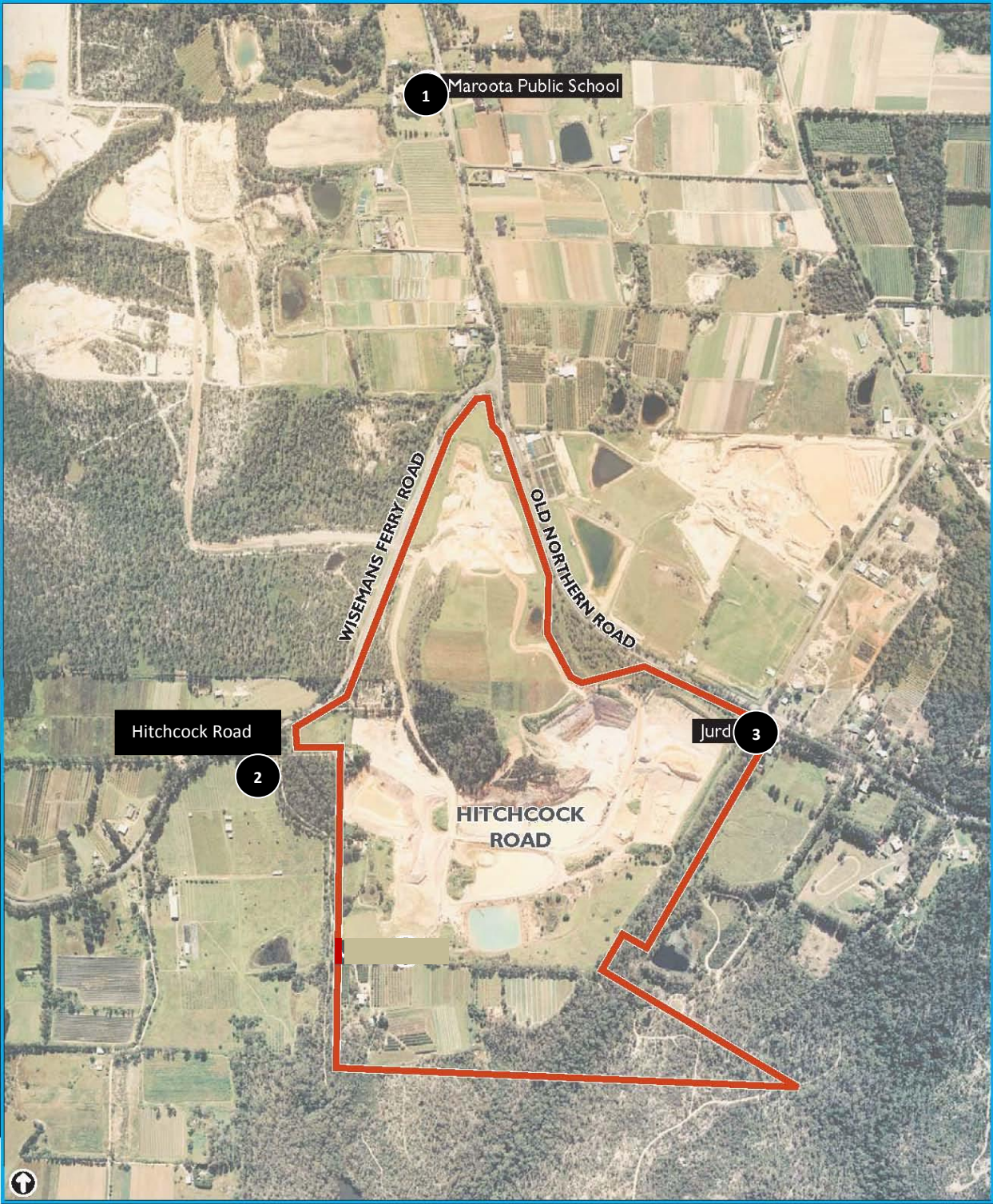
The following information can be derived from these results in relation to the dust nuisance criterion.

- The insoluble solids portion of deposited dust is expected to be mineral matter with the ash content indicating the level of solid dust particles of inorganic origin such as soil/dust that could be derived from a source such as sand extraction and processing operations.
- The monitoring results are characterised by generally low average levels over extended periods with an occasional spike when high levels are experienced. As the operations from the site are very consistent the dust generated from the site is consistent subject to weather impacts. Spikes are usually caused by factors unrelated to the quarry such as mowing or horticultural activities near the monitoring station or regional issues such as bush fires.
- The annual average ambient dust deposition rate (insoluble solids) considered a nuisance criterion is 4 g/m²/month. All sites monitored had annual averages well below this level.
- The annual average ambient dust deposit rate (insoluble solids) at Location 1 – Maroota School was 2.27 g/m²/month. This is substantially less than the prior year and the dust nuisance criterion of 4 g/m²/month. This site often gets impacted by external factors such as horticultural activities adjoining the school but October and February were the only high result months. October was also high at Location 3 but at both locations the 'Ash' figure was not particularly high for October meaning that the increase could not be attributable to mining as the insoluble matter was largely combustible ie not soil or dust.

- The annual average ambient dust deposition rate (insoluble solids) at Location 2 (Hitchcock Road), which is located near the intersection of Hitchcock Road (a dirt road) and Old Northern Road was 2.18 g/m²/month which is very low. The results were very consistent and were not impacted by any spikes.
- The annual average ambient dust deposition rate (insoluble solids) at Location 3 (Jurd residence) was 2.55 g/m²/month which is below the dust nuisance criterion defined by the DECC. October had a result of 6.04 but as mentioned earlier most of this dust was combustible (2.8 g/m²/month was ash component) and therefore was not a mineral increase.
- The results of the dust deposit gauges were very good for the year being well below the nuisance criterion. Because of the distances from the quarry operations and the significant other factors impacting the dust deposit gauge results high recordings are not necessarily a result of quarry operations. It is reassuring when all locations have relatively low results such as this year.
- PF Formation and Dixon Sand (a neighbouring operator) have an agreement whereby if the rolling 24-hour PM₁₀ average recorded by the TEOM reaches 42.5 µg/m³, PF Formation would be notified. The wind direction would then be assessed and measures to reduce any dust impacts affecting the TEOM readings would be implemented. At no time in the last 12 months have the results derived from the TEOM reached the designated trigger. A copy of the action plan if this occurs is attached in **Attachment 5D**.
- There have been no complaints concerning dust generation over the past year.
- A summary of the weather conditions recorded on-site are in **Attachment 5E**.

Conclusions

In accordance with the requirements of the Project Approval, PF Formation has implemented a program of dust deposition monitoring. The results of the regular monthly dust deposition monitoring conducted over the past year and analysed externally by Boral Materials Testing and Environmental Services show that deposition rates from all sources have declined and are well below the maximum levels criteria.



Scale
0 500 Metres

AIR QUALITY MONITORING LOCATIONS

Site boundary

3

Monitoring locations

		Summary of Dust Deposition Monitoring Results (g/m2/month)								
		Location 1 - Maroota School			Location 2 - Hitchcock Road			Location 2 (Jurd residence)		
Month/Year		Insoluble Solids	Ash	Total Solids	Insoluble Solids	Ash	Total Solids	Insoluble Solids	Ash	Total Solids
2009	June	1.1	0.53	3.37	2.85	2.22	5.56	1.48	0.83	7.83
	July	1.56	1.3	3.41	1.5	1.27	3.1	1.52	1.37	2.5
	August	2.09	1.42	3.69	2.95	2.06	5.64	3.96	3.14	6.78
	September	2.9	2.36	6.84	3.32	2.6	7.2	2.54	2.13	4.23
	October	4.19	2.61	4.72	2.23	1.66	2.51	6.04	2.8	7.11
	November	3.1	2.03	5.33	2.9	1.92	5.24	3.21	2.23	5.35
	December	2.78	2.28	3.64	1.71	1.34	3.57	2.49	1.69	3.15
2010	January	1.41	1.3	4.49	1.81	1.61	4.61	2.8	2.3	3.97
	February	5.06	3.26	5.24	1.48	1.13	5.5	2.63	1.7	3.03
	March	0.97	0.63	3.09	1.52	0.64	2.63	0.72	0.43	1.11
	April	1.26	1.03	4	2.56	1.77	4.48	2.28	1.27	4.01
	May	0.82	0.67	2.65	1.32	0.77	4.24	0.98	0.59	1.57
Monthly Average		2.27			2.18			2.55		

Attachment 5C

Monthly Dust Monitoring Results

TEST REPORT

CLIENT : P.F.FORMATION

File No:250/09

PROJECT: Gravimetrical Dust Monitoring at Maroota (P.F.Formation) for the month of July 2009

SAMPLE : Dust

TEST PROCEDURE : AS3580.10.1 - 2003 - Methods for sampling and analysis of ambient air.
Method 10.1 : Determination of particulate Deposited Matter - Gravimetric Method.

Field No :	1	2	3	4
Lab.Sample No :	95219	95220	95221	95222
Location :	Site 1	Site 2	Site 3	Site 4
Date sampled from:	1.07.09	to		3.08.09
Results :				
Insoluble solids g/m ² month :	1.56	1.50	1.52	0.89
Ash g/m ² month :	1.30	1.27	1.37	0.83
Combustible matter g/m ² month :	0.26	0.22	0.15	0.06
Soluble matter g/m ² month :	1.86	1.61	0.98	1.28
Total Solids g/m ² month :	3.41	3.10	2.50	2.17
Volume of liquid in the gauge,mL :	700	800	600	700

Refer to attached graph.

JOSHUA GRAHAM
File

M.ABDULNEBE

TEST REPORT

CLIENT : P.F.FORMATION

File No:250/09

PROJECT: Gravimetrical Dust Monitoring at Maroota (P.F.Formation) for the month of August 2009

SAMPLE : Dust

TEST PROCEDURE : AS3580.10.1 - 2003 - Methods for sampling and analysis of ambient air.
Method 10.1 : Determination of particulate Deposited Matter - Gravimetric Method.

Field No :	1	2	3	4
Lab.Sample No :	96178	96179	96180	96181
Location :	Site 1	Site 2	Site 3	Site 4
Date sampled from:	3.08.09	to		1.09.09
Results :				
Insoluble solids g/m ² month :	2.09	2.95	3.96	2.38
Ash g/m ² month :	1.42	2.06	3.14	1.68
Combustible matter g/m ² month :	0.67	0.89	0.81	0.69
Soluble matter g/m ² month :	1.60	2.69	2.83	0.83
Total Solids g/m ² month :	3.69	5.64	6.78	3.21
Volume of liquid in the gauge,mL :	600	700	800	500

Refer to attached graph.

JOSHUA GRAHAM

File

M.ABDULNEBE

TEST REPORT

CLIENT : P.F.FORMATION

File No:250/09

PROJECT: Gravimetrical Dust Monitoring at Maroota (P.F.Formation) for the month of September 2009

SAMPLE : Dust

TEST PROCEDURE : AS3580.10.1 - 2003 - Methods for sampling and analysis of ambient air.
Method 10.1 : Determination of particulate Deposited Matter - Gravimetric Method.

Field No :	1	2	3	4
Lab.Sample No :	96999	97000	97001	97002
Location :	Site 1	Site 2	Site 3	Site 4
Date sampled from:	1.09.09	to		1.10.09
Results :				
Insoluble solids g/m ² month :	2.90	3.32	2.54	2.24
Ash g/m ² month :	2.36	2.60	2.13	1.98
Combustible matter g/m ² month :	0.54	0.71	0.41	0.25
Soluble matter g/m ² month :	3.94	3.88	1.69	3.97
Total Solids g/m ² month :	6.84	7.20	4.23	6.21
Volume of liquid in the gauge,mL :	900	900	800	900
Refer to attached graph.				
JOSHUA GRAHAM				
File				

M.ABDULNEBE



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Date 2.10.09 Serial No. 81126

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TEST REPORT

CLIENT : P. F. FORMATION

File No: 250/09

PROJECT: Gravimetric Dust Monitoring at Maroota (P.F.Formation) for the month of October 2009

SAMPLE : Dust

TEST PROCEDURE : AS3580.10.1 - 2003 - Methods for sampling and analysis of ambient air.
Method 10.1 : Determination of particulate Deposited Matter - Gravimetric Method.

Field No :	1	2	3	4
Lab.Sample No :	98113	98114	98115	98116
Location :	Site 1	Site 2	Site 3	Site 4
Date sampled from:	1.10.09	to		2.11.09
Results :				
Insoluble solids (g/m ² month) :	4.19	2.23	6.04	1.75
Ash (g/m ² month) :	2.61	1.66	2.80	1.46
Combustible matter (g/m ² month) :	1.59	0.57	3.25	0.30
Soluble matter (g/m ² month) :	0.53	0.28	1.07	0.14
Total Solids (g/m ² month) :	4.72	2.51	7.11	1.89
Volume of liquid in the gauge,mL :	2000	2000	2000	1800

Refer to attached graph.

Joshua Graham, File


M. Abdulnebe



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TEST REPORT

CLIENT : P. F. FORMATION

File No: 250/09

PROJECT: Gravimetric Dust Monitoring at Maroota (P.F.Formation) for the month of November 2009

SAMPLE : Dust

TEST PROCEDURE : AS3580.10.1 - 2003 - Methods for sampling and analysis of ambient air.
Method 10.1 : Determination of particulate Deposited Matter - Gravimetric Method.

Field No :	1	2	3	4
Lab.Sample No :	98714	98715	98716	98717
Location :	Site 1	Site 2	Site 3	Site 4
Date sampled from:	2.11.09		to	1.12.09
Results :				
Insoluble solids (g/m ² month) :	3.10	2.90	3.21	7.87
Ash (g/m ² month) :	2.03	1.92	2.23	2.63
Combustible matter (g/m ² month) :	1.08	0.98	0.98	5.24
Soluble matter (g/m ² month) :	2.23	2.34	2.14	3.66
Total Solids (g/m ² month) :	5.33	5.24	5.35	11.53
Volume of liquid in the gauge,mL :	550	600	600	600

Refer to attached graph.

Joshua Graham, File

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TEST REPORT**CLIENT :** P. F. FORMATION**File No:** 250/10**PROJECT:** Gravimetric Dust Monitoring at Maroota (P.F.Formation) for the month of December 2009**SAMPLE :** Dust

TEST PROCEDURE : AS3580.10.1 - 2003 - Methods for sampling and analysis of ambient air.
Method 10.1 : Determination of particulate Deposited Matter - Gravimetric Method.

Field No :	1	2	3	4
Lab.Sample No :	99886	99887	99888	99889
Location :	Site 1	Site 2	Site 3	Site 4
Date sampled from:	1.12.09	to		4.01.10
Results :				
Insoluble solids (g/m ² month) :	2.78	1.71	2.49	1.45
Ash (g/m ² month) :	2.28	1.34	1.69	1.08
Combustible matter (g/m ² month) :	0.51	0.37	0.80	0.37
Soluble matter (g/m ² month) :	0.86	1.86	0.66	4.03
Total Solids (g/m ² month) :	3.64	3.57	3.15	5.48
Volume of liquid in the gauge, mL :	1700	1800	2000	1700

Refer to attached graph.

Note: sample collected outside period of time as stipulated in the test method.

Joshua Graham, File

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Date 21.01.10Serial No. 83476

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TEST REPORT**CLIENT :** P. F. FORMATION**File No:** 250/10**PROJECT:** Gravimetrical Dust Monitoring at Maroota (P.F.Formation) for the month of January 2010**SAMPLE :** Dust

TEST PROCEDURE : AS3580.10.1 - 2003 - Methods for sampling and analysis of ambient air.
Method 10.1 : Determination of particulate Deposited Matter - Gravimetric Method.

Field No :	1	2	3	4
Lab.Sample No :	100504	100505	100506	100507
Location :	Site 1	Site 2	Site 3	Site 4
Date sampled from:	4.01.10	to		1.02.10
Results :				
Insoluble solids (g/m ² month) :	1.41	1.81	2.80	2.68
Ash (g/m ² month) :	1.30	1.61	2.30	2.11
Combustible matter (g/m ² month) :	0.12	0.19	0.50	0.57
Soluble matter (g/m ² month) :	3.08	2.81	1.18	1.44
Total Solids (g/m ² month) :	4.49	4.61	3.97	4.12
Volume of liquid in the gauge,mL :	1200	1200	1000	1400

Refer to attached graph.

Joshua Graham, File

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TEST REPORT**CLIENT :** P. F. FORMATION**File No:** 250/10**PROJECT:** Gravimetric Dust Monitoring at Maroota (P.F.Formation) for the month of February 2010**SAMPLE :** Dust
TEST PROCEDURE : AS3580.10.1 - 2003 - Methods for sampling and analysis of ambient air.
 Method 10.1 : Determination of particulate Deposited Matter - Gravimetric Method.

Field No :	1	2	3	4
Lab.Sample No :	101428	101429	101430	101431
Location :	Site 1	Site 2	Site 3	Site 4
Date sampled from:	1.02.10	to		1.03.10
Results :				
Insoluble solids (g/m ² month) :	5.06	1.48	2.63	1.35
Ash (g/m ² month) :	3.26	1.13	1.70	0.93
Combustible matter (g/m ² month) :	1.79	0.35	0.93	0.42
Soluble matter (g/m ² month) :	0.18	4.02	0.40	1.16
Total Solids (g/m ² month) :	5.24	5.50	3.03	2.51
Volume of liquid in the gauge,mL :	2100	2000	2200	2100

Refer to attached graph.

Joshua Graham, File

M. Abdulnebe


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Date 12-03-10

Serial No.

84678

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TEST REPORT**CLIENT :** P. F. FORMATION**File No:** 250/10**PROJECT:** Gravimetrical Dust Monitoring at Maroota (P.F.Formation) for the month of March 2010**SAMPLE :** Dust
TEST PROCEDURE : AS3580.10.1 - 2003 - Methods for sampling and analysis of ambient air.
 Method 10.1 : Determination of particulate Deposited Matter - Gravimetric Method.

Field No :	1	2	3	4
Lab.Sample No :	102472	102473	102474	102475
Location :	Site 1	Site 2	Site 3	Site 4
Date sampled from:	1.03.10	to		1.04.10
Results :				
Insoluble solids (g/m ² month) :	0.97	1.52	0.72	0.89
Ash (g/m ² month) :	0.63	0.64	0.43	0.74
Combustible matter (g/m ² month) :	0.33	0.88	0.29	0.15
Soluble matter (g/m ² month) :	2.13	1.11	0.39	0.63
Total Solids (g/m ² month) :	3.09	2.63	1.11	1.52
Volume of liquid in the gauge,mL :	1400	1300	1400	1400

Refer to attached graph.

Joshua Graham, File


M. Abdulnebe


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TEST REPORT

CLIENT : P.F. FORMATION

File No.: 250 / 10

PROJECT: Gravimetrical Dust Monitoring at Maroota (P.F.Formation) for the month of April 2010

SAMPLE : Dust

TEST PROCEDURE : AS3580.10.1 - 2003 - Methods for sampling and analysis of ambient air.
Method 10.1 : Determination of particulate Deposited Matter - Gravimetric Method.

Field No.:	1	2	3	4
Lab. Sample No.:	103714	103715	103716	103717
Location:	Site 1	Site 2	Site 3	Site 4
Date sampled from:	1.04.10	to		1.05.10
Results :				
Insoluble solids (g/m ² month) :	1.26	2.56	2.28	1.36
Ash (g/m ² month) :	1.03	1.77	1.27	0.67
Combustible matter (g/m ² month) :	0.24	0.78	1.02	0.70
Soluble matter (g/m ² month) :	2.74	1.92	1.72	2.44
Total Solids (g/m ² month) :	4.00	4.48	4.01	3.80
Volume of liquid in the gauge,mL :	1000	1100	1200	1000

Refer to attached graph.

J.Graham, File.



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Approved Signatory S. KrishnamoorthyDate 21.5.10. Serial No. 86465

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Number: 9968

TEST REPORT

CLIENT : P.F. FORMATION

File No.: 250 / 10

PROJECT: Gravimetric Dust Monitoring at Maroota (P.F. Formation) for the month of May 2010

SAMPLE : Dust

TEST PROCEDURE : AS3580.10.1 - 2003 - Methods for sampling and analysis of ambient air.
Method 10.1 : Determination of particulate Deposited Matter - Gravimetric Method.

Field No.:	1	2	3	4
Lab. Sample No.:	104716	104717	104718	104719
Location:	Site 1	Site 2	Site 3	Site 4
Date sampled from:	1.05.10	to		1.06.10
Results :				
Insoluble solids (g/m ² month) :	0.82	1.32	0.98	0.21
Ash (g/m ² month) :	0.67	0.77	0.59	0.18
Combustible matter (g/m ² month) :	0.14	0.55	0.40	0.03
Soluble matter (g/m ² month) :	1.84	2.93	0.59	3.49
Total Solids (g/m ² month) :	2.65	4.24	1.57	3.70
Volume of liquid in the gauge,mL :	1750	1700	1800	1600

Refer to attached graph.

J.Graham, File.

S.Krishnamoorthy



ACCREDITED FOR
TECHNICAL
COMPETENCE

Approved Signatory [Signature]Date 10.6.10 Serial No. 87046

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NATA Accredited Laboratory
Number: 9968

TEST REPORT**CLIENT :** P.F. FORMATION**File No.:** 250 / 10**PROJECT:** Gravimetrical Dust Monitoring at Maroota (P.F.Formation) for the month of June 2010**SAMPLE :** Dust

TEST PROCEDURE : AS3580.10.1 - 2003 - Methods for sampling and analysis of ambient air.
Method 10.1 : Determination of particulate Deposited Matter - Gravimetric Method.

Field No.:	1	2	3	4
Lab. Sample No.:	105914	105915	105916	105917
Location:	Site 1	Site 2	Site 3	Site 4
Date sampled from:	1.06.10	to		1.07.10
Results :				
Insoluble solids (g/m ² month) :	1.41	1.77	0.94	0.73
Ash (g/m ² month) :	0.99	1.17	0.51	0.57
Combustible matter (g/m ² month) :	0.42	0.60	0.44	0.15
Soluble matter (g/m ² month) :	0.80	0.99	0.52	0.41
Total Solids (g/m ² month) :	2.21	2.77	1.46	1.14
Volume of liquid in the gauge, mL :	2100	2200	2200	2200

Refer to attached graph.

J.Graham, File.

S.Krishnamoorthy

Approved Signatory



Date 14.7.10

Serial No.

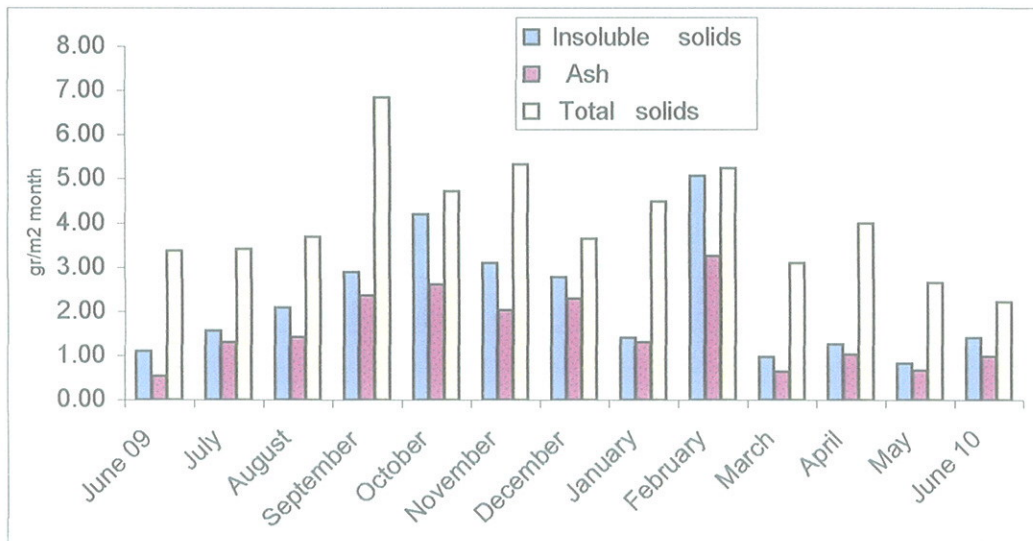
87 963

Dust Monitoring

Maroota Site 1

Maroota Public School

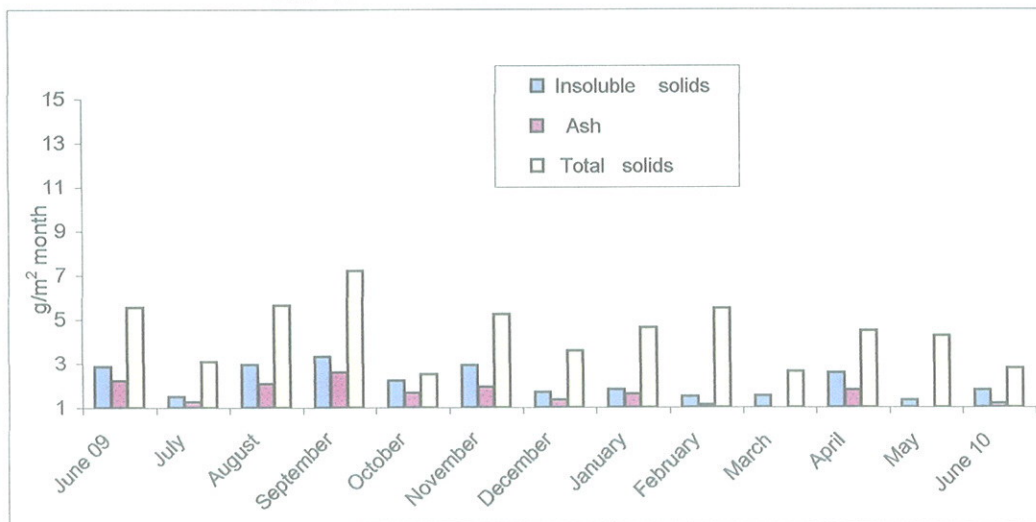
	Insoluble solids	Ash	Total solids
June 09	1.10	0.53	3.37
July	1.56	1.30	3.41
August	2.09	1.42	3.69
September	2.90	2.36	6.84
October	4.19	2.61	4.72
November	3.10	2.03	5.33
December	2.78	2.28	3.64
January	1.41	1.30	4.49
February	5.06	3.26	5.24
March	0.97	0.63	3.09
April	1.26	1.03	4.00
May	0.82	0.67	2.65
June 10	1.41	0.99	2.21



Dust Monitoring

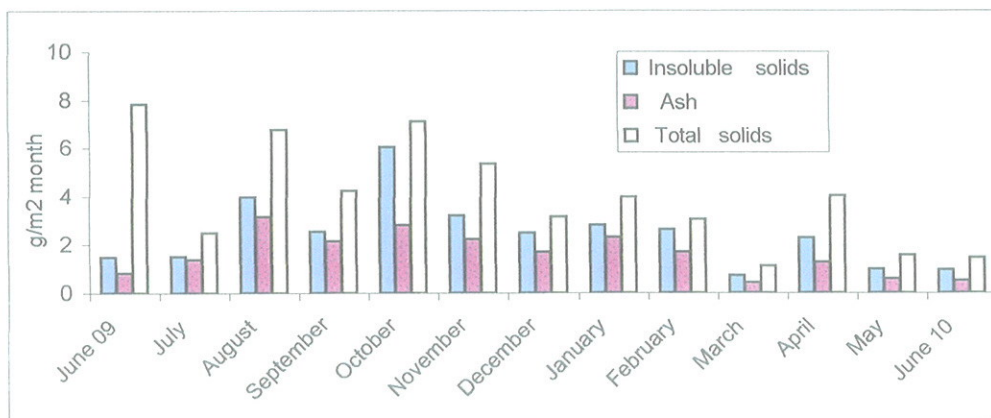
Maroota Site 2
Hitchcock Rd

	Insoluble solids	Ash	Total solids
June 09	2.85	2.22	5.56
July	1.50	1.27	3.10
August	2.95	2.06	5.64
September	3.32	2.60	7.20
October	2.23	1.66	2.51
November	2.90	1.92	5.24
December	1.71	1.34	3.57
January	1.81	1.61	4.61
February	1.48	1.13	5.50
March	1.52	0.64	2.63
April	2.56	1.77	4.48
May	1.32	0.77	4.24
June 10	1.77	1.17	2.77



Dust Monitoring
Maroota Site 3
Jurd's Property

	Insoluble solids	Ash	Total solids
June 09	1.48	0.83	7.83
July	1.52	1.37	2.50
August	3.96	3.14	6.78
September	2.54	2.13	4.23
October	6.04	2.80	7.11
November	3.21	2.23	5.35
December	2.49	1.69	3.15
January	2.80	2.30	3.97
February	2.63	1.70	3.03
March	0.72	0.43	1.11
April	2.28	1.27	4.01
May	0.98	0.59	1.57
June 10	0.94	0.51	1.46



PM10 Dust Action Plan

Background

As Dixon Sands have a PM10 monitoring location at Maroota on the property adjoining the Maroota Public School they have agreed to contact us in the event the rolling 24-hour average PM10 result nears or exceeds 42 ug/m³ in working hours. (This is after Dixon's themselves are notified by their consultants.) We have agreed to the following Plan in the event we become aware of high PM10 dust recordings in the Maroota area. The aim is to determine whether PF Formation operations could be a source or contributor to the high results and if this is the case and if there could be a potential impact on the school to take measures to reduce this potential impact.

Plan

In the event PF Formation are contacted by Dixon Sands advising that the PM10 result is near or exceeds the trigger then:

1. John Graham, Peter Watt, Joshua Graham, Luke Graham and Peter Cummins (management team) are all to be advised by telephone/two-way immediately
2. The current wind direction is to be assessed by them at the weather monitoring station.
3. If the wind direction is from our operations to the Dixon monitoring location then action must be taken to reduce PF Formation's PM10 emissions.
4. The management team are to advise all staff to assess all dust generating activities for all areas that could impact the Maroota Public School except for activities solely undertaken to reduce dust impacts
5. The management team is to evaluate the conditions, liaise with Dixon Sands regarding the status of the rolling 24-hour PM10 average and undertake necessary dust suppression activities such as watering roads, exposed areas and stockpiles.
6. If the dust levels have not reduced to allowable levels within 1 hour of ceasing dust generating activities and it is within school hours plus 30 minutes then all dust generating activities within the relevant area must stop.

Attachment 5E

Weather Condition Results

PF FORMATION WEATHER CHART

JULY 2009

DATE	TEMP-MIN	TEMP-MAX	WIND-SPD	WIND-DIR	BAR	RAIN	CONDITION
1/07/2009	16	21	10-65	NNW-WNW	999.1	NIL	FINE
2/07/2009	9	18	10-45	N-NW	1002.5	NIL	FINE
3/07/2009	9	16	25-35	WNW-SSW	998.1	NIL	FINE
4/07/2009	5	16	0-25	WNW	1006.1	NIL	FINE
6/07/2009	4	15	0-10	NW-S	1016.1	NIL	FINE
7/07/2009	7	13	0-10	SSE	1018.7	NIL	FINE
8/07/2009	8	15	0-5	SW-SE	1020.7	3mm	FINE
9/07/2009	9	15	0-10	S	1024.8	2mm	OVERCAST
10/07/2009	8	16	0-10	S-NE	1022.2	2mm	OVERCAST
11/07/2009	8	16	0-5	NNE-WSW	1015.9	NIL	FINE
13/07/2009	12	17	0-5	NW-WSW	1001.3	NIL	FINE
14/07/2009	9	15	10-25	NW-W	1001.1	NIL	FINE
15/07/2009	5	15	0-10	NW-WSW	1003.5	NIL	FINE
16/07/2009	6	15	0-25	WSW-SSE	1005.9	2.5mm	FINE
17/07/2009	7	15	0-20	WSW-SE	1011.1	NIL	FINE
18/07/2009	4	15	0	ESE	1015	NIL	FINE
20/07/2009	7	20	0-12	NNE-NNW	1018.8	NIL	FINE
21/07/2009	8	23	0-5	NNW-NW	1014.2	NIL	FINE
22/07/2009	16	23	20-25	NW-NNW	1006.7	NIL	FINE
23/07/2009	7	20	0-10	NNW-SW	1005.2	NIL	FINE
24/07/2009	7	17	0-15	S-NE	1019	NIL	FINE
25/07/2009	5	15	0-10	NNW	1019	NIL	FINE
26/07/2009						5.5mm	
27/07/2009	6	17	0-15	W-WNW	1008.8	NIL	FINE
28/07/2009	5	19	0-15	WNW-WSW	1015	NIL	FINE
29/07/2009	5	20	0-15	W-SW	1017.2	NIL	FINE
30/07/2009	5	19	0-5	SSW-WNW	1019.8	NIL	FINE
31/07/2009	6	17	0-20	NW-WNW	1013.9	NIL	FINE

PF FORMATION WEATHER CHART

AUGUST 2009

DATE	TEMP-MIN	TEMP-MAX	WIND-SPD	WIND-DIR	BAR	RAIN	CONDITION
1/08/2009	5	18	0-10	W-WNW	1019.3	NIL	FINE
2/08/2009							
3/08/2009	7	20	0-15	W-SE	1013.6	NIL	FINE
4/08/2009	7	19	0-10	S-SE	1015.6	NIL	FINE
5/08/2009	5	20	0-5	SE-S	1015	NIL	FINE
6/08/2009	6	20	0-20	NNE	1016.1	NIL	FINE
7/08/2009	7	21	0-35	NW-SW	1009	NIL	FINE
8/08/2009	5	18	0-25	SSW	1016	NIL	FINE
9/08/2009							
10/08/2009	4	17	0-15	ENE	1011.9	NIL	FINE
11/08/2009	9	17	0-20	WNW	1008.9	2mm	FINE
12/08/2009	8	20	0-15	WSW	1005.4	NIL	FINE
13/08/2009	7	22	0-15	NNW-SW	1007	NIL	FINE
14/08/2009	7	21	0-10	WNW-SE	1012.8	NIL	FINE
15/08/2009	6	21	0-10	ESE-NE	1012.5	NIL	FINE
16/08/2009							
17/08/2009	17	23	0-35	WSW-SW	1005.3	NIL	FINE
18/08/2009	5	21	0-20	S-N	1021	NIL	FINE
19/08/2009	6	19	0-25	NE-NW	1021.4	NIL	FINE
20/08/2009	8	22	0-5	NNW-NNE	1012.7	NIL	FINE
21/08/2009	12	23	0-10	N-NNW	1004.6	NIL	FINE
22/08/2009	13	25	0-20	NNW	1006.7	NIL	FINE
23/08/2009							
24/08/2009	20	26	0-60	N-NW	1006.2	NIL	FINE
25/08/2009	17	20	65-10	WSW-NNW	1007.2	NIL	FINE
26/08/2009	13	22	30-55	W-SW	1015.3	NIL	FINE
27/08/2009	9	25	0-25	W-NNW	1014.6	NIL	FINE
28/08/2009	9	26	0-25	NNW	1019.6	NIL	FINE
29/08/2009	14	20	0-15	NW	1012.2	NIL	FINE
30/08/2009							
31/08/2009	6	21	0-20	NW	1019.7	NIL	FINE

PF FORMATION WEATHER CHART

SEPTEMBER 2009

DATE	TEMP-MIN	TEMP-MAX	WIND-SPD	WIND-DIR	BAR	RAIN	CONDITION
1/09/2009	8	23	5-20	ENE-E	1022.8	NIL	FINE
2/09/2009	7	22	5-15	N-NE	1026.2	NIL	FINE
3/09/2009	8	16	0-10	ENE-WNW	1023.4	5mm	FINE
4/09/2009	12	24	10-20	NNE-NW	1016.8	1.5mm	FINE
5/09/2009	12	22	0-15	NE-WNW	1017.1	NIL	FINE
6/09/2009							
7/09/2009	12	17	0-25	N-WNW	1012.1	1.5mm	FINE
8/09/2009	9	20	0-20	NW-SW	1008.2	NIL	FINE
9/09/2009	8	21	0-20	W-SW	1013	NIL	FINE
10/09/2009	6	23	0-20	NW	1015.4	NIL	FINE
11/09/2009	6	24	0-10	N-NW	1019.9	NIL	FINE
12/09/2009	11	29	0-20	NW	1023.4	NIL	FINE
13/09/2009							
14/09/2009	19	22	0-25	NW-SW	1018.8	NIL	FINE
15/09/2009	15	23	0-15	SE-NNE	1023.7	NIL	FINE
16/09/2009	15	21	0-12	S-NW	1025.7	NIL	FINE
17/09/2009	14	31	5-35	NNW-WNW	1020.3	NIL	FINE
18/09/2009	13	30	0-20	NNW-SW	1021.3	NIL	FINE
19/09/2009	15	24	0-20	NNW	1021.2	NIL	FINE
20/09/2009							
21/09/2009	14	20	0-15	SW-NNW	1016.5	0.5mm	FINE
22/09/2009	15	29	8-48	NW	1006.3	NIL	FINE
23/09/2009	19	21	30-55	NNW	998.5	NIL	FINE
24/09/2009	13	22	0-35	WSW	1012.4	NIL	FINE
25/09/2009	11	26	8-20	NNW-WNW	1015.3	NIL	FINE
26/09/2009	18	22	20-35	SW-NW	1004.7	NIL	FINE
27/09/2009							
28/09/2009	9	22	0-15	W-WSW	1010.3	NIL	FINE
29/09/2009	8	22	0-15	SSW-E	1014.8	NIL	FINE
30/09/2009	8	28	0-15	NNE-W	1020.2	NIL	FINE

PF FORMATION WEATHER CHART

OCTOBER 2009

DATE	TEMP-MIN	TEMP-MAX	WIND-SPD	WIND-DIR	BAR	RAIN	CONDITION
1/10/2009	15	33	0-25	NNW-W	1016.8	NIL	FINE
2/10/2009	15	30	0-15	S-SW	1014.1	10mm	FINE
3/10/2009	14	22	0-20	SSW-S	1011.4	28mm	STORM
4/10/2009							
5/10/2009							
6/10/2009	9	21	0-10	SE-ESE	1021.9	3mm	OVERCAST
7/10/2009	11	20	0-20	ENE-SW	1016.5	NIL	CLOUDY
8/10/2009	8	17	15-35	SSE-SSW	1019.7	NIL	FINE
9/10/2009	8	17	5-30	SW-SSW	1028.4	1.5mm	CLOUDY
10/10/2009	8	17	5-25	SSW-SSE	1032.6	4mm	CLOUDY
11/10/2009							
12/10/2009	10	21	0-20	N-NNW	1013.6	NIL	CLOUDY
13/10/2009	14	23	0-45	NNW-NW	1002.7	NIL	FINE
14/10/2009	14	21	5-35	NW-W	1003.4	5mm	CLOUDY
15/10/2009	13	21	5-30	NW-W	1009.8	NIL	FINE
16/10/2009	9	21	0-30	WSW-W	1013	NIL	FINE
17/10/2009	8	21	0-25	WSW	1016.2	NIL	FINE
18/10/2009							
19/10/2009	9	28	0-10	NE-ENE	1029	NIL	FINE
20/10/2009	13	32	0-26	ESE-S	1026.4	NIL	FINE
21/10/2009	13	36	0-10	E-SW	1022.4	NIL	FINE
22/10/2009	18	25	0-20	SE-NNE	1026.7	NIL	FINE
23/10/2009	13	34	0-10	NNW-SW	1019.7	NIL	FINE
24/10/2009	17	32	0	S-N	1020.6	NIL	FINE
25/10/2009						22mm	
26/10/2009	13	22	10-25	SE-SSW	1022	23mm	OVERCAST
27/10/2009	13	25	0-15	SSW-NW	1030.1	NIL	FINE
28/10/2009	12	26	0-10	S-NE	1027.6	NIL	FINE
29/10/2009	16	22	0-10	S-SSW	1026.7	NIL	FINE
30/10/2009	16	29	0-15	N-NW	1024.5	NIL	FINE
31/10/2009	18	26	0-20	NNW-NW	1025.7	NIL	FINE

PF FORMATION WEATHER CHART

NOVEMBER 2009

DATE	TEMP-MIN	TEMP-MAX	WIND-SPD	WIND-DIR	BAR	RAIN	CONDITION
1/11/2009							
2/11/2009	18	32	0-20	SSE	1022	NIL	FINE
3/11/2009	18	36	Jul-20	NNE-NW	1014.9	NIL	FINE
4/11/2009	18	21	0-5	NE-SE	1015.7	NIL	FINE
5/11/2009	16	22	0-10	E-S	1021	2mm	FINE
6/11/2009	16		0-5	SE	1029.2	NIL	FINE
7/11/2009	17	21	0-15	SE-NE	1028.3	NIL	FINE
8/11/2009						4.5mm	OVERCAST
9/11/2009	17	27	0-10	NE-SE	1029	NIL	FINE
10/11/2009	12	30	0-15	N-NNE	1024.3	NIL	FINE
11/11/2009	14	30	0-15	E-NE	1023.8	NIL	FINE
12/11/2009	14	35	0-15	NE-E	1022.1	6.5mm	FINE
13/11/2009	18	22	8-28	ESE-SSE	1018.8	NIL	FINE
14/11/2009	13	32	0-10	ESE	1018.5	NIL	FINE
15/11/2009							
16/11/2009	19	35	0-15	ESE-NE	1011	NIL	FINE
17/11/2009	19	25	0-10	ESE	1009.7	NIL	FINE
18/11/2009	16	28	0-10	SE-NNE	1014.4	NIL	FINE
19/11/2009	17	35	0-15	N-NE	1012.1	NIL	FINE
20/11/2009	22	42	0-25	ENE	1009.9	3mm	STORM
21/11/2009	22	36	5-15	S-SSW	1011.4	NIL	FINE
22/11/2009							
23/11/2009	20	21	10-20	SSE-SSW	1021.3	NIL	FINE
24/11/2009	15	20	5-15	SSW	1028.4	1.5mm	FINE
25/11/2009	17	29	0-15	SSW-NE	1023.6	NIL	FINE
26/11/2009	19	32	0-15	NE	1018.7	3mm	FINE
27/11/2009	20	33	0-25	WNW-WSW	1011.2	NIL	FINE
28/11/2009	20	34	0-5	WSW	1007.2	NIL	FINE
29/11/2009							
30/11/2009	16	25	0-25	SW-SE	1006.3	12mm	STORM

PF FORMATION WEATHER CHART

DECEMBER 2009

DATE	TEMP-MIN	TEMP-MAX	WIND-SPD	WIND-DIR	BAR	RAIN	CONDITION
1/12/2009	12	23	0-10	S-SE	1017.6	2mm	FINE
2/12/2009	13	22	0-10	S-SE	1023	NIL	FINE
3/12/2009	15	29	0-15	SE-ENE	1018.9	NIL	FINE
4/12/2009	16	30	0-10	N-NW	1014.9	NIL	FINE
5/12/2009	17	30	0-10	WNW	1016	NIL	FINE
6/12/2009							
7/12/2009	19	36	0-15	WNW	1010.4	NIL	FINE
8/12/2009	19	37	0-15	S-SSW	1009.5	NIL	FINE
9/12/2009	18	27	0-20	SSW-SSE	1009.8	NIL	FINE
10/12/2009	19	30	0-25	ENE-NNW	1012.3	NIL	FINE
11/12/2009	20	30	0-25	NNW-SSW	1012.9	NIL	FINE
12/12/2009	15	31	0-15	SE	1019.2	NIL	FINE
13/12/2009							
14/12/2009	20	22	0-10	SE	1020.3	NIL	FINE
15/12/2009	18	26	0-10	SE-N	1023.7	NIL	FINE
16/12/2009	20	35	0-15	N-NE	1021.6	NIL	FINE
17/12/2009	21	40	0-66	NW	1015.2	7mm	LATE STORM
18/12/2009	22	27	0-10	NE	1012.8	20mm	RAIN
19/12/2009	17	29	0-10	SSE-SW	1017.3	NIL	FINE
20/12/2009							
21/12/2009	17	28	0-20	N-NW	1017.4	NIL	FINE
22/12/2009	20	30	0-15	NW-WNW	1012.3	1mm	FINE
23/12/2009	19	32	0-15	WNW-ENE	1017.1	NIL	FINE
24/12/2009	22	32	0-10	N	1013.9	NIL	FINE
25/12/2009	NOTE - 70mm RAIN BETWEEN 24-12-09 AND 4-01-10						
26/12/2009							
27/12/2009							
28/12/2009							
29/12/2009							
30/12/2009							
31/12/2009							

PF FORMATION WEATHER CHART

JANUARY 2010

DATE	TEMP-MIN	TEMP-MAX	WIND-SPD	WIND-DIR	BAR	RAIN	CONDITION
1/01/2010							
2/01/2010							
3/01/2010							
4/01/2010	17	24	0-10	NNW-NE	1022.4	NIL	FINE
5/01/2010	17	33	0-20	NNE-NE	1018.8	NIL	FINE
6/01/2010	20	31	0-10	NW-SE	1014.7	NIL	FINE
7/01/2010	20	23	0-15	SSE-SE	1017.7	1mm	FINE
8/01/2010	18	27	0-10	SW	1021.8	NIL	FINE
9/01/2010	19	34	0-15	N-SSE	1018.7	NIL	FINE
10/01/2010							
11/01/2010	21	30	0-20	S-E	1021.1	NIL	FINE
12/01/2010	22	39	0-25	N-NNW	1013.7	NIL	FINE
13/01/2010	26	35	0-20	N-S	1009.4	18mm	FINE
14/01/2010	19	27	0-15	S-SSW	1017.1	3mm	FINE
15/01/2010	18	26	0-10	SSW-ENE	1019	NIL	FINE
16/01/2010	20	30	0-5	ENE	1015.1	7mm	FINE
17/01/2010							
18/01/2010	16	26	0-45	SW-WNW	1003.2	NIL	FINE
19/01/2010	12	27	0-25	SSE-SSW	1009.6	NIL	FINE
20/01/2010	14	33	0-10	W-N	1010.4	NIL	FINE
21/01/2010	17	37	0-10	ENE-NE	1011.9	NIL	FINE
22/01/2010	21	39	0-25	S-W	1014.1	NIL	FINE
23/01/2010	28	42	10-20	NNW	1009.5	NIL	FINE
24/01/2010							
25/01/2010	20	30	0-15	NW	1013.9	NIL	FINE
26/01/2010							
27/01/2010	23	28	0-0	SSW-E	1015.1	NIL	FINE
28/01/2010	20	33	0-20	W-SW	1013.1	7mm	FINE
29/01/2010	19	32	0-25	W-SW	1008.1	NIL	FINE
30/01/2010	21	24	0-25	SSW-SSE	1019.5	18mm	RAIN
31/01/2010							

PF FORMATION WEATHER CHART

FEBRUARY 2010

DATE	TEMP-MIN	TEMP-MAX	WIND-SPD	WIND-DIR	BAR	RAIN	CONDITION
1/02/2010	19	30	0-10	NNE-SE	1015.7	3mm	FINE
2/02/2010	20	27	0-5	SSE-ESE	1017.8	8mm	FINE
3/02/2010	20	27	0-15	SE-E	1014.9	17mm	OVERCAST
4/02/2010	22	27	0-10	ENE-NNW	1013.8	19mm	OVERCAST
5/02/2010	22	27	0-20	N-NE	1009.8	8	OVERCAST
6/02/2010	20	32	0-15	SSE	1017.2	90mm	OVERCAST
7/02/2010							
8/02/2010	21	25	0-15	N-SW	1022.3	1mm	FINE
9/02/2010	20	28	0-10	W-NE	1024.3	0	FINE
10/02/2010	20	32	0-5	NE-ENE	1017.6	0	FINE
11/02/2010	20	32	0-15	NNE-NE	1017.3	0	FINE
12/02/2010	24	36	0-25	NNE-NW	1009.1	10mm	FINE
13/02/2010	22	24	0-24	WSW-SE	1011.9		FINE
14/02/2010						22mm	
15/02/2010	20	31	0-15	S-NNW	1006.5	0	FINE
16/02/2010	20	25	0-10	WSW-SE	1011.5	0	FINE
17/02/2010	17	27	0-10	SSE	1018.9	0	FINE
18/02/2010	17	25	0-15	SSE-SE	1022.1	0	FINE
19/02/2010	16	23	0-10	SE-NE	1026.8	0	FINE
20/02/2010							
21/02/2010							
22/02/2010	21	36	0-25	WNW-NW	1015.1	0	FINE
23/02/2010	23	34	0-20	NNW-ESE	1013.2	0	FINE
24/02/2010	19	23	0-5	S-ESE	1022.1	0	FINE
25/02/2010	14	24	0-0	NE-SSW	1027.6	0	FINE
26/02/2010	16	25	0-0	NNE	1028	0	FINE
27/02/2010	17	27	0-0	NNE-NNW	1022.9	0	FINE
28/02/2010							

PF FORMATION WEATHER CHART

MAR 10

DATE	TEMP-MIN	TEMP-MAX	WIND-SPD	WIND-DIR	BAR	RAIN	CONDITION
1/03/2010	17	18	0-5	SSW-S	1019.2	3	CLOUDY
2/03/2010	15	20	0-15	SSE	1021.4	1	CLOUDY
3/03/2010	16	23	0-10	SSE-NNE	1018.4	0	FINE
4/03/2010	16	20	0-10	NNE	1018.1	0	FINE
5/03/2010	19	22	0-5	NNE-WSW	1011	2	CLOUDY
6/03/2010	20	27	0-5	WNW	1012.6	0	FINE
7/03/2010	SUNDAY						
8/03/2010	20	29	0-8	NNE-N	1010	0	FINE
9/03/2010	17	29	0-9	SSW-WNW	1014	0	FINE
10/03/2010	16	19	0-9	WNW-ESS	1023	9	CLOUDY
11/03/2010	17	21	0-12	SSW-SSW	1031.8	1	FINE
12/03/2010	NIL	NIL	NIL	NIL	NIL	NIL	NIL
13/03/2010	NIL	NIL	NIL	NIL	NIL	NIL	NIL
14/03/2010	NIL	NIL	NIL	NIL	NIL	NIL	NIL
15/03/2010	16	26	0-0	S-E	1027	0-0	CLOUDY
16/03/2010	16	27	0-5	E-N	1023.9	0-0	FINE
17/03/2010	14	28	0-0	NNE-N	1027.1	0-0	FINE
18/03/2010	15	30	0-0	N-NNE	1026.9	0-0	FINE
19/03/2010	16	32	0-0	NNE-NNE	1023.6	0-0	FINE
20/03/2010	18	31	0-0	NNE-NNE	1021.7	0-0	FINE
21/03/2010	SUNDAY						
22/03/2010	21	27	0-10	NNE-NNE	1019.4	0-0	CLOUDY
23/03/2010	17	28	0-0	NNE-NNE	1021.1	0-0	FINE
24/03/2010	17	28	0-0	WNW-NNE	1020.5	0-0	CLOUDY
25/03/2010	19	28	0-5	S-NNE	1024.1	0-0	FINE
26/03/2010	19	29	0-5	NNE	1091.4	0-0	FINE
27/03/2010	22	30	0-0	NNE	1018.7	0-0	CLOUDY
28/03/2010	SUNDAY						
29/03/2010	22	28	0-0	WNN	1015.4	0-0	CLOUDY
30/03/2010	20	20	0-0	NNE	1017.9	12	CLOUDY
31/03/2010	17		0-10	NNE	1020.5	6	CLOUDY

PF FORMATION WEATHER CHART

APR 10

DATE	TEMP-MIN	TEMP-MAX	WIND-SPD	WIND-DIR	BAR	RAIN	CONDITION
1/04/2010	24	27	0-10	NNE	1019.8	0	FINE
2/04/2010	-	-	-	-	-	-	-
3/04/2010	-	-	-	-	-	-	
4/04/2010	-	-	-	-	-	-	-
5/04/2010	-	-	-	-	-	-	-
6/04/2010	16		0	NNE	1022.6	0	CLOUDY
7/04/2010	17		0	NNE	1018.4	0	CLOUDY
8/04/2010	19	25	0	NNE	1013	0	CLOUDY
9/04/2010	15	26	0	NNE-SEE	1016.4	0	CLOUDY
10/04/2010	16	23	0	N	1010	0	CLOUDY
11/04/2010	-	-	-	-	-	-	-
12/04/2010	12	26	0	nne	1015.7	0	FINE
13/04/2010	9	23	9	NNE	1023	0	FINE
14/04/2010	10	26	0	NNE	1024.9	0	FINE
15/04/2010	9	25	0	S-W	1022.9	0	FINE
16/04/2010	16	22	0	S-S	1027.4	0	CLOUDY
17/04/2010	15	24	0	S-S	1029.4	0	FOG-FINE
18/04/2010	-	-	-	-	-	-	-
19/04/2010	16	24	0	NNE-ES	1027.4	0.25	FOG-CLOUDY
20/04/2010	17	25	0	N-NNE	1026.4	0	FOG-CLOUDY
21/04/2010	15	26	0	NNE-NE	1024.3	0	FOG-FINE
22/04/2010	14	30	0	NNE-ES	1023.9	0	FOG-FINE
23/04/2010	14	29	0	NNE-NNE	1021.7	0	FINE
24/04/2010	20	25	9	N	1016.1	0	CLOUDY
25/04/2010	-	-	-	-	-	-	-
26/04/2010	-	-	-	-	-	-	-
27/04/2010	9	18	0	N-NW	1022.9	21	CLOUDY
28/04/2010	11	25	0	W-N	1023.1	0	FINE
29/04/2010	10	25	0-7	W-WWN	1021.6	0	FINE
30/04/2010	10	16	0-5	NNE-SSE	1026.4	0	CLOUDY

PF FORMATION WEATHER CHART

MAY 10

DATE	TEMP-MIN	TEMP-MAX	WIND-SPD	WIND-DIR	BAR	RAIN	CONDITION
1/05/2010	13	0	0	SSE-SSE	1029.3	3	RAIN
2/05/2010	-	-	-	-	-	-	-
3/05/2010	13	20	0-0	ES-W	1029.9	0	CLOUDY
4/05/2010	15	23	0-10	W-NNW	1023.7	0	FOG-FINE
5/05/2010	14	0	0	W-W	1015.1	4	CLOUDY
6/05/2010	7	22	0	W-SSE	1022.2	0	FINE
7/05/2010	7	23	0	SSW-N	1025.5	0	FINE
8/05/2010	7	21	0	E-W	1024.6	0	FINE
9/05/2010	-	-	-	-	-	-	-
10/05/2010	11	25	0	WWN-N	1022.2	0	FINE
11/05/2010	11	25	5-10	N-N	1015.7	0	FINE - WINDY
12/05/2010	7	22	0-10	SSW-SSE	1019.8	0	FINE
13/05/2010	5	21	0-5	EES-SWW	1021.9	0	FINE
14/05/2010	7	21	16-8	EES-EES	1019.6	0	FINE
15/05/2010	7	20	0-0	S-EES	1020.1	0	FINE-CLOUDY
16/05/2010	-	-	-	-	-	-	-
17/05/2010	10	16	0-5	W-W	1022.9	0	CLOUDY
18/05/2010	12	16	0-5	E-E	1020.4	3	CLOUDY
19/05/2010	10	18	0-0	SSW-ESE	1023.8	3	CLOUDY
20/05/2010	8	16	0-5	E-NWW	1023.8	0	FOG-CLOUDY
21/05/2010	10	16	0-0	W-SE	1023	0	CLOUDY-FINE
22/05/2010	10	18	0-15	S-S	1023	0	CLOUDY-FINE
23/05/2010	-	-	-	-	-	-	-
24/05/2010	9	15	0-0	S-S	1024	0	CLOUDY
25/05/2010	13	15	0-0	SSW-ESE	1014.5	15	RAIN
26/05/2010	13	17	0-0	NNE-SSE	1005.7	35	RAIN
27/05/2010	11	17	0-11	S-S	1018.6	5	RAIN
28/05/2010	10	16	0-5	SSW-ESE	1023.2	0	FOG-CLOUDY
29/05/2010	13	15	0-9	N-WNN	1010.6	2	RAIN
30/05/2010	-	-	-	-	-	-	-
31/05/2010	11	13	0-0	SSW-SSW	1009.7	18	RAIN

PF FORMATION WEATHER CHART

JUN 10

DATE	TEMP-MIN	TEMP-MAX	WIND-SPD	WIND-DIR	BAR	RAIN	CONDITION
1/06/2010	10	18	0-0	SSW-SSE	1019.3	0	CLOUDY
2/06/2010	10	15	0-0	S-NIL	1023.2	2	CLOUDY
3/06/2010	13	15	0-15	S-NIL	1025	35	FOG -CLOUDY
4/06/2010	14	14	0-17	EES-S	1020.9	39	FOG CLOUDY
5/06/2010	11	19	0-0	SSW-S	1016.9	50	CLOUDY
6/06/2010	-	-	-	-	-	-	-
7/06/2010	7	18	0-10	S-NIL	1026.8	0	CLOUDY
8/06/2010	8	16	0-10	S-NIL	1026.3	0	CLOUDY
9/06/2010	8	16	0-25	NWN	1017	0	FINE
10/06/2010	8	17	7-0	W-SSE	1018.1	0	FINE
11/06/2010	4	17	0-0	SSW-W	1024-1	0	FINE
12/06/2010	4	16	0-0	S-E	1024.8	0	FINE
13/06/2010	-	-	-	-	-	-	-
14/06/2010	-	-	-	-	-	-	-
15/06/2010	6	18	0-0	E-NE	1037.2	0	FINE
16/06/2010	7	17	0-0	WW-NIL	1030.3	0	FINE
17/06/2010	12	17	0-28	N-NNW	1018.2	0	CLOUDY
18/06/2010	7	18	0-8	W-SSW	1019.4	0	FINE
19/06/2010	5	17	0-0	N-NNW	1021.8	0	FINE
20/06/2010	-	-	-	-	-	-	-
21/06/2010	7	18	0-10	S-S	1034.8	0	CLOUDY
22/06/2010	11	18	0-0	SS-EES	1039.3	0	CLOUDY
23/06/2010	11	14	0-0	S-W	1039.2	6	CLOUDY
24/06/2010	11	16	0-0	EES-W	1033.6	0	FOG CLOUDY
25/06/2010	11	14	0-0	NNE-NE	1027-7	2	CLOUDY
26/06/2010	13	14	0-6	N-WW	1020.9	0	CLOUDY
27/06/2010	-	-	-	-	-	-	-
28/06/2010	3	15	0-0	S-N	1024.6	0	FINE
29/06/2010	2	14	0-0	W-WW	1022.2	0	FINE
30/06/2010	1	15	0-0	N-NNW	1024.4	0	FINE

Chapter Six

GROUND & SURFACE WATER MANAGEMENT

Introduction

The groundwater monitoring program included in the Water Management Plan approved by the Director-General of the Department of Planning on 8 July 2009 includes:

- provision of additional monitoring bores around the periphery of the site;
- detailed baseline data on groundwater levels, flows and quality in the region and particularly any groundwater bores, springs and seeps (including spring and seep fed dams) that may be affected by operations on site;
- groundwater assessment criteria including trigger levels for investigating any potentially adverse groundwater impacts;
- a program to monitor:
 - groundwater levels and quality in new and existing monitoring bores;
 - impacts of the project on any groundwater bores, springs and seeps (including spring and seep fed farm dams) on privately-owned land and any groundwater dependent ecosystems; and
- a protocol for further groundwater modelling to confirm the limits to excavation depth across the site permitted in accordance with **Condition 9** of **Schedule 2**.

This chapter addresses the surface and groundwater aspects of the sand extraction operations at the site.

Groundwater management

The groundwater component of the report has been prepared by URS Australia and their full report follows in **Attachment 6A**.

Surface water management

Current site conditions

The location of the current extraction areas, tailings ponds and sediment basins is shown on the figure at **Attachment 2A**. No significant changes have occurred in these areas in the last year as discussed in Chapter 2.

The following points respond, where appropriate, to the specific surface water issues listed in the Water Management Plan.

Treatment of sediment-laden water

Sediment-laden water is treated by the use of a series of tailings ponds which enable the sediment to progressively settle out of suspension with the resulting clean water returned to the processing cycle.

Stormwater runoff from disturbed areas flows to these ponds and other sediment basins across the site to maximise reuse of all water. Prior to overflow and discharge from the spillways and the site, the stormwater runoff is treated where necessary.

The clean water supply dam, located close to the southern boundary of the southern catchment, comprises the final sediment basin before any discharge of stormwater from the Hitchcock Road site. It is included in the process water cycle and, at the time of the inspection, was estimated to be using about 25 percent of its calculated capacity of 25,000 cubic metres.

The clean water supply dam is connected by pipe to the clean water dam on Lot 198 DP 752025 below the central processing plant (sand washplant). The Lot 198 DP 752025 dam was emptied in December 2009 and cleaned out in January 2010. Silt and sediment had built up over the years in this dam and this material was removed to increase the capacity. The capacity is 50,000 cubic metres and was estimated to be using 25% at the time of inspection. Water can be balanced between the two sites as necessary. **(Attachment 2C – Photos 7, 8 & 9)**

Past extraction in the northern extraction area has created a temporary excavation, the capacity of which significantly exceeds that required as a sediment basin for the northern catchment section of the site. A minimum capacity of 7,800 cubic metres will be maintained following final trimming of this basin. Inspection indicates a current freeboard to the spillway of about 3.5 metres with no indication of any discharge from the site during the year.

Maintaining/monitoring current surface water quality

The site does not have any permanently flowing surface waters. Existing surface water is limited to a supply sump in an area of previous extraction and a number of small farm dams. The existing tailings ponds and sediment basins will maintain the quality of the intermittent surface water flows experienced on the site.

Monitoring of surface water quality will be achieved by the visual inspection of waters within the sediment basins allowing treatment to take place if necessary prior to overflow and discharge from the site.

No discharges from the site occurred but quarterly samples were taken from an existing monitoring site on the creek below Lot 198 DP 752025. The results from these samples are in **Attachment 6B**. The PH (4.1 to 4.9), electrical conductivity and oil and grease results were all within the expected ranges. The total suspended solids of 77.6 mg/l in the 4 February 2010 sample was higher than the 50 mg/l criteria but was unrelated to the PF Formation operations.

Dewatering of water pits

Of the commissioned ponds, Numbers 9 and 10 are currently in the tailings stream cycle with Numbers 5 and 7 currently drying prior to capping.

All other tailings ponds have been fully capped.

Decant water from the tailings ponds flows to the clean water supply dam, thence to the slurry plant and the processing/wash plant on Lot 198.

The tailings ponds on Lot 198 (Wisemans Ferry Road) are currently not used for tailings disposal.

Only one uncapped tailings pond remains in Area B and those in Area C are fully capped with topsoil spread as part of the rehabilitation process.

Destination points for waters collected within the extraction areas

In the southern catchment, the collected waters flow to the tailings ponds and the clean water dam (southern sediment basin) and thence to the slurry plant and the main process plant on Lot 198.

In the northern part of the Hitchcock Road site they flow to the northern sediment basin and thence (if not recovered and reused) via the overflow spillway, and two further minor sediment traps to the Wisemans Ferry Road surface drains. There are no indications that any surface water has been discharged from the Hitchcock Road site and all available water is used in the processing cycle.

On-site reuse of collected waters

All collected waters are reused in the processing cycle during the operational stage of the extraction works.

Water levels within the existing water sump

Water levels and volumes within the sump are detailed in **Attachment 6A**. The sump (dam) is located at the lowest point- in the south-eastern corner of the existing pit on Portion 167 on the eastern side of the clean water dam. The capacity of this area is essentially the full extent of the existing pit and would greatly exceed that calculated in the Rehabilitation Plan as necessary for the total capture of runoff from the 100 year time of concentration storm event (19,400 m³).

Significant site features, recharge areas and natural areas

The main extraction area has now moved from Lot 168 to continue within Lot 214 and along the western edge of Lot 167. Extraction in the northern part of the site will continue southwards over the next three years. Groundwater recharge areas, outside the current extraction areas remain essentially unaltered and the groundwater management plan has concluded that there has been no apparent impact on the sustainability of the groundwater. (see **Attachment 6A**)

Conclusion

Groundwater and surface water levels have been monitored and water samples tested with no abnormalities noted.

Attachment 6A

Annual Groundwater Management Plan



Report

Hitchcock Road Site

2010 Annual Groundwater Management Plan

30 JUNE 2010

Prepared for
PF Formation
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Date: **30 June 2010**
Reference: 43167726/Rep 50/A
Status: Final

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Figure 8	PF167 DAM, Groundwater Hydrograph; September 1996 – June 2010
Figure 9	PF167DAM Monthly Pumpage Records

Appendices

Appendix A	Groundwater Water Quality Plots
Appendix B	Analytical Laboratory Reports

Introduction

1.1 Introduction

PF Formation (PFF) is required under the Development Approval conditions set for the Maroota Hitchcock Road property area to prepare an annual Water Management Plan (WMP) report to the Baulkham Hills Shire Council (BHSC). The WMP is part of the overall Environmental Management Plan and addresses the surface water and groundwater aspects of the sand extraction operations at the site.

URS Australia Pty Ltd (URS), as part of the on-going involvement with the project, has been retained by PFF to prepare the groundwater component of the above report, which is presented in the following sections.

The WMP for the year July 2009 to June 2010 also includes all the monitoring data collected from 1996 to date for the Hitchcock Road site and for Portion 198.

Groundwater Management Facilities

2.1 General

At the Hitchcock Road site, groundwater is monitored at five locations:

1. monitoring bore PF167MW1, located in Portion 167;
2. monitoring bore PF166MW1, located in Portion 166;
3. supply dam PF167DAM, located in Portion 167;
4. monitoring bore PFL2HitchMW1, located in Lot 2; and
5. monitoring bore PFP214MW1, located in Portion 214.

In addition, groundwater pumpage and chemical records are also collected from the two water supply bores in Portion 198, PF198PB1 and PF198PB2.

Groundwater monitoring has been carried out at the sites since 1996. Initially, water levels in bores PF166MW1 and PF167MW1 were measured manually at weekly intervals together with chemical field parameters such as pH and Electrical Conductivity (EC). The manual measurements continued until December 1998. In January 1999, the two bores were equipped with Dataflow Systems automatic data loggers.

Dataloggers have been downloaded quarterly between January 1999 and June 2000. Since June 2000, the dataloggers have been downloaded biannually. In January 2006, the old style Dataflow dataloggers were replaced with Solinst Levellogger 3001 units, capable of storing 40 000 readings in the memory, with a battery life span of around 10 years. The new Solinst dataloggers allow data annual downloading, a monitoring interval started on July 2006.

Groundwater samples for chemical analysis have been collected at the same time for the monitoring and pumping bores. The analytical results have been plotted on individual graphs that are continuously updated to assess possible trends with time.

Water samples from five bores were collected and submitted for chemical analysis under Chain of Custody procedures to Australian Laboratory Services Pty Ltd. The laboratory reports are presented in Appendix B.

A groundwater sample from bore PF198PB2 could not be collected as the pump was out of service and in the process of being repaired.

The analytical list for all bores, which was discussed and agreed upon with the DLWC (now the NSW Office of Water) has included:

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

2 Groundwater Management Facilities

2.1.1 Monitoring Bore PF167MW1

Groundwater monitoring at bore PF167MW1 commenced in March 1996. The data between March 1996 and December 1998 (manual collection) have been plotted in the graph of Figure 2, together with EC and rainfall records collected by PFF.

Figure 3 presents the combined Dataflow and Solinst dataloggers records for bore PF167MW1. Some minor data gaps exist and a slight difference between the manual data and the start of the automatic recording is evident in the graph, which are due to the time intervening between the end of the manual and start of the automatic recording methods.

2.1.2 Monitoring Bore PF166MW1

Groundwater monitoring at bore PF166MW1 commenced in March 1998 in the same manner as for bore PF167MW1. The data between March 1998 and December 1998 (manual collection) have been plotted in the graph of Figure 4, together with EC and rainfall records collected by PFF.

The plots of bore PF167MW1 records collected after the installation of the Dataflow datalogger and those of the Solinst dataloggers are presented in Figure 5.

2.1.3 Monitoring Bore PFP214MW1

Bore PFP214MW1 was installed in March 2009 as part of an extended groundwater monitoring network following the Development Approval for Portion 214, located at the southern boundary of the Hitchcock Road site.

A datalogger was installed in the bore in early April 2009 (Solinst Levellogger Gold 3001, serial no.51040540) and downloaded for the first time in July 2009. Figure 6 shows Bore PFP214MW1 hydrograph.

2.1.4 Monitoring Bore PFL2HitchMW1

Bore PFL2HitchMW1 was also installed in March 2009. This bore is located midway along the eastern boundary of the Hitchcock Site and monitors the full sequence of the Maroota Sand.

A datalogger was installed in the bore in early April 2009 (Solinst Levellogger Gold 3001, serial no.510405840) and downloaded for the first time in July 2009. Figure 7 shows Bore PFL2HitchMW1 hydrograph.

2.1.5 Portion 167 Dam

At the early stages of the site development, an excavation (PF167DAM) was carried out to the top of the Hawkesbury Sandstone to an approximate level of 178 m AHD. The excavation collects groundwater and surface water and was eventually licensed by the DLWC (No.10BL157308) as part of the water supply of the operation.

Water levels measured against surveyed pegs have been collected at the dam since September 1996 and pumpage records kept since January 1997.

Plots of the water levels in the dam and of the rainfall in the same period are presented in Figure 8 and a plot of the pumpage records in Figure 9.

2 Groundwater Management Facilities

Water quality in the dam is not monitored because the dam collects incident rainfall, run-off and groundwater and, as a result, water quality would vary according to the proportion of each component at the time of measurement.

2.1.6 Portion 198 Water Supply Bores

The two water supply bores in Portion 198 (PF198PB1 and PF198PB2) have been monitored manually since their installation in March 1998. Groundwater samples have been collected quarterly for the last four quarters to March 2000, biannually up to July 2006 and annually since then. Pumpage records are collected and totalised fortnightly.

Water quality data have been plotted for selected parameters and the graphs are presented in Appendix A and the laboratory reports in Appendix B.

3 Data Assessment

Data Assessment

3.1 Groundwater Levels

Groundwater levels in the Maroota Sand measured in the monitoring bores indicate that the aquifer is variable and contains numerous perched water tables. The plots of bore PF167MW1, which taps the full saturated thickness of the Maroota Sand, and bore PF166MW1, which taps an unconfined aquifer perched at a higher elevation, indicate a rapid response to periods of sustained rainfall. Records for the two new monitoring bores, PFP214MW1 and PFL2HitchMW1, indicate a moderate response to rainfall.

The average yearly rainfall for the year July 2009 - June 2010 has been 797 mm, below the long term average of 884.8 mm. The rainfall data are reported from the PFF data recording system, as the Bureau of Meteorology data have not been quality controlled for the last year.

3.1.1 Bore PF167MW1

After a significant rain event in June 2007, the water level rose by 4.5 m to a level similar to the highest recorded value in mid 2000.

The unexpected rise in the water level in this bore exceeded the datalogger 10 m pressure sensor range and data were not recorded for the last six months. The datalogger suspension wire has been shortened by 3 m and the logger reset. However, the plot shows the July manual water level measurement at 182.44 m AHD, confirming the rising water level trend at this site. Since July 2008 the water level in this bores has followed a familiar pattern of decline with occasional small rises following major rainfall events.

3.1.2 Bore PF166MW1

Since June 2007, following a period of significant and sustained rainfall, the water level in this bore has risen by 1.5 m, less than 1 m of the highest level recorded in the first half of 2002. This bore taps a perched aquifer with variable responses to major rainfall events.

3.1.3 Bore PFP214MW1

Bore PFP214MW1 taps the full thickness of the Maroota Sand towards its southern edge. Since its installation in March 2009, the water shows a slow declining trend, with only a minor response to the major rainfall events in February and May 2010. It is possible that increased recharge from rainfall at this site is rejected as surface flow down the steep slope to the south.

3.1.4 Bore PFL2HitchMW1

Bore PFL2HitchMW1 is the deepest bore in the Hitchcock Road site, as it is located in the vicinity of the former trigonometric station, which is the highest elevation on the site and taps the full thickness of the Maroota Sand aquifer.

3 Data Assessment

The hydrograph shows that after an initial settlement period after drilling, the water level has stabilised at an RL level of 189.6 m AHD without any significant response to the rainfall events. The lack of water level response is possibly due to the depth of the bore and to a possible higher clay content and resulting lower permeability.

3.1.5 PF167Dam

Water levels in the PF167DAM, which was originally excavated to the base of the Maroota Sand within the deep palaeochannel, have been kept above 180 m AHD over the year to June 2010 period by regulating pumpage so as not to exceed this level. Due to the above average rainfall of the last two years there have been long periods when no water was extracted from this site.

The rainfall recorded at the PFF offices for the year to the end of June 2010 has been 797 mm, below the yearly average of 884.8 mm and well below the previous year (1294 mm). In November 2008 the water level in the dam rose to just above 183 m AHD, the highest level recorded at this site since monitoring started in September 1996. Pumping from this source was stopped in February 2010 in order to not exceed the licensed volume. As a result, the water level has peaked to an RL of 183 m AHD, with an average over the period of 182.4 m AHD.

The high level is considered to be the results of the combined effect of the February and May 2010 rainfall, of the reduced pumping from this source and general aquifer recovery and recharge.

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 sand slurring, records show that water levels return rapidly to the average values indicated above, even after higher levels are experienced after heavy rainfall and consequent run-off. Figure 8 shows these combined effects upon the water level in the dam. The records suggest that the Maroota Sand aquifer at the site is capable of sustaining the required pumpage even under the low rainfall recharge conditions and the additional demand posed upon it in the wider Maroota area by the many groundwater users.

3.1.6 Groundwater Quality

As indicated in Section 2.1, water quality in bores PF167MW1 and PF166MW1 has been monitored for pH and EC since monitoring started. Since June 1999 groundwater quality has been analysed for a range of analytical parameters and for Oil and Grease to obtain background data.

Since July 2009, groundwater quality data have become available also from the newly installed monitoring bores, PFP214MW1 and PFL2HitchMW1.

Historical and recent analytical results for the other samples from the monitoring sites are summarised in Tables 3-1 to 3-6, and have been plotted in the graphs presented in Appendix A. The laboratory reports are presented in Appendix B.

Figures 2 and 4 show plots of the EC together with water levels and rainfall for the initial monitoring period, before the installation of the data loggers. The EC plots show a sympathetic variation with rainfall, indicating the effects of dilution generated by recharge (decrease in EC) and by lower water table. In the latter case, the improved EC is interpreted as the effect of aquifer recharge by fresher water.

3 Data Assessment

The plots confirm the dependence of the aquifer upon rainfall to maintain storage and supply. No analysis has been carried out of the water from the dam because extraneous influences, such as direct rainfall and run-off, make the water in the dam not representative of the groundwater at that site.

Groundwater quality has also been monitored at bores PF198PB1 and PF198PB2, the two processing plant water supply bores. The water in these bores is derived from the Hawkesbury Sandstone aquifer. Quality records are summarised in Tables 3-7 and 3-8 and have been plotted in the graphs presented in Appendix B. However, as the pump in bore PF198PB2 was out of service, a water sample could not be obtained during the current monitoring event.

The waters in the Maroota Sand aquifer 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 in bore PF198PB1 in January 2006 (6 mg/L), in bore PF198PB2 in December 2001 (11 mg/L) and in bore PF166MW1 (6 mg/L). These appear to be isolated detections and, as no Oil and Grease has been detected in all other sampling occasions, it is considered that such occurrences do not represent a cause of concern.

The deep Hawkesbury Sandstone pumping bores groundwater display a slightly different character from that in the shallow Maroota Sand aquifer in the Hitchcock Road area and from shallow Hawkesbury Sandstone aquifer in other areas of Maroota. The deeper groundwater has a slightly higher TDS, pH and bicarbonate content (PF198PB2) than the shallower Maroota Sand groundwater; however, its overall low salinity content and sodium-chloride meteoric composition indicate a dynamic groundwater regime with regular and rapid rainfall recharge.

Overall, all the bores in both the Hawkesbury Sandstone and in the Maroota Sand show a marginal decrease in Total Dissolved Solids over time, the deeper bores showing a more constant character.

3.1.7 Quality Control

The laboratory quality control samples (laboratory duplicates, procedure blanks and control spikes) returned results within the required limits and acceptance criteria. The quality control data generated by the laboratory are presented with the laboratory certificates in Appendix B.

Based on the evaluation of the data, it is assessed that the accuracy and precision of the analytical data generated in the sampling round, as reported by the analytical laboratory, are acceptable as a basis for interpretation.

3 Data Assessment

Table 3-1 Bore PF167MW1 Chemical Analyses Summary

ANALYTE	Unit													
Date		2.6.99	8.9.99	21.12.99	9.3.00	28.11.00	21.6.01	19.12.01	26.6.02	23.1.03	9.7.03	30.1.04	29.6.04	15.12.04
pH		4.43	4.49	4.21	4.93	4.28	4.61	4.98	4.52	4.54	5.15	4.31	4.38	4.68
Electrical Conductivity, EC	µS/cm	164	190	201	179	184	170	188	215	199	204	225	221	240
Total Dissolved Solids, TDS	mg/L	118	90	105	115	207	120	108	121	101	116	157	110	143
Calcium, Ca	mg/L	3	3	5	6	3	6	6	5	3	4	4	5	5
Magnesium, Mg	mg/L	5	4	4	4	4	4	5	4	4	3	4	4	4
Sodium, Na	mg/L	16	18	16	15	18	16	18	25	20	19	22	23	26
Potassium, K	mg/L	2	2	3	3	3	5	4	5	2	2	2	3	3
Bicarbonate, HCO ₃	mg/L	<1	<1	<1	<1	<1	<1	<1	<1	<1	1	<1	<1	<1
Sulphate, SO ₄	mg/L	9	11	35	32	16	15	15	14	9	13	12	10	13
Chloride, Cl	mg/L	36	11	35	32	35	36	47	58	4	48	51	53	50
Oil and Grease	mg/L	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5		<5	<5
Date		22.6.05	19.1.06	6.7.06	5.7.07	3.7.08	3.7.09	16.6.10						
pH		5.42	4.32	4.27	4.88	5.29	4.00	4.30						
Electrical Conductivity, EC	µS/cm	215	205	199	188	161	177	190						
Total Dissolved Solids, TDS	mg/L	137	141	119	76	100	104	111						
Calcium, Ca	mg/L	5	4	4	2	6	5	3						
Magnesium, Mg	mg/L	4	4	4	3	5	4	3						
Sodium, Na	mg/L	28	25	23	16	13	14	15						
Potassium, K	mg/L	3	3	3	2	4	4	2						
Bicarbonate, HCO ₃	mg/L	2	1	<1	<1	<1	<1	2						
Sulphate, SO ₄	mg/L	13	10	6	10	30	22.6	17.1						
Chloride, Cl	mg/L	56.6	57.4	53.1	36.1	26.4	34.8	39.9						
Oil and Grease	mg/L	<5	<5	<5	<5	<5	<5	<5						

3 Data Assessment

Table 3-2 Bore PF166MW1 Chemical Analyses Summary

ANALYTE	Unit													
Date		1.6.99	8.9.99	21.12.99	9.3.00	29.11.00	21.6.01	19.12.01	26.6.02	23.1.03	9.7.03	30.1.04	29.6.04	15.12.04
pH		4.18	4.19	4.13	4.14	4.31	4.19	4.63	4.48	4.82	7.86	4.39	4.27	4.06
Electrical Conductivity, EC	µS/cm	222	240	230	214	266	194	228	219	203	221	193	235	203
Total Dissolved Solids, TDS	mg/L	118	108	137	170	460	115	210	280	128	134	204	280	120
Calcium, Ca	mg/L	1	1	1	1	1	1	1	2	1	1	<1	1	1
Magnesium, Mg	mg/L	6	6	6	5	6	5	6	6	5	4	5	5	4
Sodium, Na	mg/L	26	23	23	22	29	21	22	24	19	20	18	19	19
Potassium, K	mg/L	<1	<1	1	1	1	1	2	1	<1	<1	<1	1	1
Bicarbonate, HCO ₃	mg/L	<1	<1	<1	<1	<1	<1	<1	<1	<1	1	<1	<1	<1
Sulphate, SO ₄	mg/L	1	7	1	1	16	2	1	2	<1	<1	2	<1	2
Chloride, Cl	mg/L	58	49	51	52	58	49	58	61	46	50	47	44	36
Oil and Grease	mg/L	<5	<5	<5	<5	<5	<5	<5	<5	6	<5	<5	5	<5
Date		22.6.05	19.1.06	6.7.06	5.7.07	3.7.08	3.7.09	16.6.10						
pH					4.76		3.58	4.06						
Electrical Conductivity, EC	µS/cm	DRY	DRY	DRY	163	NA	240	247						
Total Dissolved Solids, TDS	mg/L				98		140	141						
Calcium, Ca	mg/L						<1	<1						
Magnesium, Mg	mg/L						4	4						
Sodium, Na	mg/L						256	24						
Potassium, K	mg/L						2	2						
Bicarbonate, HCO ₃	mg/L						<1	<1						
Sulphate, SO ₄	mg/L						2.21	1.77						
Chloride, Cl	mg/L						49.1	56.3						
Oil and Grease	mg/L						<5	<5						

3 Data Assessment

Table 3-3 Bore PF166MW1 Chemical Analyses Summary

ANALYTE		Unit	
Date		3.7.2009	16.6.2010
pH		3.96	4.1
Electrical Conductivity, EC	µS/cm	182	154
Total Dissolved Solids, TDS	mg/L	84	88
Calcium, Ca	mg/L	1	<1
Magnesium, Mg	mg/L	2	2
Sodium, Na	mg/L	19	16
Potassium, K	mg/L	2	<1
Bicarbonate, HCO ₃	mg/L	<1	<
Sulphate, SO ₄	mg/L	7.88	4.06
Chloride, Cl	mg/L	40.3	36.9
Oil and Grease	mg/L	<5	<5

3 Data Assessment

Table 3-4 Bore PFP214MW1 Chemical Analyses Summary

ANALYTE	Unit		
Date		3.7.2009	16.6.2010
pH		4.19	4.16
Electrical Conductivity, EC	µS/cm	168	164
Total Dissolved Solids, TDS	mg/L	100	96
Calcium, Ca	mg/L	<1	<1
Magnesium, Mg	mg/L	6	5
Sodium, Na	mg/L	18	15
Potassium, K	mg/L	1	<1
Bicarbonate, HCO ₃	mg/L	<1	<1
Sulphate, SO ₄	mg/L	1.90	<0.5
Chloride, Cl	mg/L	24.3	23.8
Oil and Grease	mg/L	<5	<5

3 Data Assessment

Table 3-5 Bore PF198PB1 Chemical Analyses Summary

ANALYTE	Unit													
Date		1.6.99	8.9.99	21.12.99	9.3.00	28.11.00	21.6.01	19.12.01	26.6.02	23.1.03	9.7.03	30.1.04	29.6.04	15.12.04
pH		5.87	6.24	6.11	4.69	4.49	4.51	5.41	4.73	4.49	5.06	5	4.53	4.28
Electrical Conductivity, EC	µS/cm	161	170	169	141	182	179	204	199	243	199	160	291	197
Total Dissolved Solids, TDS	mg/L	124	116	98	97	107	102	116	112	139	102	116	174	88
Calcium, Ca	mg/L	1	<1	1	1	3	2	2	4	3	2	2	4	1
Magnesium, Mg	mg/L	4	6	5	3	3	4	4	4	4	3	2	5	2
Sodium, Na	mg/L	21	24	22	19	20	21	27	23	31	22	19	40	25
Potassium, K	mg/L	1	<1	1	1	2	5	5	3	3	2	2	3	2
Bicarbonate, HCO ₃	mg/L	13	29	22	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Sulphate, SO ₄	mg/L	4	4	4	2	8	8	3	7	4	8	6	9	8
Chloride, Cl	mg/L	39	35	36	36	40	49	60	58	64	49	43	83	42
Oil and Grease	mg/L	<5	<5	<5	<5	<5	<5	<5	<5	6	<5	<5	<5	<5
Date		22.6.05	19.1.06	6.7.06	5.7.07	3.7.08	3.7.09	16.6.10						
pH		5.22	5.74	5.16	No sample	4.59	3.94	4.43						
Electrical Conductivity, EC	µS/cm	157	158	155		144	174	163						
Total Dissolved Solids, TDS	mg/L	105	115	98		85	83	88						
Calcium, Ca	mg/L	1	2	1		<1	1	<1						
Magnesium, Mg	mg/L	2	4	3		2	2	2						
Sodium, Na	mg/L	23	21	20		18	19	16						
Potassium, K	mg/L	2	2	2		1	2	1						
Bicarbonate, HCO ₃	mg/L	1	12	5		<1	<1	<1						
Sulphate, SO ₄	mg/L	8	6	2		10	9.31	6.89						
Chloride, Cl	mg/L	47.1	43.4	43.8		31.1	38.8	41.1						
Oil and Grease	mg/L	<5	5	<5		<5	<5	<5						

3 Data Assessment

Table 3-6 Bore PF198PB2 Chemical Analyses Summary

ANALYTE	Unit													
Date		1.6.99	8.9.99	21.12.99	9.3.00	29.11.00	21.6.01	19.12.01	26.6.02	23.1.03	9.7.03	30.1.04	29.6.04	15.12.04
pH		5.78	6.61	5.96	NA	4.80	5.24	5.99	6.33	5.96	4.84	5	5.78	5.39
Electrical Conductivity, EC	µS/cm	139	174	146	NA	152	130	141	151	146	162	160	136	156
Total Dissolved Solids, TDS	mg/L	126	102	85	NA	100	87	87	102	84	87	116	79	105
Calcium, Ca	mg/L	1	2	2	NA	<1	<1	<1	1	<1	<1	2	1	1
Magnesium, Mg	mg/L	5	5	5	NA	4	3	4	4	4	2	2	4	2
Sodium, Na	mg/L	18	19	18	NA	19	18	18	21	17	18	19	18	20
Potassium, K	mg/L	2	2	2	NA	1	1	2	2	1	<1	2	1	2
Bicarbonate, HCO ₃	mg/L	23	33	19	NA	4	3	13	8	16	<1	<1	9	2
Sulphate, SO ₄	mg/L	3	3	2	NA	1	1	3	2	<1	<1	6	1	4
Chloride, Cl	mg/L	31	28	31	NA	41	38	33	46	33	40	43	37	35
Oil and Grease	mg/L	<5	<5	<5	NA	<5	<5	11	<5	<5	<5	<5	<5	<5
Date		22.6.05	19.1.06	6.7.06	5.7.07	3.7.08	3.7.09	16.6.10						
pH		6.43	5.3	5.46	4.37	5.25	4.50	NA						
Electrical Conductivity, EC	µS/cm	133	126	122	195	135	130							
Total Dissolved Solids, TDS	mg/L	87	104	79	88	79	79							
Calcium, Ca	mg/L	<1	<1	1	<1	1	<1							
Magnesium, Mg	mg/L	4	3	4	3	5	3							
Sodium, Na	mg/L	17	19	16	21	16	16							
Potassium, K	mg/L	2	1	2	1	2	2							
Bicarbonate, HCO ₃	mg/L	14	7	24	<1	24.4	9.2							
Sulphate, SO ₄	mg/L	4	1	1	4	2	2.78							
Chloride, Cl	mg/L	34.9	38.8	30.2	44.8	31.8	32.2							
Oil and Grease	mg/L	<5	<5	<5	<5	<5	<5							

3 Data Assessment

3.1.8 Portion 167 dam

Records of pump operation have been kept from PF167DAM since January 1997. Figure 9 shows the monthly summary of the pumpage from the dam and Table 3-7 shows the annual totals. Annual pumpage for the current year (56.2 ML) has been marginally above the licensed limit (50 ML/year). This excess is due to the malfunction of the pump in bore PF198PB2 since December 2009, as this required additional pumpage from the dam. However, this marginal excess is largely offset by the significantly lower combined volumes extracted from the two pumping bores, as shown in following Table 3.8, indicating an overall reduced water usage at the site.

Table 3-7 Portion 167 Dam Annual Pumpage Records

YEAR	TOTAL, ML
1997	24.56
1998	24.24
1999 to May	16.84
1 June 1999 – 30 June 2000	66.3
1 July 2000 – 5 September 2000	31.4
5 September 2000 – 25 June 2001	Not used
25 June 2001 – 30 June 2001	1.0
1 July 2001 – 8 February 2002	59.2
8 February 2002 – 30 June 2002	Not used
30 June 2002 – 29 August 2002	Not used
29 August 2002 – 30 June 2003	65.2
1 July 2003 – 29 June 2004	73.1
1 July 2004 – 3 May 2005	57.5
7 October 2005 – 30 June 2006	25.4
1 July 2006 – 30 June 2007	21.3
1 July 2007 - 30 June 2008	21.5
1 July 2008 – 30 June 2009	42.2
1 July 2009 – 30 June 2010	56.2

3 Data Assessment

3.1.9 Water Supply Bores, Portion 198

Pumping records for the two water supply bores in Portion 198 for the year July 2009 to June 2010 are tabulated in Table 3-8 below. The total pumpage of 17.6 ML for the year has been significantly below the combined annual allocation of 60 ML.

Table 3-8 Water Supply Bores Annual Pumpage Records

YEAR	BORE	TOTAL, ML
1 July 1999 – 30 June 2000	Bore PF198PB1	21.1
	Bore PF198PB2	35.6
1 July 2000- 30 June 2001	Bore PF198PB1	20.3
	Bore PF198PB2	29.0
1 July 2001 – 30 June 2002	Bore PF198PB1	25.1
	Bore PF198PB2	36.0
1 July 2002 – 30 June 2003	Bore PF198PB1	24.8
	Bore PF198PB2	47.8
1 July 2003 – 29 June 2004	Bore PF198PB1	22.9
	Bore PF198PB2	49.3
1 July 2004 – 29 June 2005	Bore PF198PB1	4.2
	Bore PF198PB2	18.7
5 July 2005 – 23 June 2006*	Bore PF198PB1	14.8
	Bore PF198PB2	8.9
24 June 2006 – 30 June 2007*	Bore PF198PB1	7.8
	Bore PF198PB2	19.9
1 July 2007 – 30 June 2008*	Bore PF198PB1	1.6
	Bore PF198PB2	22.9
1 July 2008 – 30 June 2009*	Bore PF198PB1	25.6
	Bore PF198PB2	16.0
1 July 2008 – 30 June 2009*	Bore PF198PB1	9.5
	Bore PF198PB2**	8.1

* Due to modifications carried out at the wash plant, these bores are no longer required for continuous supply.

** The pump in bore PF198PB2 has been out of service since December 2009, requiring additional pumpage from the PF167 DAM.

Conclusions

4.1 Conclusions

The assessment of the data collected on the groundwater levels and quality in the Maroota Trig area, some of which represent the oldest data available to the groundwater study carried out by the DLWC (now The Office of Water) in the area, indicate that:

- water levels in the Maroota Sand aquifer respond rapidly to the rainfall pattern;
- since April 2002 the water table in bore PF167MW1 has fallen steadily in response to the lower rainfall, but it rose sharply after the rain events in June 2007 and in June 2008; followed by a characteristic slow decline pattern;
- water quality in the Maroota Sand aquifer varies with rainfall recharge;
- pumpage from the dam in Portion 167 for the year to the end of June 2010 (56.2 ML) has been above the licence limit of 50 ML/year. The pumping exceedance at this site was largely offset by the lower extraction from the two water supply bores; giving an overall reduced water usage at the site;
- during the year 2009 – 2010, the water level in the Portion 167 dam has averaged 182.4 m AHD, a value higher than that of the long term average (181.08 m AHD) since September 1996. This high level is thought to be due to the stop of pumping since February 2010, and to high run off into the dam following high rainfall events in February and June 2010;
- records indicate that the water level in the dam recovers rapidly upon cessation of pumping;
- the groundwater pumpage from the two deep water supply bores in Portion 198 (17.6 ML) has been significantly below the combined licence limit of 60 ML for the year;
- the quality of the groundwater in the deep aquifer of the Hawkesbury Sandstone (water supply bores in Portion 198) has an overall character that indicates that recharge occurs readily;
- the current sand extraction operations in the Hitchcock Road area operate in a manner that does not appear to have a significant impact upon the groundwater sustainability, and in accordance with the DA conditions.

The data collected during the year are available to the NSW Office of Water for their continued study in the area.

Limitations

5.1 Geotechnical & Hydro Geological Report

URS Australia Pty Ltd (URS) has prepared this report in accordance with the usual care and thoroughness of the consulting profession for the use of PF Formation and only those third parties who have been authorised in writing by URS to rely on the report. It is based on generally accepted practices and standards at the time it was prepared. No other warranty, expressed or implied, is made as to the professional advice included in this report. It is prepared in accordance with the scope of work and for the purpose outlined in the Proposal dated 3 June 2010.

The methodology adopted and sources of information used by URS are outlined in this report. URS has made no independent verification of this information beyond the agreed scope of works and URS assumes no responsibility for any inaccuracies or omissions. No indications were found during our investigations that information contained in this report as provided to URS was false.

This report was prepared between 16 and 30 June 2010 and is based on the conditions encountered and information reviewed at the time of preparation. URS disclaims responsibility for any changes that may have occurred after this time.

This report should be read in full. No responsibility is accepted for use of any part of this report in any other context or for any other purpose or by third parties. This report does not purport to give legal advice. Legal advice can only be given by qualified legal practitioners.

This report contains information obtained by inspection, sampling, testing or other means of investigation. This information is directly relevant only to the points in the ground where they were obtained at the time of the assessment. The borehole logs indicate the inferred ground conditions only at the specific locations tested. The precision with which conditions are indicated depends largely on the frequency and method of sampling, and the uniformity of conditions as constrained by the project budget limitations. The behaviour of groundwater and some aspects of contaminants in soil and groundwater are complex. Our conclusions are based upon the analytical data presented in this report and our experience. Future advances in regard to the understanding of chemicals and their behaviour, and changes in regulations affecting their management, could impact on our conclusions and recommendations regarding their potential presence on this site.

Where conditions encountered at the site are subsequently found to differ significantly from those anticipated in this report, URS must be notified of any such findings and be provided with an opportunity to review the recommendations of this report.

Whilst to the best of our knowledge information contained in this report is accurate at the date of issue, subsurface conditions, including groundwater levels can change in a limited time. Therefore this document and the information contained herein should only be regarded as valid at the time of the investigation unless otherwise explicitly stated in this report.



Legend

- Site Boundary
- Groundwater Monitoring Site

Client

PF FORMATION

URS

Project

HITCHCOCK ROAD, SAND EXTRACTION
AND REHABILITATION PROJECT

Drawn: AJW

Approved: FC

Date: 13/07/2009

Job No: **43346029**

File No: 43346029-004.wor

Title

**HITCHCOCK ROAD SITE
LOCALITY PLAN**

Figure: **1**



P.F.FORMATION
Bore PF167MW1 Groundwater Monitoring Data

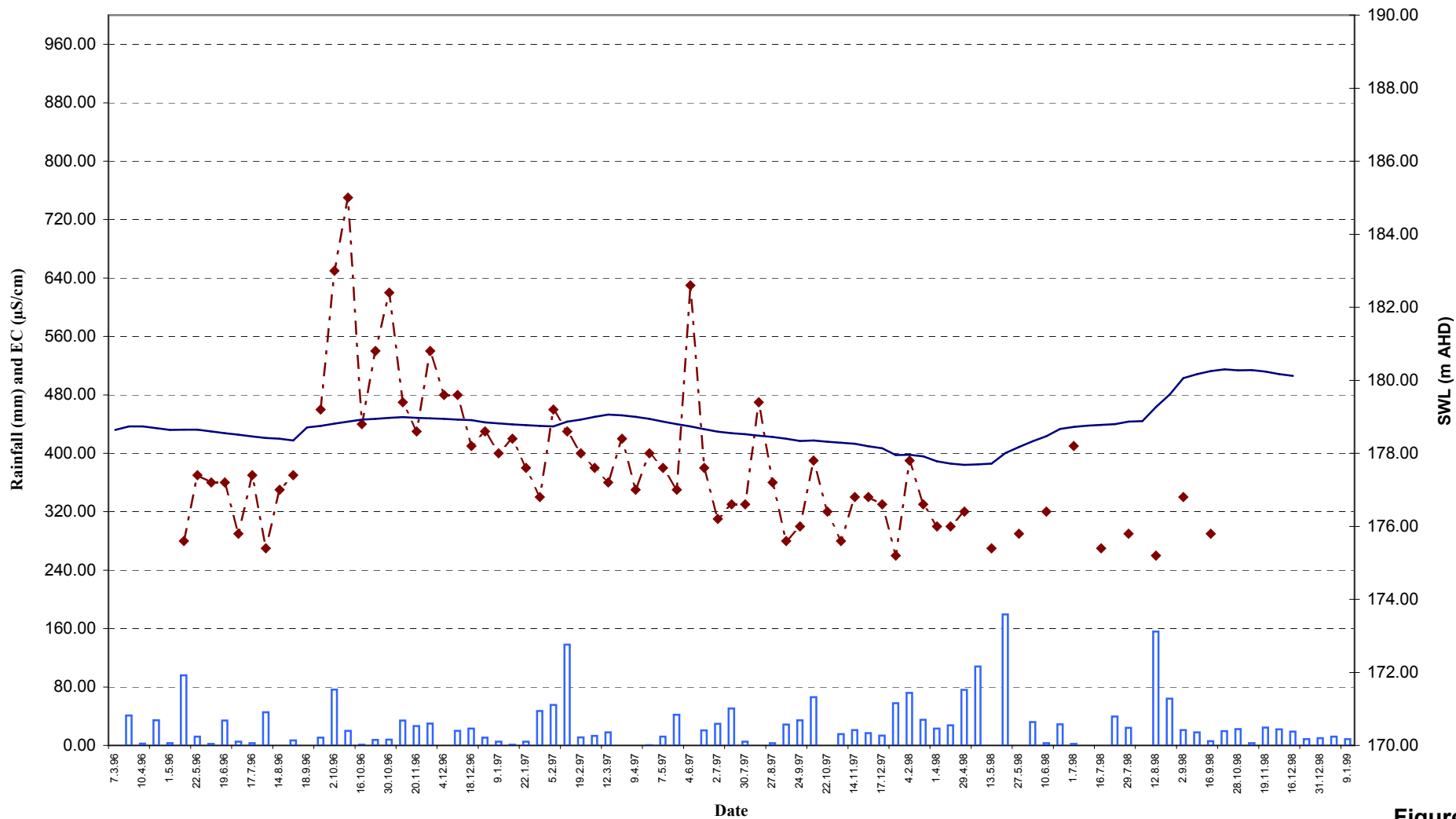
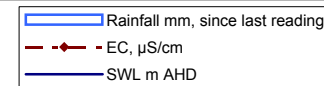


Figure 2



PF FORMATION
Bore PF167MW1 Groundwater Monitoring Data

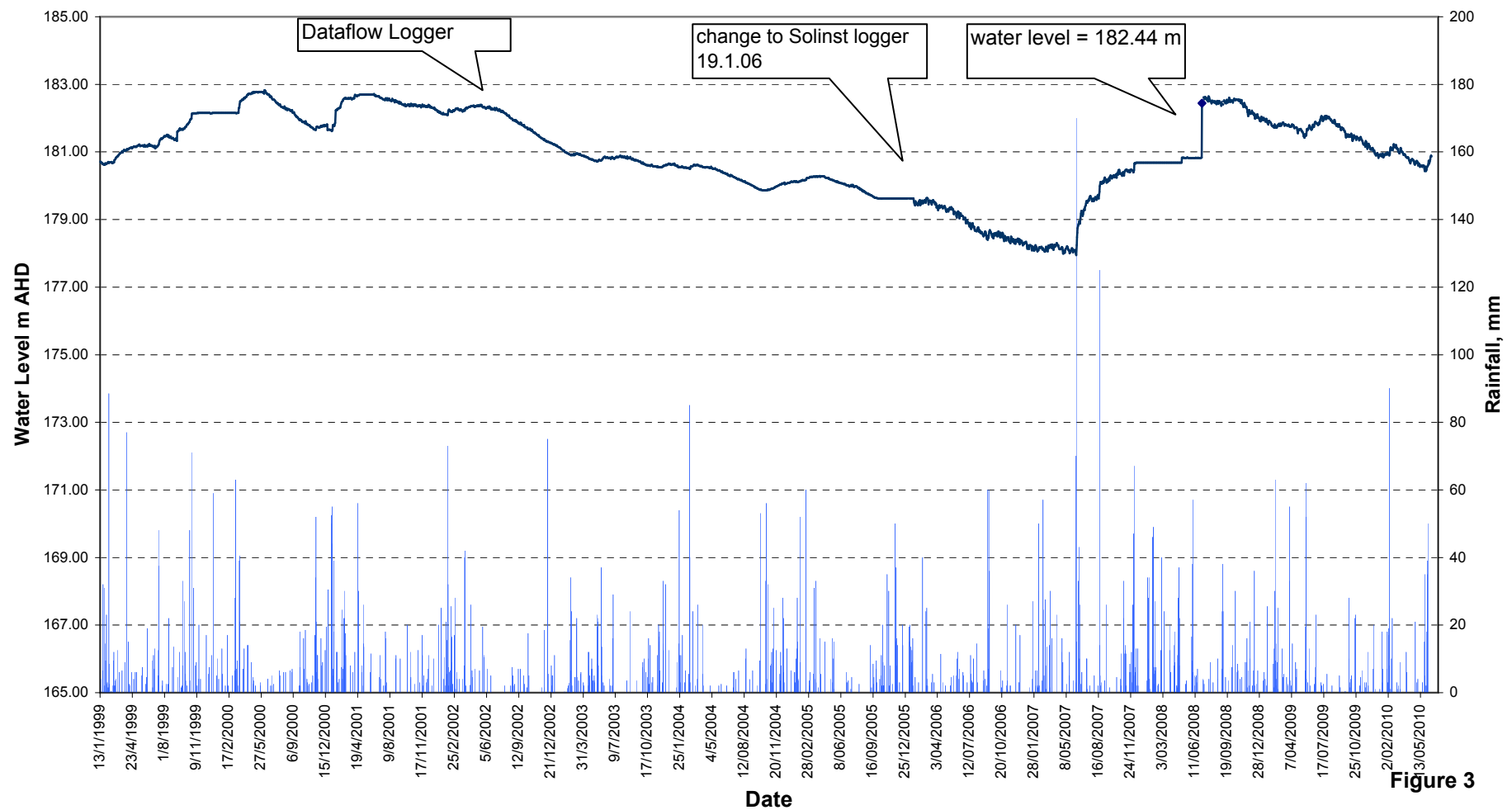
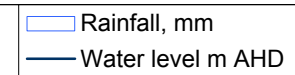


Figure 3



PF FORMATION
PF166MW1 Groundwater Monitoring Data

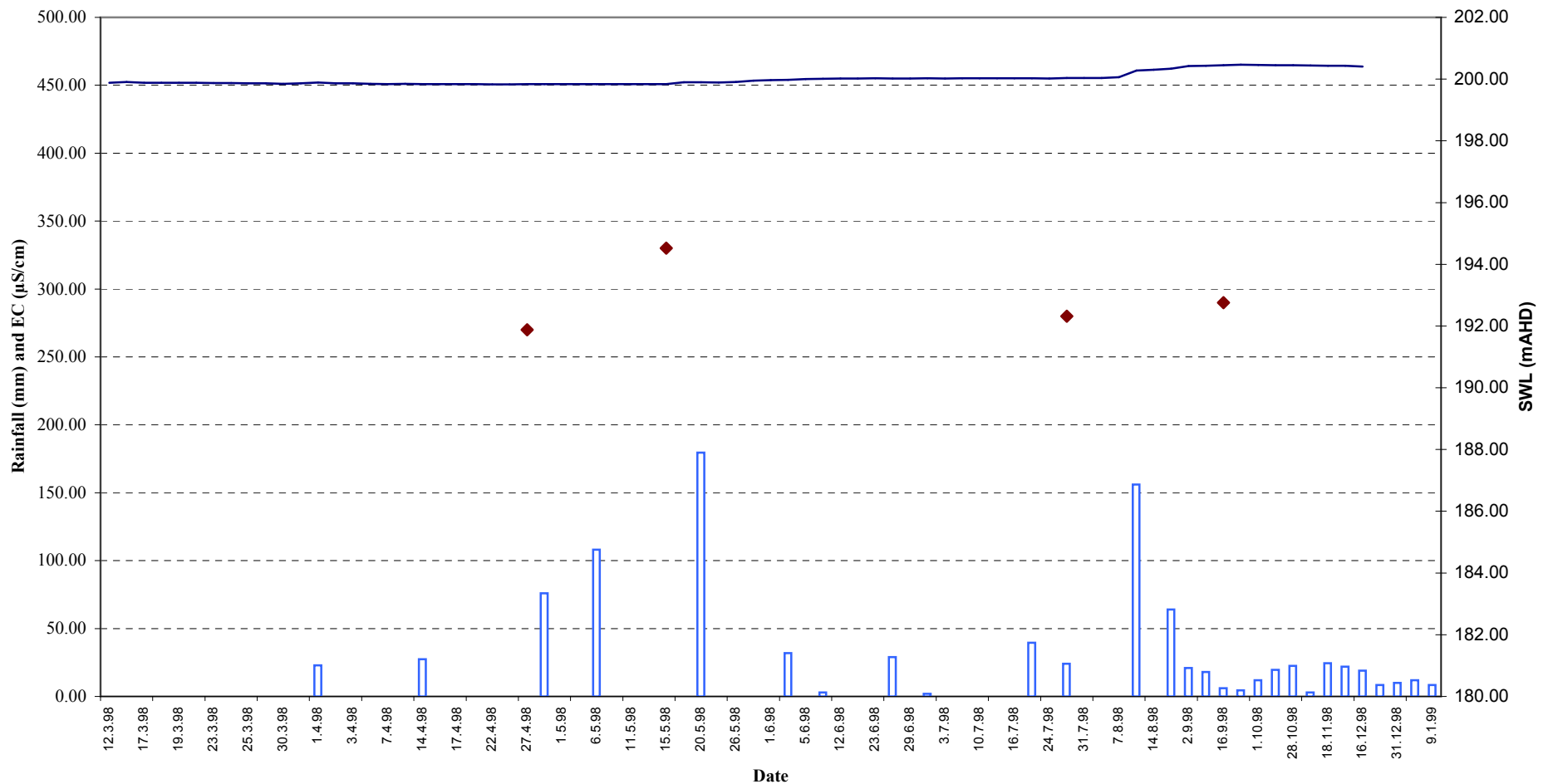
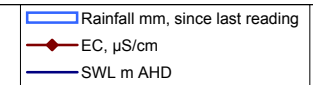


Figure 4



PF FORMATION
Bore PF166MW1 Groundwater Monitoring Data

□ Rainfall, mm
— Water Level m AHD

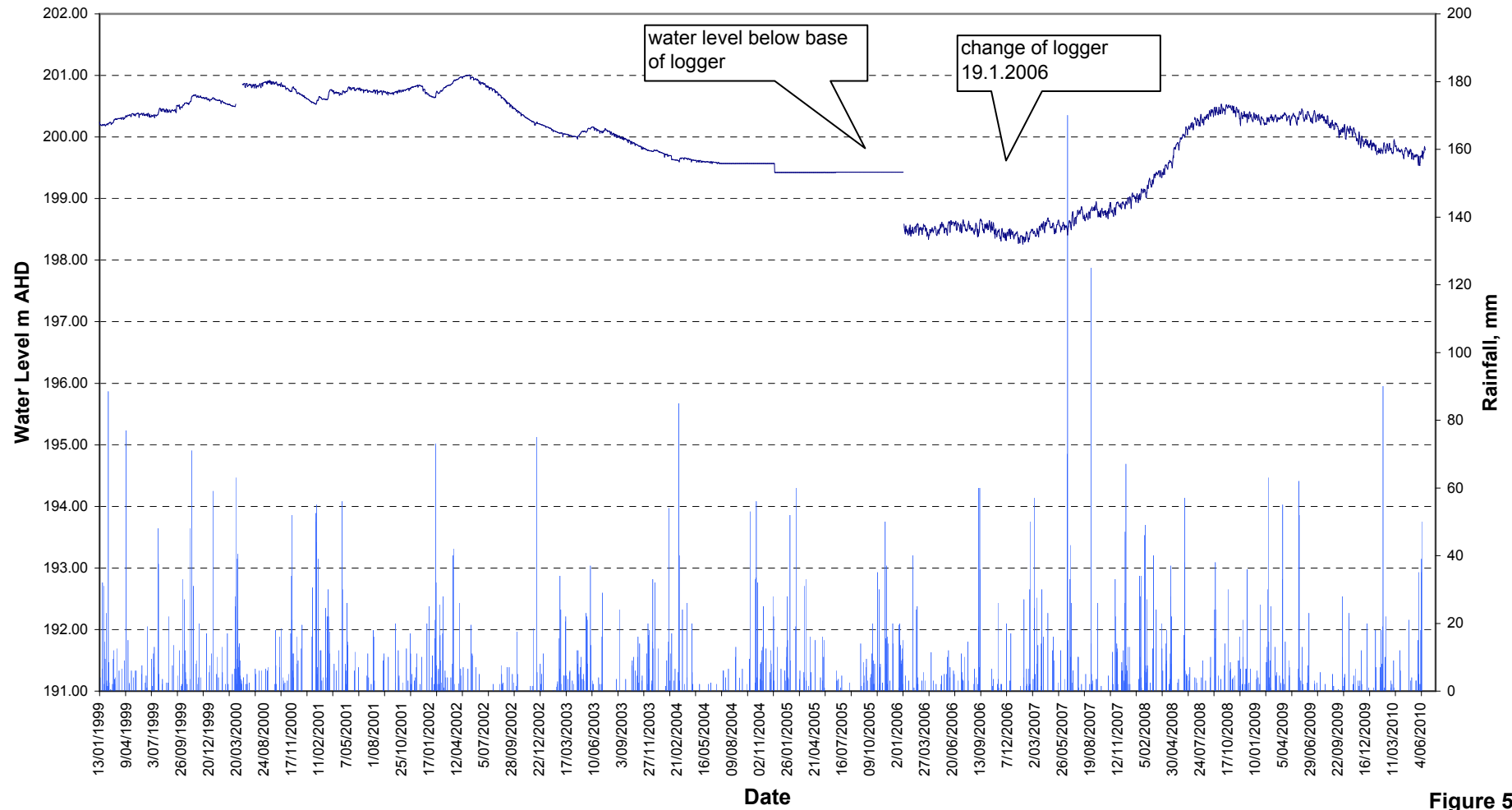


Figure 5



PF FORMATION
Bore PFP214MW1 Groundwater Monitoring Data

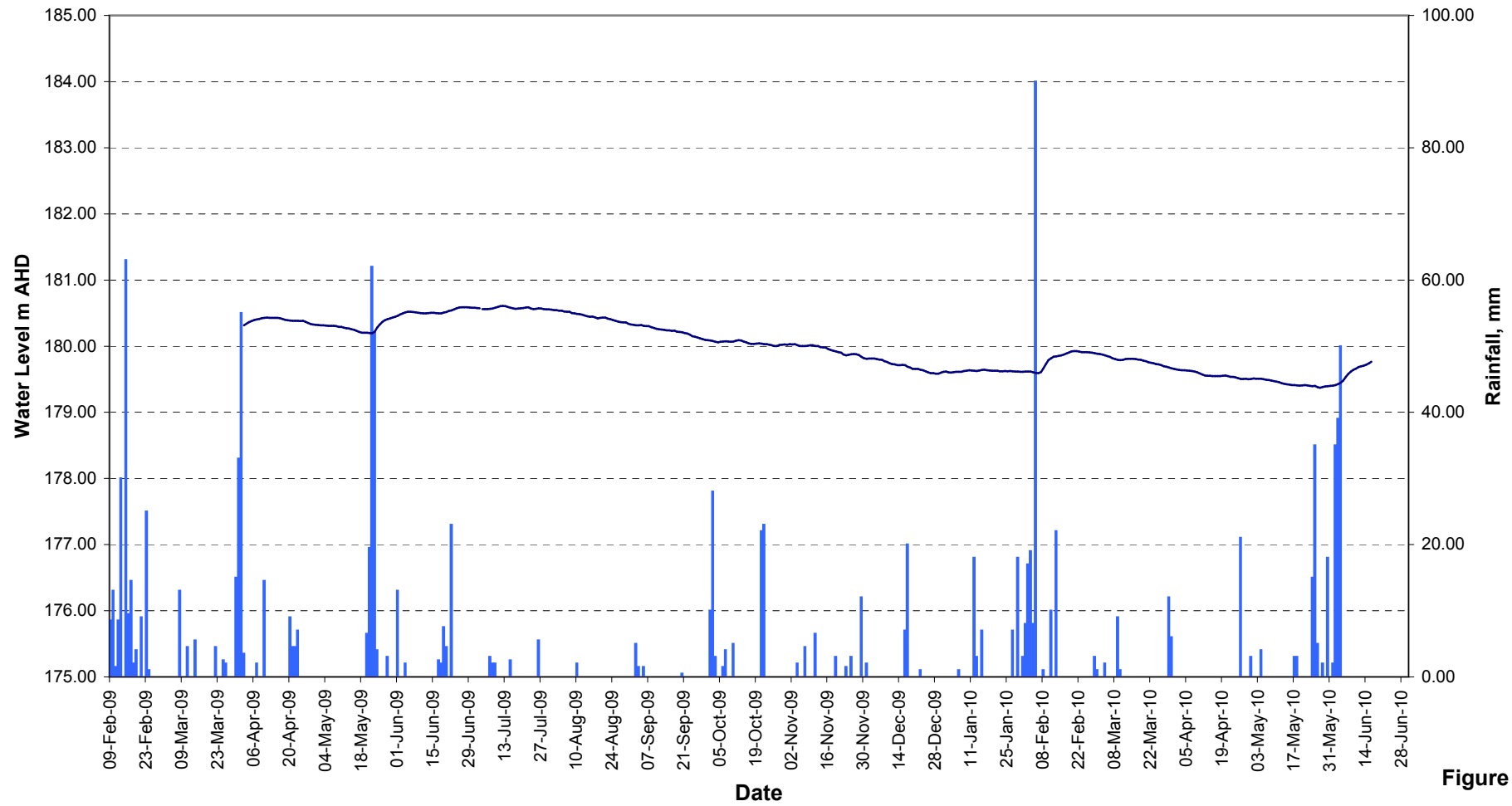
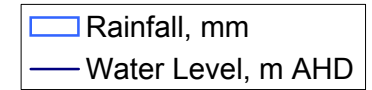


Figure 6



PF FORMATION
Bore PFL2HitchMW1 Groundwater Monitoring Data

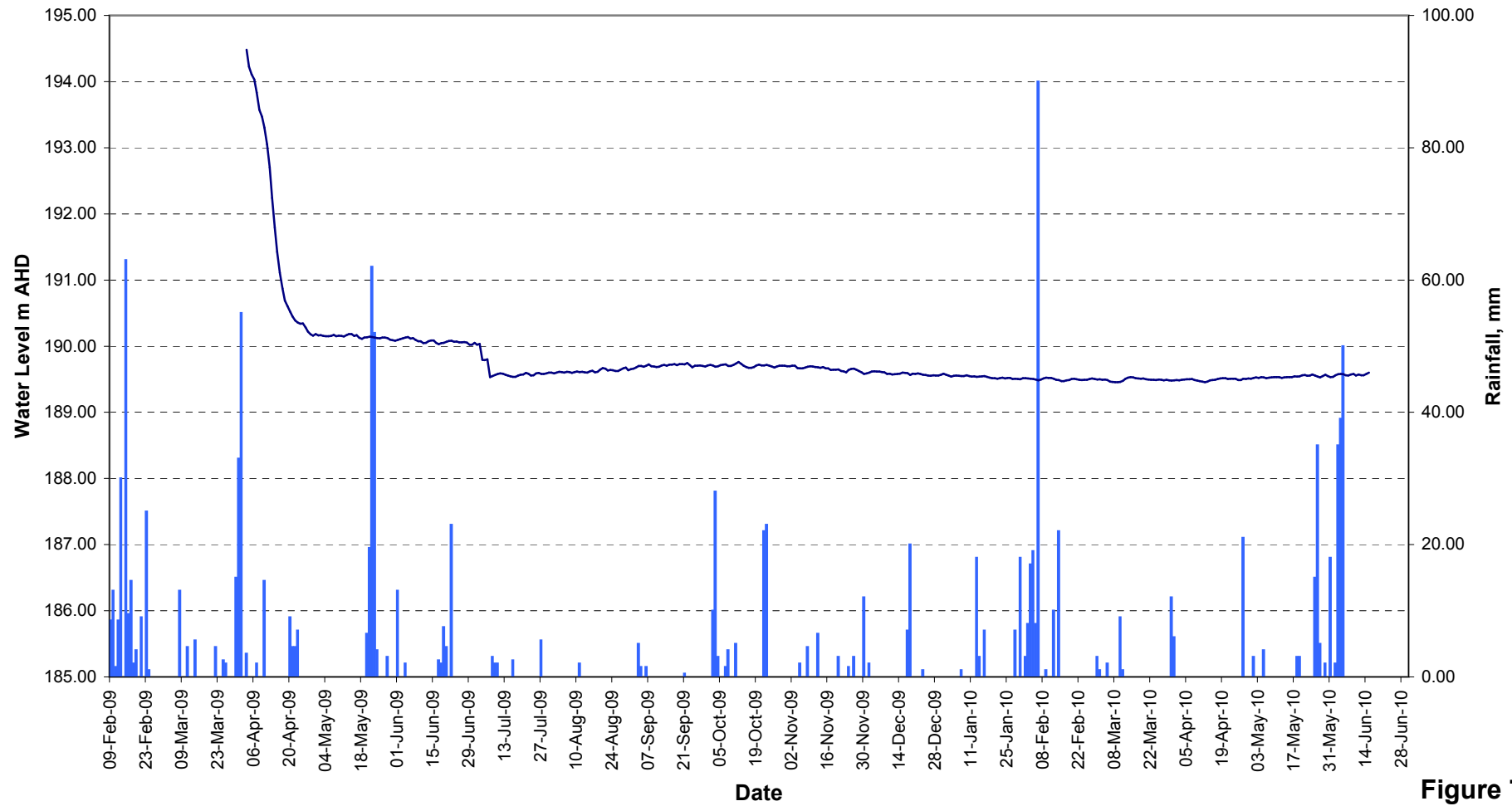
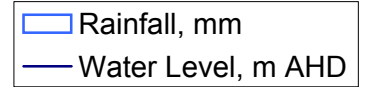


Figure 7

PF FORMATION
PF167DAM, Licence No. 10BL157308, Groundwater Monitoring Data

— Rainfall mm, since last reading
 ◆ WL m AHD

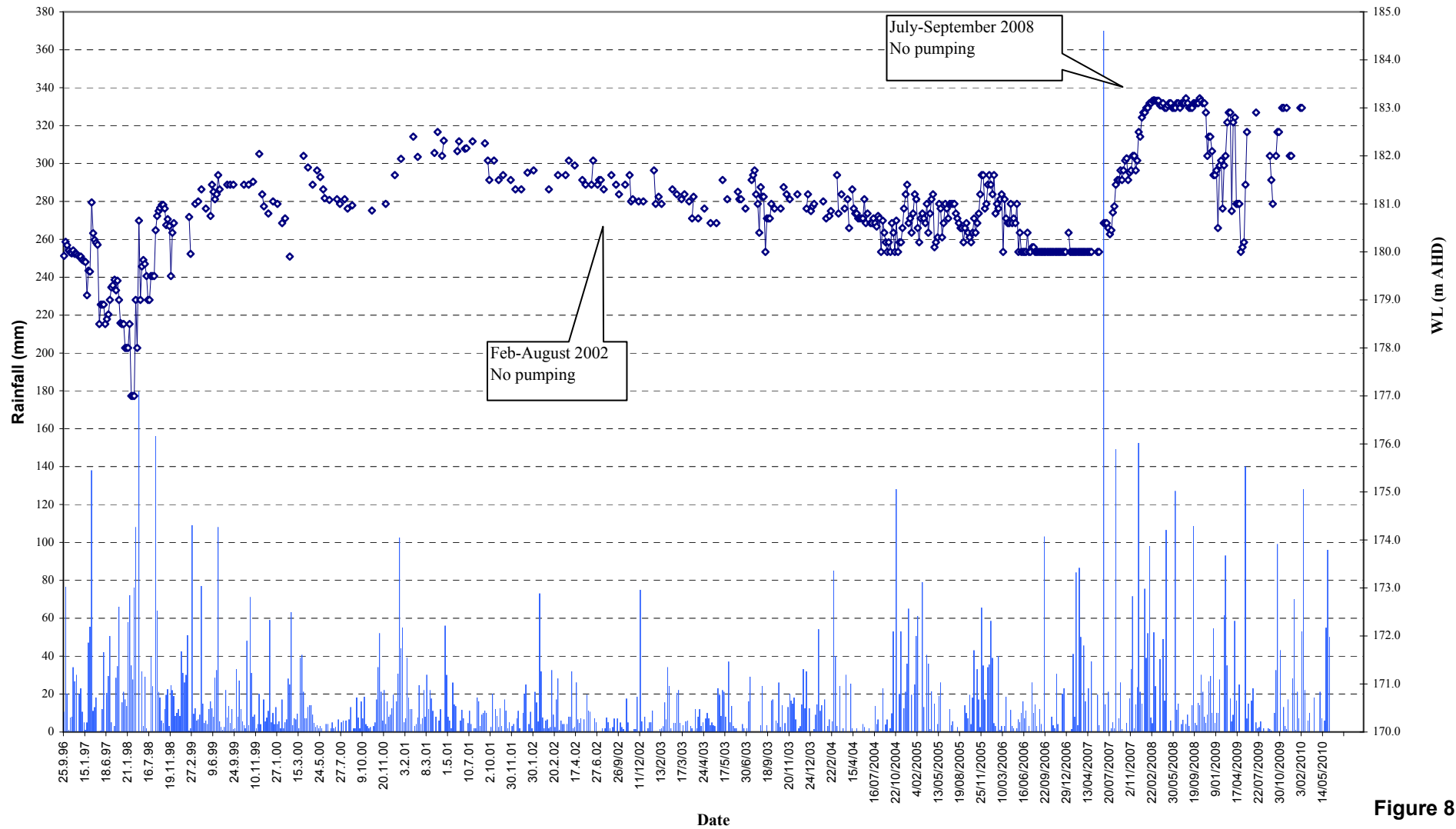


Figure 8



PF FORMATION
PF167DAM Monthly Pumpage Records

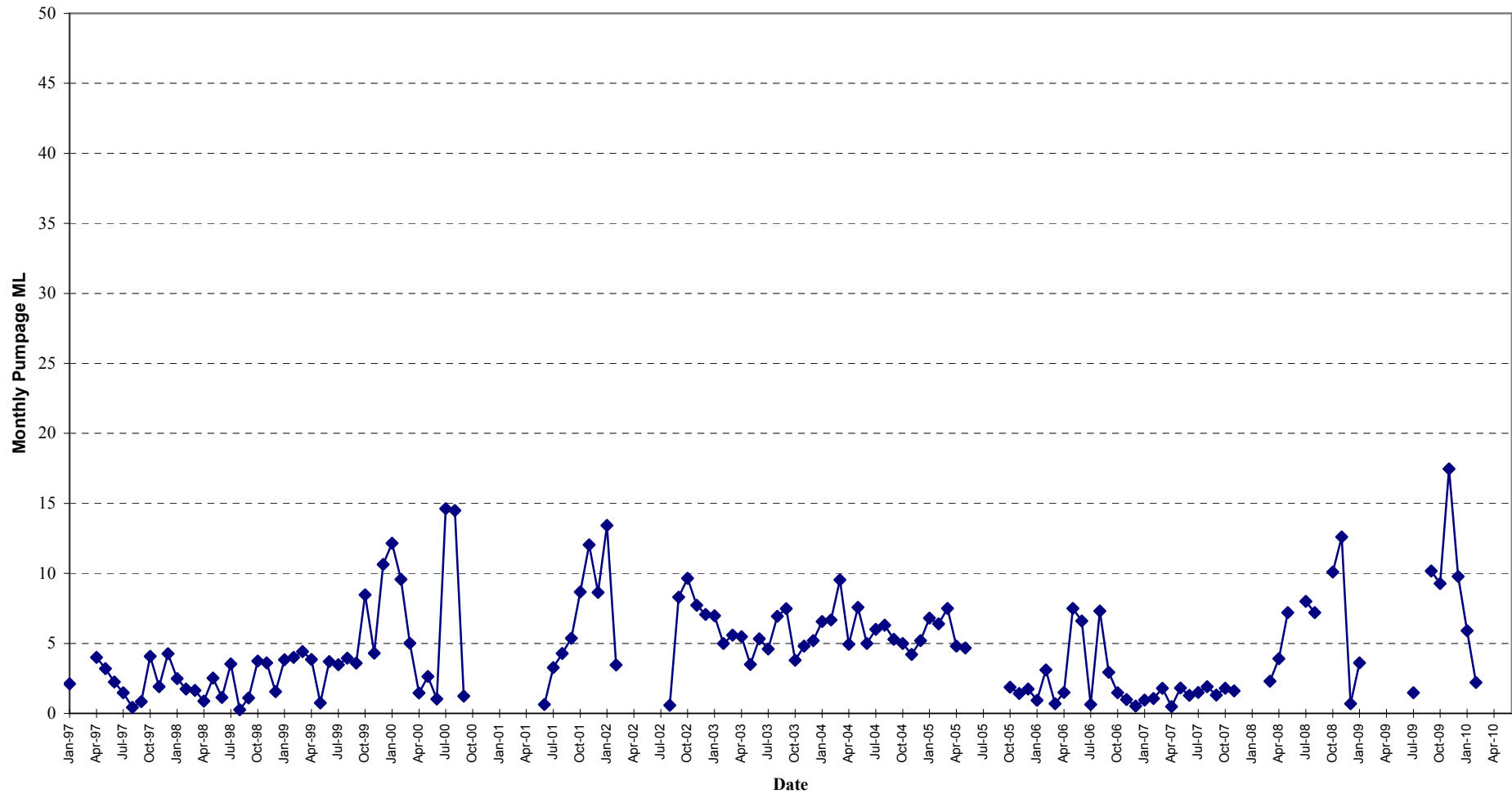


Figure 9

Appendix A Groundwater Water Quality Plots

PF FORMATION - MAROOTA
BORE PF166MW1 GROUNDWATER ANALYTICAL SUMMARY

Analysis	Units	LOR	1.06.99	8.09.99	21.12.99	9.03.00	28.11.00	21.06.01	19.12.01	26.06.02	23.01.03	9.07.03	30.01.04	29.06.04	15.12.04	22.06.05	19.01.06	6.07.06	5.07.07	3.07.08	3.07.09	16.06.10
pH		0.01	4.18	4.19	4.13	4.14	4.31	4.19	4.63	4.48	4.82	7.86	4.39	4.27	4.06	DRY	DRY	DRY	4.76	DRY	3.58	4.06
Electrical Conductivity	µS/cm	1	222	240	230	214	266	194	228	219	203	221	193	235	203				163		240	247
Total Dissolved Solids	mg/L	1	118	108	137	170	460	115	210	280	128	134	204	280	120				98		140	141
Calcium	mg/L	1	1	1	1	1	1	1	1	2	1	1	<1	1	1						1	<1
Magnesium	mg/L	1	6	6	6	5	6	5	6	6	5	4	5	5	4						4	4
Sodium	mg/L	1	26	23	23	22	29	21	22	24	19	20	18	19	19						26	24
Potassium	mg/L	1	<1	<1	1	1	1	1	2	1	<1	<1	<1	1	1						2	2
Bicarbonate	mg/L	1	<1	<1	<1	<1	<1	<1	<1	<1	<1	1	<1	<1	<1						<1	<1
Sulphate	mg/L	1	1	7	1	1	16	2	1	2	<1	<1	2	<1	2						2.21	1.77
Chloride	mg/L	1	58	49	51	52	58	49	58	61	46	50	47	44	36						49.1	56.3
Oil and Grease	mg/L	5	<5	<5	<5	<5	<5	<5	<5	<5	6	<5	<5	5	<5						<5	<5

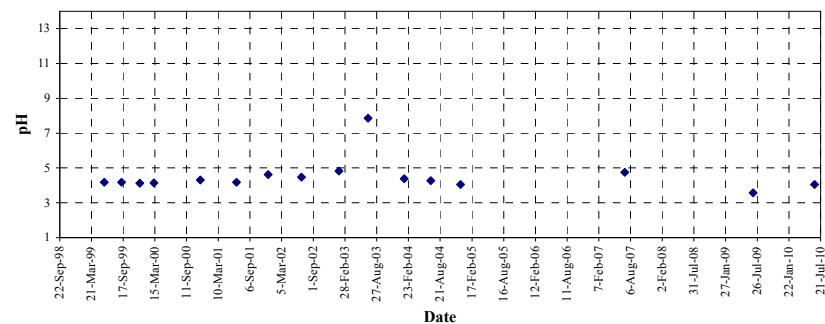
LOR = Limit of Reporting

* field measurements

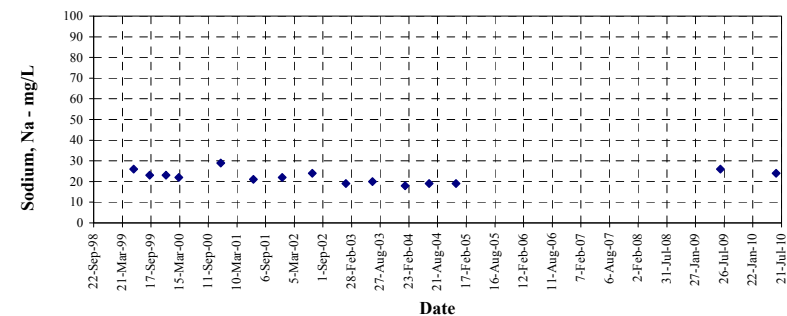
Average EC = 220 µS/cm
Average TDS = 178 mg/L
Average pH = 5

N.B. = TDS value in November 2000 is unusually high because of the presence of particulate matter in the sample.
NA = Not enough water for sample

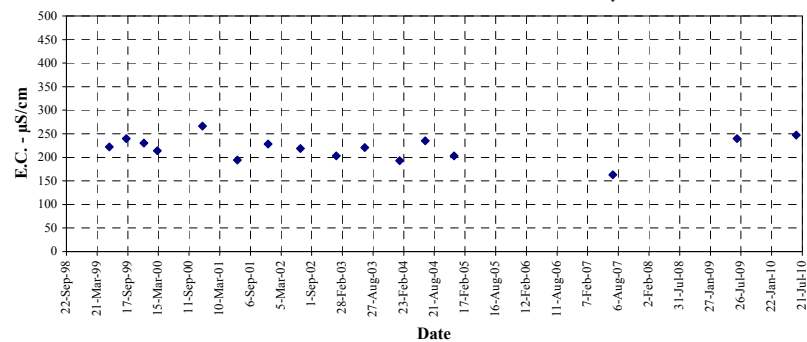
PF FORMATION - Bore PF166MW1 - pH



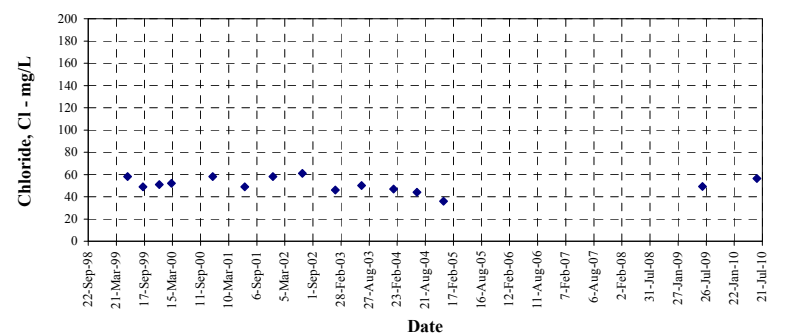
PF FORMATION - Bore PF166MW1 - Sodium



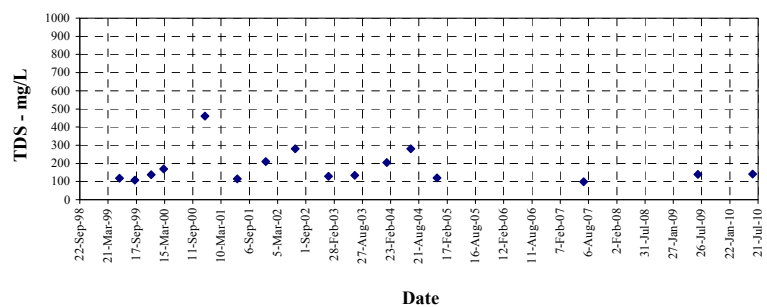
PF FORMATION - Bore PF166MW1 - Electrical Conductivity



PF FORMATION - Bore PF166MW1 - Chloride



PF FORMATION - Bore PF166MW1 - Total Dissolved Solids



PF FORMATION - MAROOTA
BORE PF167MW1 GROUNDWATER ANALYTICAL SUMMARY

Analysis	Units	LOR	1.06.99	8.09.99	21.12.99	9.03.00	28.11.00	21.06.01	19.12.01	26.06.02	23.01.03	9.07.03	30.01.04	29.06.04	15.12.04	22.06.05	19.01.06	6.07.06	5.07.07	3.07.08	3.07.09	16.06.10
pH		0.01	4.43	4.49	4.21	4.93	4.28	4.61	4.98	4.52	4.54	5.15	4.31	4.38	4.68	5.42	4.32	4.27	4.88	5.29	4	4.3
Electrical Conductivity	µS/cm	1	164	190	201	179	184	170	188	215	199	204	225	221	240	215	205	199	188	161	177	190
Total Dissolved Solids	mg/L	1	118	90	105	115	207	120	108	121	101	116	157	110	143	137	141	119	76	100	104	111
Calcium	mg/L	1	3	3	5	6	3	6	6	5	3	4	4	5	5	5	4	4	2	6	5	3
Magnesium	mg/L	1	5	4	4	4	4	4	5	4	4	3	4	4	4	4	4	4	3	5	4	3
Sodium	mg/L	1	16	18	16	15	18	16	18	25	20	19	22	23	26	28	25	23	16	13	14	15
Potassium	mg/L	1	2	2	3	3	3	5	4	5	2	2	2	3	3	3	3	3	2	4	4	2
Bicarbonate	mg/L	1	<1	<1	<1	<1	<1	<1	<1	<1	<1	1	<1	<1	<1	2	1	<1	<1	<1	<1	2.4
Sulphate	mg/L	1	9	<1	13	17	16	15	15	14	9	13	12	10	13	13	10	6	10	30	22.6	17.1
Chloride	mg/L	1	36	11	35	32	35	36	47	58	44	48	51	53	50	56.6	57.4	53.1	36.1	26.4	34.8	39.9
Oil and Grease	mg/L	5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5

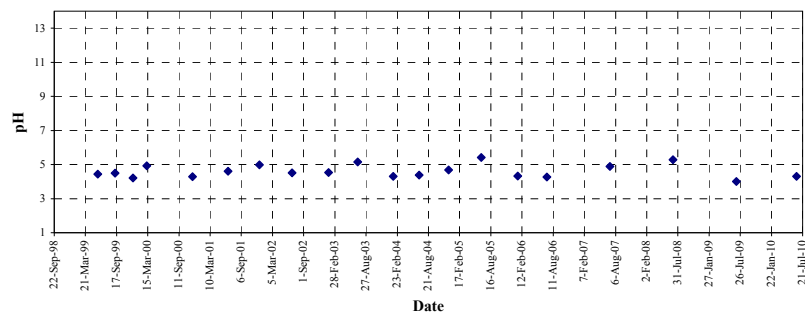
LOR = Limit of Reporting

Average EC = 196 µS/cm
Average TDS = 120 mg/L
Average pH = 5

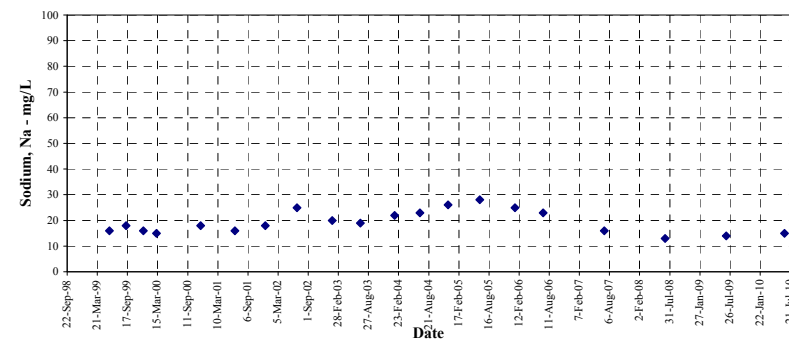
N.B. = TDS value in November 2000 is unusually high because of the presence of particulate matter in the sample.



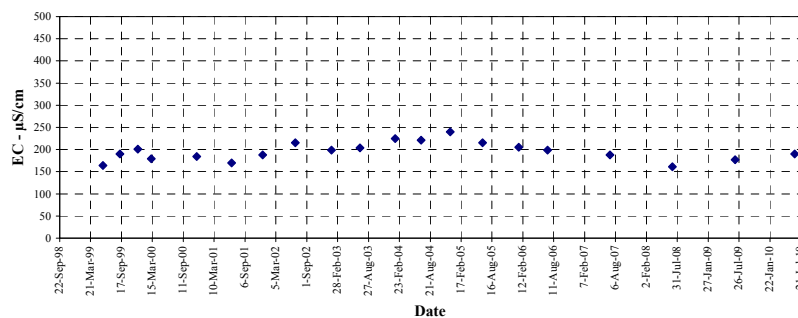
PF FORMATION - Bore PF167MW1 - pH



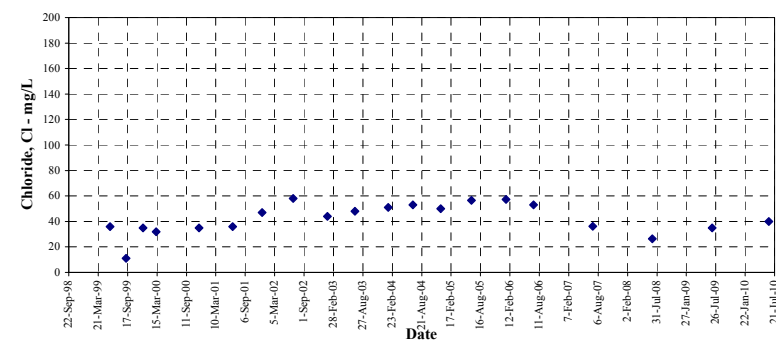
PF FORMATION - Bore PF167MW1 - Sodium



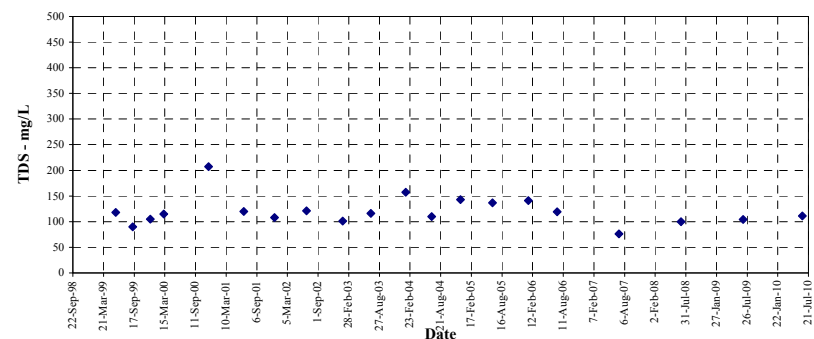
PF FORMATION - Bore PF167MW1 - Electrical Conductivity



PF FORMATION - Bore PF167MW1 - Chloride



PF FORMATION - Bore PF167MW1 - Total Dissolved Solids



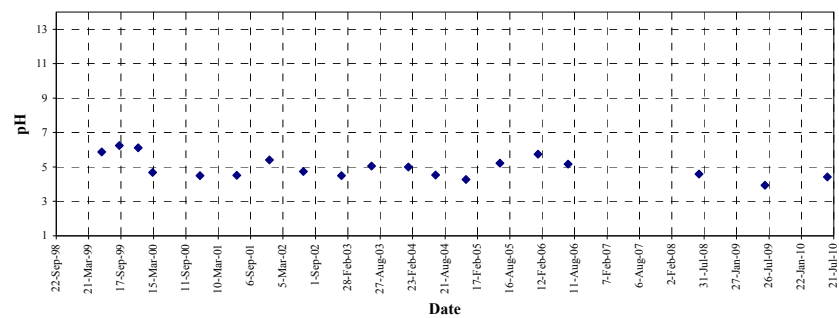
PF FORMATION - MAROOTA
BORE PF198PB1 GROUNDWATER ANALYTICAL SUMMARY

Analysis	Units	LOR	1.06.99	8.09.99	21.12.99	10.03.00	28.11.00	21.06.01	20.12.01	26.06.02	23.01.03	9.07.03	30.01.04	29.06.04	15.12.04	22.06.05	19.01.06	6.07.06	5.07.07	3.07.08	3.07.09	16.06.10
pH		0.01	5.87	6.24	6.11	4.69	4.49	4.51	5.41	4.73	4.49	5.06	5	4.53	4.28	5.22	5.74	5.16	NA	4.59	3.94	4.43
Electrical Conductivity	µS/cm	1	161	170	169	141	182	179	204	199	243	199	160	291	197	157	158	155		144	172	163
Total Dissolved Solids	mg/L	1	124	116	98	97	107	102	116	112	139	102	116	174	88	105	115	98		85	83	88
Calcium	mg/L	1	1	<1	1	1	3	2	2	4	3	2	2	4	1	1	2	1		<1	1	<1
Magnesium	mg/L	1	4	6	5	3	3	4	4	4	4	3	2	5	2	2	4	3		2	2	2
Sodium	mg/L	1	21	24	22	19	20	21	27	23	31	22	19	40	25	23	21	20		18	19	16
Potassium	mg/L	1	1	<1	1	1	2	5	5	3	3	2	2	3	2	2	2	2		1	2	1
Bicarbonate	mg/L	1	13	29	22	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	1	12	5		<1	<1	8.54
Sulphate	mg/L	1	4	4	4	2	8	8	3	7	4	8	6	9	8	8	6	2		10	9.31	6.1
Chloride	mg/L	1	39	35	36	36	40	49	60	58	64	49	43	83	42	47.1	43.4	43.8		34.1	38.8	48.4
Oil and Grease	mg/L	5	<5	<5	<5	<5	<5	<5	<5	<5	6	<5	<5	<5	<5	<5	5	<5		<5	<5	<5

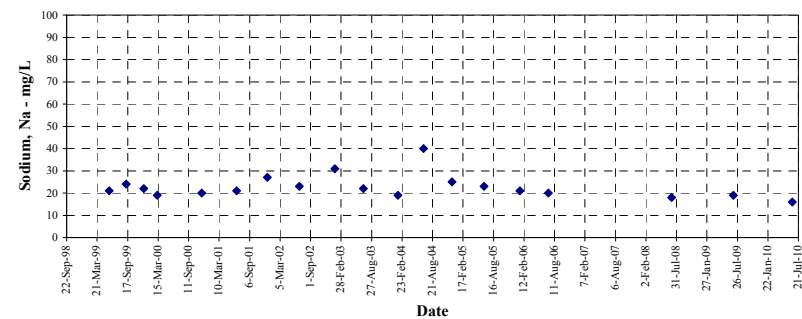
LOR = Limit of Reporting

Average EC = 181 µS/cm
Average TDS = 109 mg/L
Average pH = 5

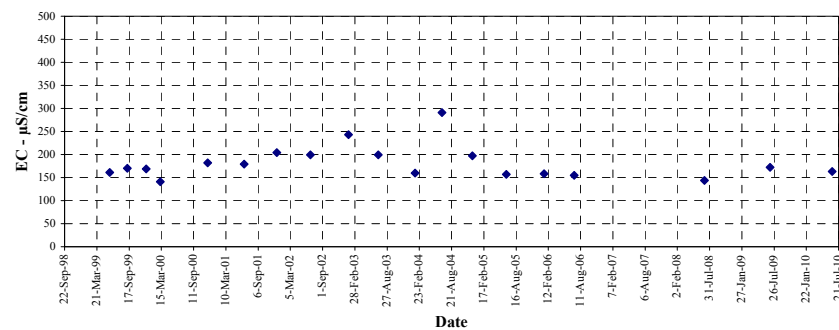
PF FORMATION Bore PF198PB1 - pH



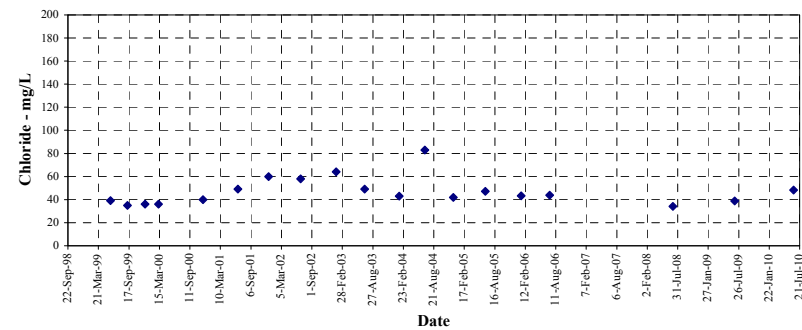
PF FORMATION Bore PF198PB1 - Sodium



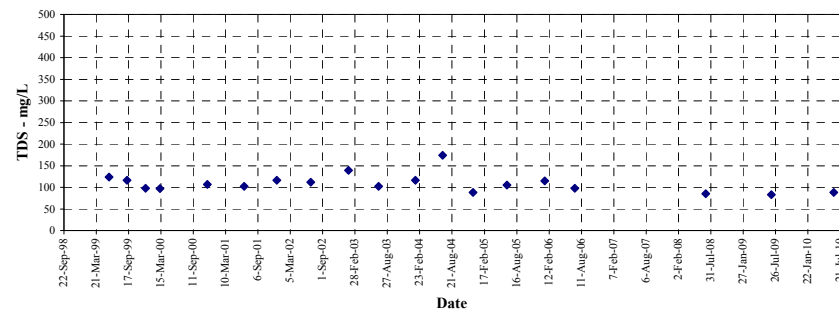
PF FORMATION Bore PF198PB1 - Electrical Conductivity



PF FORMATION Bore PF198PB1 - Chloride



PF FORMATION Bore PF198PB1 - Total Dissolved Solids



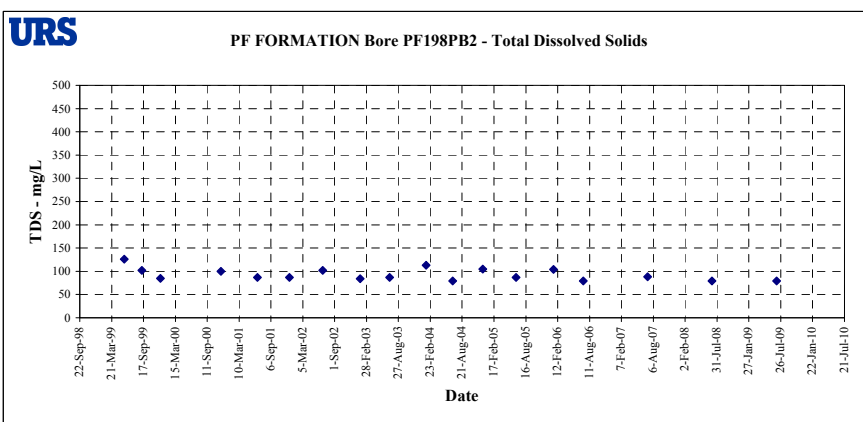
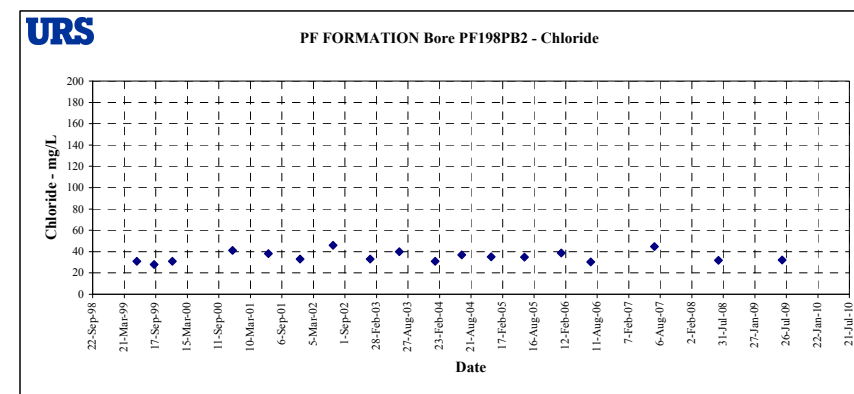
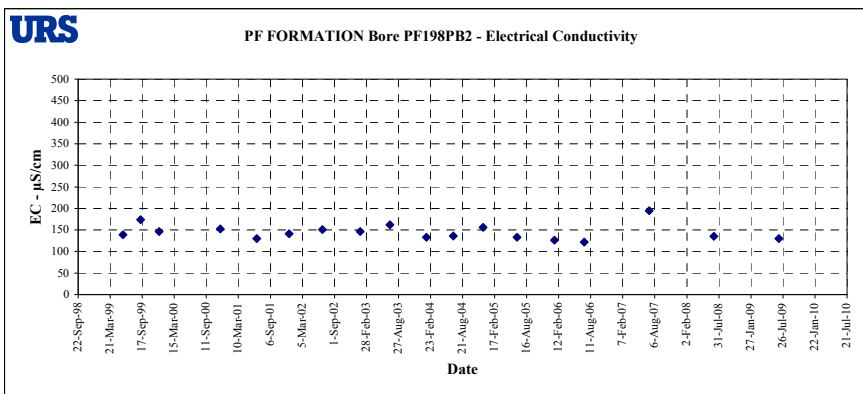
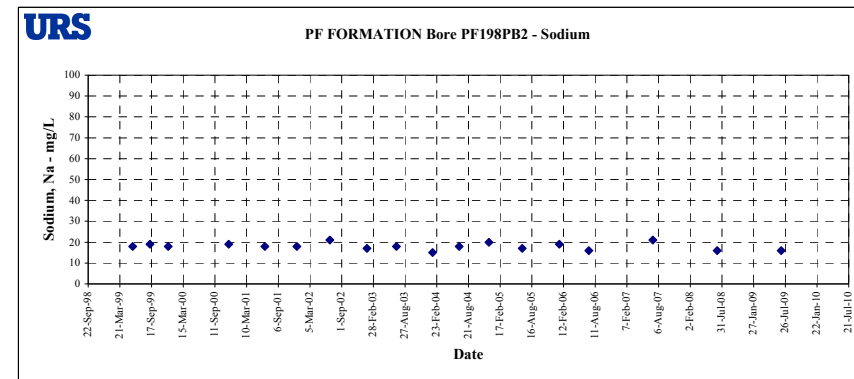
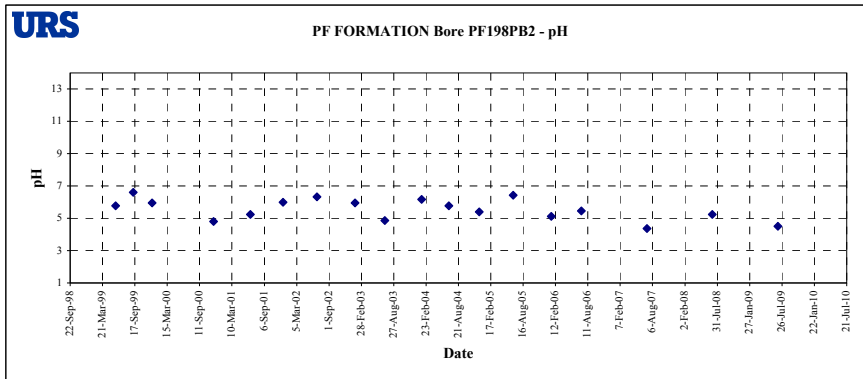
PF FORMATION - MAROOTA
BORE PF198PB2 GROUNDWATER ANALYTICAL SUMMARY

Analysis	Units	LOR	1.06.99	8.09.99	21.12.99	28.11.00	21.06.01	20.12.01	26.06.02	23.01.03	9.07.03	30.01.04	29.06.04	15.12.04	22.06.05	19.01.06	6.07.06	5.07.07	3.07.08	3.07.09	16.06.10
pH		0.01	5.78	6.61	5.96	4.8	5.24	5.99	6.33	5.96	4.87	6.18	5.78	5.39	6.43	5.13	5.46	4.37	5.25	4.5	NA
Electrical Conductivity	µS/cm	1	139	174	146	152	130	141	151	146	162	133	136	156	133	126	122	195	135	130	
Total Dissolved Solids	mg/L	1	126	102	85	100	87	87	102	84	87	113	79	105	87	104	79	88	79	79	
Calcium	mg/L	1	1	2	2	<1	<1	<1	1	<1	<1	<1	1	1	<1	<1	1	0.01	1	<1	
Magnesium	mg/L	1	5	5	5	4	3	4	4	4	2	4	4	2	4	3	4	3	5	3	
Sodium	mg/L	1	18	19	18	19	18	18	21	17	18	15	18	20	17	19	16	21	16	16	
Potassium	mg/L	1	2	2	2	1	1	2	2	1	<1	1	1	2	2	1	2	1	2	2	
Bicarbonate	mg/L	1	23	33	19	4	3	13	8	16	<1	16	9	2	14	7	24	<1	24.4	9.6	
Sulphate	mg/L	1	3	3	2	1	1	3	2	<1	4	2	1	4	4	1	1	4	2	2.78	
Chloride	mg/L	1	31	28	31	41	38	33	46	33	40	31	37	35	34.9	38.8	30.2	44.8	31.8	32.2	
Oil and Grease	mg/L	5	<5	<5	<5	<5	<5	11	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	

LOR = Limit of Reporting

Average EC = 145 µS/cm
Average TDS = 93 mg/L
Average pH = 6

Note: PF198PB2 could not be sampled in March 2000

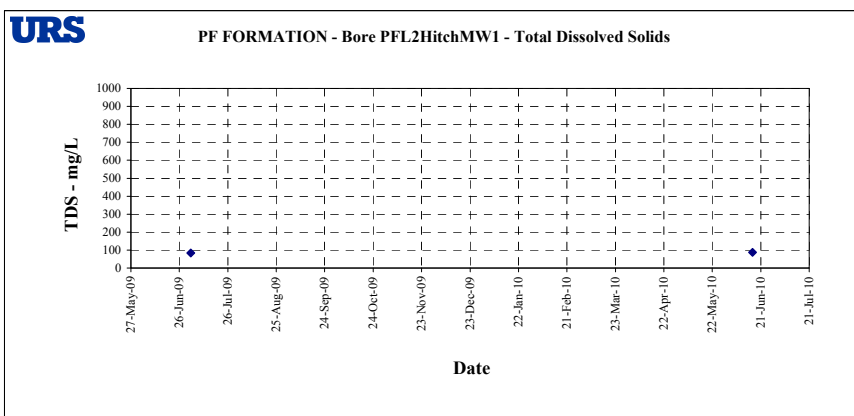
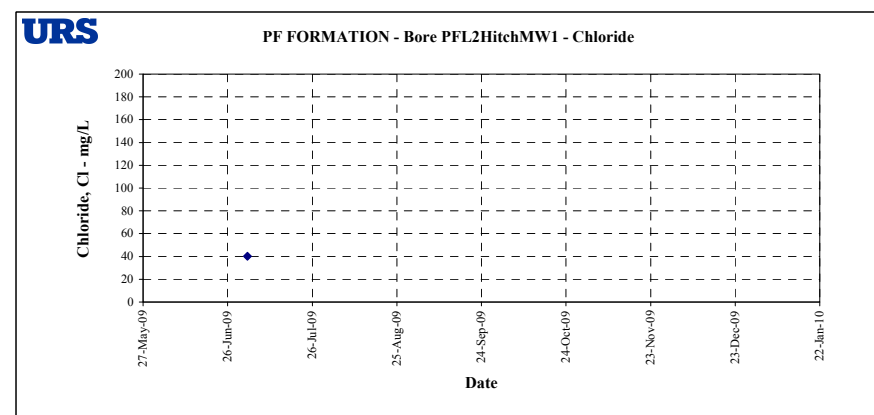
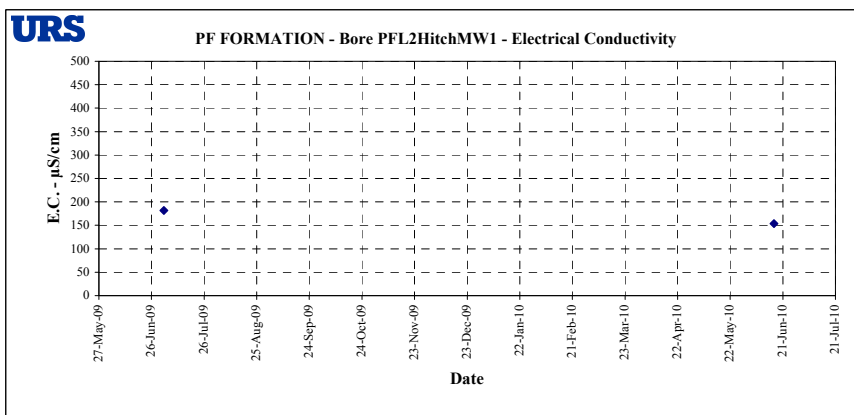
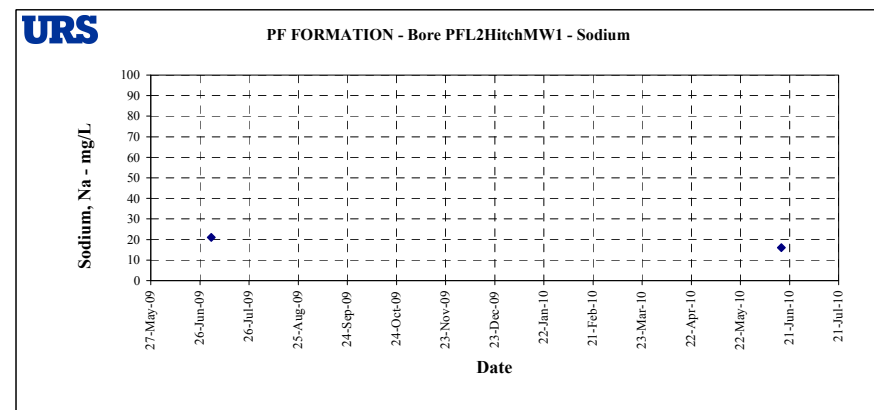
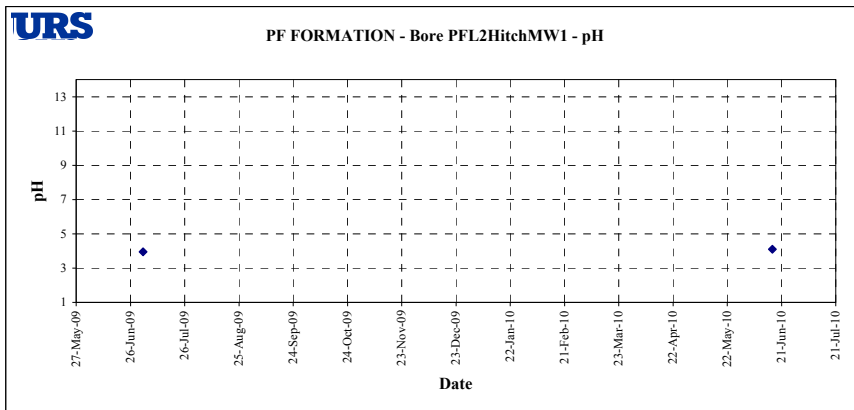


PF FORMATION - MAROOTA
BORE PFL2HitchMW1 GROUNDWATER ANALYTICAL SUMMARY

Analysis	Units	LOR	3.07.09	16.06.10
pH		0.01	3.96	4.1
Electrical Conductivity	µS/cm	1	182	154
Total Dissolved Solids	mg/L	1	84	88
Calcium	mg/L	1	<1	<1
Magnesium	mg/L	1	2	2
Sodium	mg/L	1	21	16
Potassium	mg/L	1	<1	<1
Bicarbonate	mg/L	1	<1	<1
Sulphate	mg/L	1	7.88	7.06
Chloride	mg/L	1	40.3	36.9
Oil and Grease	mg/L	5	<5	<5

LOR = Limit of Reporting

Average EC = 168 µS/cm
Average TDS = 86 mg/L
Average pH = 4

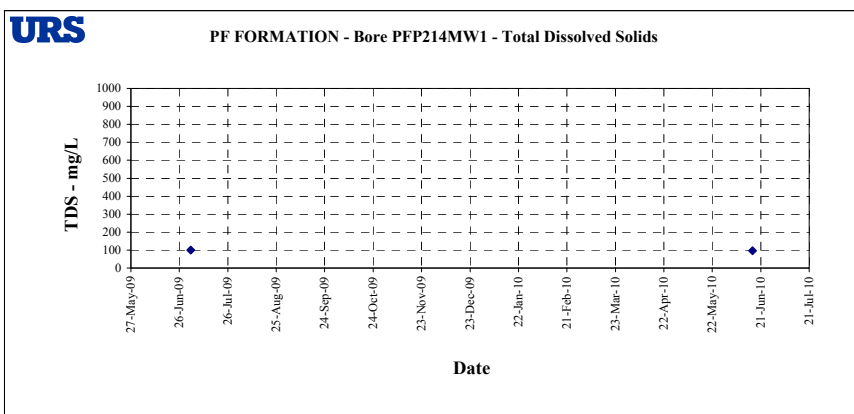
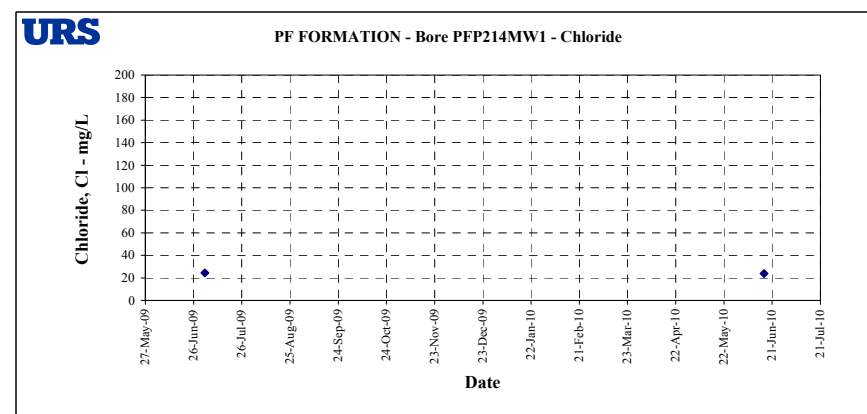
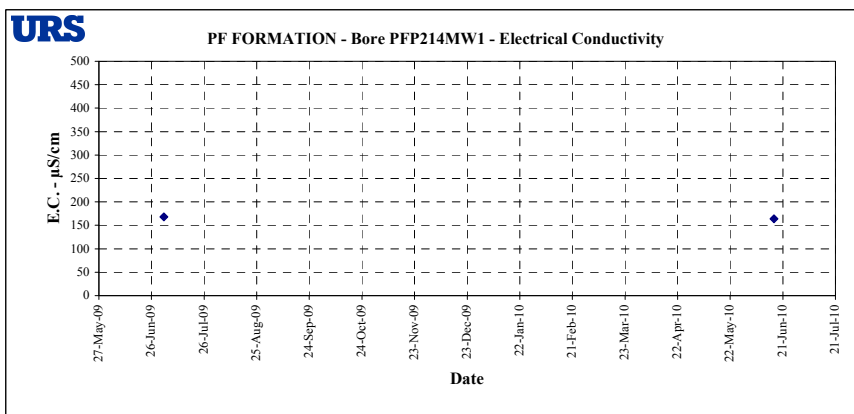
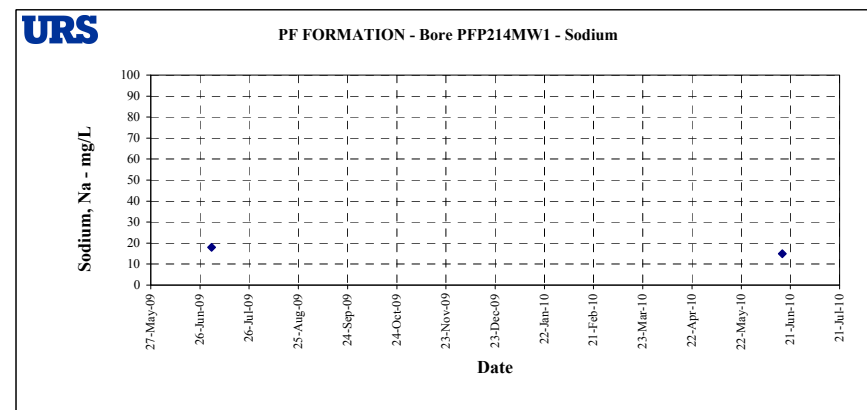
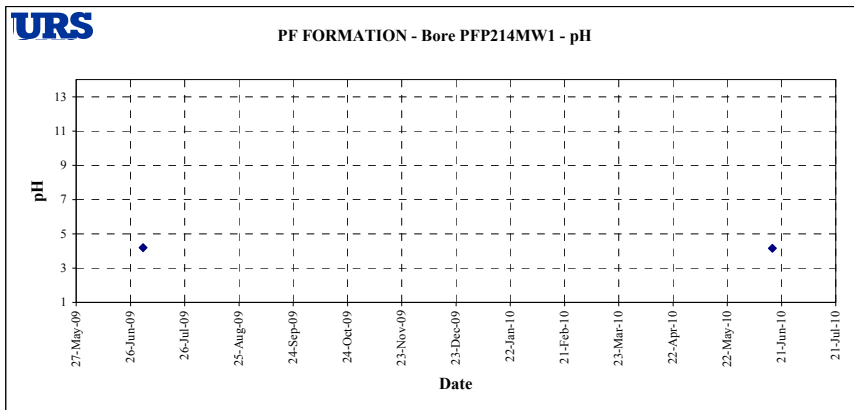


PF FORMATION - MAROOTA
BORE PFP214MW1 GROUNDWATER ANALYTICAL SUMMARY

Analysis	Units	LOR	3.07.09	16.06.10
pH		0.01	4.19	4.16
Electrical Conductivity	µS/cm	1	168	164
Total Dissolved Solids	mg/L	1	100	96
Calcium	mg/L	1	<1	<1
Magnesium	mg/L	1	6	5
Sodium	mg/L	1	18	15
Potassium	mg/L	1	1	<1
Bicarbonate	mg/L	1	<1	<1
Sulphate	mg/L	1	1.9	<0.5
Chloride	mg/L	1	24.3	23.8
Oil and Grease	mg/L	5	<5	<5

LOR = Limit of Reporting

Average EC = 166 µS/cm
Average TDS = 98 mg/L
Average pH = 4



Appendix B Analytical Laboratory Reports



Environmental Division

CERTIFICATE OF ANALYSIS

Work Order	: ES1011690	Page	: 1 of 4
Client	: URS AUSTRALIA (NSW) PTY LTD	Laboratory	: Environmental Division Sydney
Contact	: MR FABIO CAROSONE	Contact	: Charlie Pierce
Address	: LEVEL 4, 407 PACIFIC HIGHWAY ARTARMON NSW, AUSTRALIA 2064	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
E-mail	: fabio_carosone@urscorp.com	E-mail	: sydney.enviro.services@alsglobal.com
Telephone	: +61 89255500	Telephone	: +61-2-8784 8555
Facsimile	: +61 02 89255555	Facsimile	: +61-2-8784 8500
Project	: 43167726	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Order number	: —	Date Samples Received	: 16-JUN-2010
C-O-C number	: —	Issue Date	: 25-JUN-2010
Sampler	: FC	No. of samples received	: 10
Site	: —	No. of samples analysed	: 10
Quote number	: EN/001/10		

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. All pages of this report have been checked and approved for release.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results



NATA Accredited Laboratory 825

This document is issued in
accordance with NATA
accreditation requirements.

Accredited for compliance with
ISO/IEC 17025.

Signatories

This document has been electronically signed by the authorized signatories indicated below. Electronic signing has been carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	Position	Accreditation Category
Ankit Joshi	Inorganic Chemist	Inorganics
Celine Conceicao	Spectroscopist	Inorganics

Environmental Division Sydney
Part of the **ALS Laboratory Group**
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A Campbell Brothers Limited Company



General Comments

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When date(s) and/or time(s) are shown bracketed, these have been assumed by the laboratory for processing purposes. If the sampling time is displayed as 0:00 the information was not provided by client.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.

LOR = Limit of reporting

^ = This result is computed from individual analyte detections at or above the level of reporting



Analytical Results

Sub-Matrix: WATER

Client sample ID

Client sampling date / time

Compound	CAS Number	LOR	Unit
EA005: pH			
pH Value	—	0.01	pH Unit
EA010P: Conductivity by PC Titrator			
Electrical Conductivity @ 25°C	—	1	µS/cm
EA015: Total Dissolved Solids			
^ Total Dissolved Solids @180°C	GIS-210-010	1	mg/L
ED009: Anions			
Chloride	16887-00-6	0.50	mg/L
Sulfate	14808-79-8	0.50	mg/L
ED037P: Alkalinity by PC Titrator			
Hydroxide Alkalinity as CaCO ₃	DMO-210-001	1	mg/L
Carbonate Alkalinity as CaCO ₃	3812-32-6	1	mg/L
Bicarbonate Alkalinity as CaCO ₃	71-52-3	1	mg/L
Total Alkalinity as CaCO ₃	—	1	mg/L
ED093F: Dissolved Major Cations			
Calcium	7440-70-2	1	mg/L
Magnesium	7439-95-4	1	mg/L
Sodium	7440-23-5	1	mg/L
Potassium	7440-09-7	1	mg/L
EN055: Ionic Balance			
^ Total Anions	—	0.01	meq/L
^ Total Cations	—	0.01	meq/L
EP020: Oil and Grease (O&G)			
Oil & Grease	—	5	mg/L

PFL2HITCHMW1 [16-JUN-2010] ES1011690-007	PFP214MW1 [16-JUN-2010] ES1011690-008	PF198PB1 [16-JUN-2010] ES1011690-009
4.10	4.16	4.43
154	164	163
88	96	88
36.9	23.8	41.4
7.06	<0.50	6.89
<1	<1	<1
<1	<1	<1
<1	<1	<1
<1	<1	<1
<1	<1	<1
2	5	2
16	15	16
<1	<1	1
1.19	0.67	1.31
0.83	1.05	0.96
<5	<5	<5



Analytical Results

Sub-Matrix: WATER

Client sample ID

Client sampling date / time

Compound	CAS Number	LOR	Unit						PF167MW1 [16-JUN-2010] ES1011690-005
EA005: pH									
pH Value	—	0.01	pH Unit						4.30
EA010P: Conductivity by PC Titrator									
Electrical Conductivity @ 25°C	—	1	µS/cm						190
EA015: Total Dissolved Solids									
^ Total Dissolved Solids @180°C	GIS-210-010	1	mg/L						111
ED009: Anions									
Chloride	16887-00-6	0.50	mg/L						39.9
Sulfate	14808-79-8	0.50	mg/L						17.1
ED037P: Alkalinity by PC Titrator									
Hydroxide Alkalinity as CaCO ₃	DMO-210-001	1	mg/L						<1
Carbonate Alkalinity as CaCO ₃	3812-32-6	1	mg/L						<1
Bicarbonate Alkalinity as CaCO ₃	71-52-3	1	mg/L						2
Total Alkalinity as CaCO ₃	—	1	mg/L						2
ED093F: Dissolved Major Cations									
Calcium	7440-70-2	1	mg/L						3
Magnesium	7439-95-4	1	mg/L						3
Sodium	7440-23-5	1	mg/L						15
Potassium	7440-09-7	1	mg/L						2
EN055: Ionic Balance									
^ Total Anions	—	0.01	meq/L						1.53
^ Total Cations	—	0.01	meq/L						1.14
EP020: Oil and Grease (O&G)									
Oil & Grease	—	5	mg/L						<5

THIS COLUMN FOR LAB USE ONLY		Job Code:		UFS FROM: 407 Pacific Hwy ACN 000 691 690 Artamon 2064 Ph: 8925 5500 Fax: 8925 5555		Date: 16/06/2010 TO: ALS		Container Size, Type, Preservative and Analysis Container Identification									
Due Date:		Project No: 43167726 Project Manager: Fabio Carosone Agreement No:		Released for URS by: Fabio Carosone Date: 5/7/07 Time:		Received for Laboratory by: <i>Stephano Arastoy</i> Date: 16/6/10 Time: 16:50		Number of containers pH, EC, TDS, Ca, Mg, Na, K, Cl, HCO3, SO4 oil and grease H2SO4									
Custody seal intact? YES <input checked="" type="checkbox"/> NO <input type="checkbox"/>		Sample cold? YES <input type="checkbox"/> NO <input checked="" type="checkbox"/>		Lab Identification		Date 16/06/2010		Matrix		Sample Number		Comments		Total no		Tick required analytes	
Remarks:		Water		PFL3MW1		1		Water		PIT 4MW1		2		✓		✓	
Water		PIT 4MW2		3		Water		PIT4MW3		4		2		✓		✓	
Water		PFL2HtchMW1		7		Water		PF166MW1		6		2		✓		✓	
Water		PF167MW1		5		Water		PIT4MW2		4		2		✓		✓	
Water		PF167MW1		5		Water		PIT4MW3		4		2		✓		✓	
Water		PF166MW1		6		Water		PIT4MW2		4		2		✓		✓	
Water		PFL2HtchMW1		7		Water		PF166MW1		6		2		✓		✓	
Water		PFP214MW1		8		Water		PIT4MW3		4		2		✓		✓	
Water		PF198PB1		9		Water		PIT4MW2		4		2		✓		✓	
Water		PFL3MW1		10		Water		PIT4MW3		4		2		✓		✓	
TOTAL		20		10		10		✓		✓		✓		✓		✓	
Container Type and Preservative Codes: P = Neutral Plastic; N = Nitric Acid Preserved; C = Sodium Hydroxide Preserved; J = Solvent Washed Acid Rinsed Jar; S = Solvent Washed Acid Rinsed Glass Bottle; V = Hydrochloric Acid Preserved Vial; VS = Sulfuric Acid Preserved Vial; BS = Sulfuric Acid Preserved Glass Bottle; Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle		Specify Turnaround Time:		NOTE: SAMPLES MAY CONTAIN DANGEROUS AND HAZARDOUS SUBSTANCES		Counter Job No:											



Environmental Division

QUALITY CONTROL REPORT

Work Order	: ES1011690	Page	: 1 of 6
Client	: URS AUSTRALIA (NSW) PTY LTD	Laboratory	: Environmental Division Sydney
Contact	: MR FABIO CAROSONE	Contact	: Charlie Pierce
Address	: LEVEL 4, 407 PACIFIC HIGHWAY ARTARMON NSW, AUSTRALIA 2064	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
E-mail	: fabio_carosone@urscorp.com	E-mail	: sydney.enviro.services@alsglobal.com
Telephone	: +61 89255500	Telephone	: +61-2-8784 8555
Facsimile	: +61 02 89255555	Facsimile	: +61-2-8784 8500
Project	: 43167726	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Site	: ----	Date Samples Received	: 16-JUN-2010
C-O-C number	: ----	Issue Date	: 25-JUN-2010
Sampler	: FC	No. of samples received	: 10
Order number	: ----	No. of samples analysed	: 10
Quote number	: EN/001/10		

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. All pages of this report have been checked and approved for release.

This Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percentage Difference (RPD) and Acceptance Limits
- Method Blank (MB) and Laboratory Control Spike (LCS) Report; Recovery and Acceptance Limits
- Matrix Spike (MS) Report; Recovery and Acceptance Limits



NATA Accredited Laboratory 825

This document is issued in accordance with NATA accreditation requirements.

Accredited for compliance with ISO/IEC 17025.

Signatories

This document has been electronically signed by the authorized signatories indicated below. Electronic signing has been carried out in compliance with procedures specified in 21 CFR Part 11.

<i>Signatories</i>	<i>Position</i>	<i>Accreditation Category</i>
Ankit Joshi	Inorganic Chemist	Inorganics
Celine Conceicao	Spectroscopist	Inorganics

Environmental Division Sydney

Part of the **ALS Laboratory Group**

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General Comments

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

Key :
Anonymous = Refers to samples which are not specifically part of this work order but formed part of the QC process lot
CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
RPD = Relative Percentage Difference
= Indicates failed QC



Laboratory Duplicate (DUP) Report

The quality control term Laboratory Duplicate refers to a randomly selected intralaboratory split. Laboratory duplicates provide information regarding method precision and sample heterogeneity. The permitted ranges for the Relative Percent Deviation (RPD) of Laboratory Duplicates are specified in ALS Method QWI-EN/38 and are dependent on the magnitude of results in comparison to the level of reporting: Result < 10 times LOR:- No Limit; Result between 10 and 20 times LOR:- 0% - 50%; Result > 20 times LOR:- 0% - 20%.

Sub-Matrix: **WATER**

Sub-Matrix: WATER				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
EA005: pH (QC Lot: 1383207)									
ES1011678-001	Anonymous	EA005: pH Value	----	0.01	pH Unit	Anonymous	Anonymous	Anonymous	Anonymous
ES1011690-007	PFL2HITCHMW1	EA005: pH Value	----	0.01	pH Unit	4.10		1.0	0% - 20%
EA010P: Conductivity by PC Titrator (QC Lot: 1392281)									
ES1011689-001	Anonymous	EA010-P: Electrical Conductivity @ 25°C	----	1	µS/cm	Anonymous	Anonymous	Anonymous	Anonymous
ES1011690-009	PF198PB1	EA010-P: Electrical Conductivity @ 25°C	----	1	µS/cm	163		0.0	0% - 20%
EA015: Total Dissolved Solids (QC Lot: 1389369)									
ES1011690-001	PFL3MW1	EA015: Total Dissolved Solids @180°C	GIS-210-010	1	mg/L	108		3.6	0% - 20%
ES1011690-010	PFPIT4PBI	EA015: Total Dissolved Solids @180°C	GIS-210-010	1	mg/L	102	100	2.0	0% - 20%
ED009: Anions (QC Lot: 1384981)									
ES1011634-001	Anonymous	ED009: Chloride	16887-00-6	0.50	mg/L	Anonymous	Anonymous	Anonymous	Anonymous
		ED009: Sulfate	14808-79-8	0.50	mg/L	Anonymous	Anonymous	Anonymous	Anonymous
ES1011676-008	Anonymous	ED009: Chloride	16887-00-6	0.50	mg/L	Anonymous	Anonymous	Anonymous	Anonymous
		ED009: Sulfate	14808-79-8	0.50	mg/L	Anonymous	Anonymous	Anonymous	Anonymous
ED009: Anions (QC Lot: 1384982)									
ES1011690-008	PFP214MW1	ED009: Chloride	16887-00-6	0.50	mg/L	23.8	23.9	0.4	0% - 20%
		ED009: Sulfate	14808-79-8	0.50	mg/L	<0.50	<0.50	0.0	No Limit
ES1011716-003	Anonymous	ED009: Chloride	16887-00-6	0.50	mg/L	Anonymous	Anonymous	Anonymous	Anonymous
		ED009: Sulfate	14808-79-8	0.50	mg/L	Anonymous	Anonymous	Anonymous	Anonymous
ED037P: Alkalinity by PC Titrator (QC Lot: 1392282)									
ES1011690-001	PFL3MW1	ED037-P: Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1		0.0	No Limit
		ED037-P: Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1		0.0	No Limit
		ED037-P: Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	6	4	41.6	No Limit
		ED037-P: Total Alkalinity as CaCO3	----	1	mg/L	6	4	41.6	No Limit
ES1011690-009	PF198PB1	ED037-P: Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1		0.0	No Limit
		ED037-P: Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1		0.0	No Limit
		ED037-P: Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	<1		0.0	No Limit
		ED037-P: Total Alkalinity as CaCO3	----	1	mg/L	<1	<1	0.0	No Limit
ED093F: Dissolved Major Cations (QC Lot: 1383147)									
ES1011496-003	Anonymous	ED093F: Calcium	7440-70-2	1	mg/L	Anonymous	Anonymous	Anonymous	Anonymous
		ED093F: Magnesium	7439-95-4	1	mg/L	Anonymous	Anonymous	Anonymous	Anonymous
		ED093F: Sodium	7440-23-5	1	mg/L	Anonymous	Anonymous	Anonymous	Anonymous
		ED093F: Potassium	7440-09-7	1	mg/L	Anonymous	Anonymous	Anonymous	Anonymous
ES1011690-002	PIT4MW1	ED093F: Calcium	7440-70-2	1	mg/L	<1		0.0	No Limit
		ED093F: Magnesium	7439-95-4	1	mg/L	2		0.0	No Limit
		ED093F: Sodium	7440-23-5	1	mg/L	16	16	0.0	0% - 50%



Sub-Matrix: WATER				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
ED093F: Dissolved Major Cations (QC Lot: 1383147) - continued									
ES1011690-002	PIT4MW1	ED093F: Potassium	7440-09-7	1	mg/L	<1		0.0	No Limit



Method Blank (MB) and Laboratory Control Spike (LCS) Report

The quality control term Method / Laboratory Blank refers to an analyte free matrix to which all reagents are added in the same volumes or proportions as used in standard sample preparation. The purpose of this QC parameter is to monitor potential laboratory contamination. The quality control term Laboratory Control Sample (LCS) refers to a certified reference material, or a known interference free matrix spiked with target analytes. The purpose of this QC parameter is to monitor method precision and accuracy independent of sample matrix. Dynamic Recovery Limits are based on statistical evaluation of processed LCS.

Sub-Matrix: **WATER**

Sub-Matrix: WATER				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike Concentration	Spike Recovery (%)	Recovery Limits (%)	
Method: Compound	CAS Number	LOR	Unit	Result		LCS	Low	High
EA010P: Conductivity by PC Titrator (QCLot: 1392281)								
EA010-P: Electrical Conductivity @ 25°C	----	1	µS/cm	<1	2000 µS/cm	99.2	86.3	112
EA015: Total Dissolved Solids (QCLot: 1389369)								
EA015: Total Dissolved Solids @180°C	GIS-210-010	1	mg/L	<1	293 mg/L	101	77.9	122
ED009: Anions (QCLot: 1384981)								
ED009: Chloride	16887-00-6	0.5	mg/L	<0.50	4 mg/L	97.7	70	130
ED009: Sulfate	14808-79-8	0.5	mg/L	<0.50	4 mg/L	80.5	70	130
ED009: Anions (QCLot: 1384982)								
ED009: Chloride	16887-00-6	0.5	mg/L	<0.50	4 mg/L	97.5	70	130
ED009: Sulfate	14808-79-8	0.5	mg/L	<0.50	4 mg/L	119	70	130
ED037P: Alkalinity by PC Titrator (QCLot: 1392282)								
ED037-P: Total Alkalinity as CaCO3	----	1	mg/L	----	200 mg/L	88.0	80.2	108
ED093F: Dissolved Major Cations (QCLot: 1383147)								
ED093F: Calcium	7440-70-2	1	mg/L	<1	50 mg/L	94.6	88	110
ED093F: Magnesium	7439-95-4	1	mg/L	<1	50 mg/L	102	90	110
ED093F: Sodium	7440-23-5	1	mg/L	<1	50 mg/L	88.8	81	107
ED093F: Potassium	7440-09-7	1	mg/L	<1	50 mg/L	92.4	89	109
EP020: Oil and Grease (O&G) (QCLot: 1389786)								
EP020: Oil & Grease	----	5	mg/L	<5	5000 mg/L	82.2	81.6	107
EP020: Oil and Grease (O&G) (QCLot: 1390436)								
EP020: Oil & Grease	----	5	mg/L	<5	5000 mg/L	88.8	81.6	107



Matrix Spike (MS) Report

The quality control term Matrix Spike (MS) refers to an intralaboratory split sample spiked with a representative set of target analytes. The purpose of this QC parameter is to monitor potential matrix effects on analyte recoveries. Static Recovery Limits as per laboratory Data Quality Objectives (DQOs). Ideal recovery ranges stated may be waived in the event of sample matrix interference.

Sub-Matrix: WATER

Sub-Matrix: WATER				Matrix Spike (MS) Report			
				Spike Concentration	Spike Recovery (%)	Recovery Limits (%)	
					MS	Low	High
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number				
ED009: Anions (QCLot: 1384981)							
ES1011634-001	Anonymous	ED009: Chloride	16887-00-6	Anonymous	Anonymous	Anonymous	Anonymous
		ED009: Sulfate	14808-79-8	Anonymous	Anonymous	Anonymous	Anonymous
ED009: Anions (QCLot: 1384982)							
ES1011690-008	PFP214MW1	ED009: Chloride	16887-00-6	4 mg/L	# Not Determined	70	130
		ED009: Sulfate	14808-79-8	4 mg/L	128	70	130



Environmental Division

INTERPRETIVE QUALITY CONTROL REPORT

Work Order	: ES1011690	Page	: 1 of 6
Client	: URS AUSTRALIA (NSW) PTY LTD	Laboratory	: Environmental Division Sydney
Contact	: MR FABIO CAROSONE	Contact	: Charlie Pierce
Address	: LEVEL 4, 407 PACIFIC HIGHWAY ARTARMON NSW, AUSTRALIA 2064	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
E-mail	: fabio_carosone@urscorp.com	E-mail	: charlie.pierce@alsenviro.com
Telephone	: +61 89255500	Telephone	: +61-2-8784 8555
Facsimile	: +61 02 89255555	Facsimile	: +61-2-8784 8500
Project	: 43167726	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Site	: ----		
C-O-C number	: ----	Date Samples Received	: 16-JUN-2010
Sampler	: FC	Issue Date	: 25-JUN-2010
Order number	: ----		
Quote number	: EN/001/10	No. of samples received	: 10
		No. of samples analysed	: 10

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. All pages of this report have been checked and approved for release.

This Interpretive Quality Control Report contains the following information:

- Analysis Holding Time Compliance
- Quality Control Parameter Frequency Compliance
- Brief Method Summaries
- Summary of Outliers

Environmental Division Sydney

Part of the **ALS Laboratory Group**

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Analysis Holding Time Compliance

The following report summarises extraction / preparation and analysis times and compares with recommended holding times. Dates reported represent first date of extraction or analysis and precludes subsequent dilutions and reruns. Information is also provided re the sample container (preservative) from which the analysis aliquot was taken. Elapsed period to analysis represents number of days from sampling where no extraction / digestion is involved or period from extraction / digestion where this is present. For composite samples, sampling date is assumed to be that of the oldest sample contributing to the composite. Sample date for laboratory produced leachates is assumed as the completion date of the leaching process. Outliers for holding time are based on USEPA SW 846, APHA, AS and NEPM (1999). A listing of breaches is provided in the Summary of Outliers.

Holding times for leachate methods (excluding elutriates) vary according to the analytes being determined on the resulting solution. For non-volatile analytes, the holding time compliance assessment compares the leach date with the shortest analyte holding time for the equivalent soil method. These soil holding times are: Organics (14 days); Mercury (28 days) & other metals (180 days). A recorded breach therefore does not guarantee a breach for all non-volatile parameters.

Matrix: **WATER**

Evaluation: * = Holding time breach ; ✓ = Within holding time.

Method	Sample Date	Extraction / Preparation			Analysis			
Container / Client Sample ID(s)		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation	
EA005: pH								
Clear Plastic Bottle - Natural PFL3MW1,								



Matrix: **WATER**

Evaluation: * = Holding time breach ; ✓ = Within holding time.

Method	Sample Date	Extraction / Preparation			Analysis			
Container / Client Sample ID(s)		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation	
ED037P: Alkalinity by PC Titrator								
Clear Plastic Bottle - Natural PFL3MW1, PIT4MW1, PIT4MW2, PIT4MW3, PF167MW1, PF166MW1, PFL2HITCHMW1, PFP214MW1, PF198PB1, PFPIT4PBI	16-JUN-2010	---	---	----	24-JUN-2010	30-JUN-2010	✓	
ED093F: Dissolved Major Cations								
Clear Plastic Bottle - Natural PFL3MW1, PIT4MW1, PIT4MW2, PIT4MW3, PF167MW1, PF166MW1, PFL2HITCHMW1, PFP214MW1, PF198PB1, PFPIT4PBI	16-JUN-2010	---	---	----	16-JUN-2010	23-JUN-2010	✓	
EP020: Oil and Grease (O&G)								
Amber Glass Bottle - Sulphuric Acid PFL3MW1, PIT4MW1, PIT4MW2, PIT4MW3	16-JUN-2010	----	----	----	22-JUN-2010	14-JUL-2010	✓	
Amber Glass Bottle - Sulphuric Acid PF167MW1, PF166MW1, PFL2HITCHMW1, PFP214MW1, PF198PB1, PFPIT4PBI	16-JUN-2010	----	----	----	23-JUN-2010	14-JUL-2010	✓	



Quality Control Parameter Frequency Compliance

The following report summarises the frequency of laboratory QC samples analysed within the analytical lot(s) in which the submitted sample(s) was(where) processed. Actual rate should be greater than or equal to the expected rate. A listing of breaches is provided in the Summary of Outliers.

Matrix: **WATER** Evaluation: ✖ = Quality Control frequency not within specification ; ✔ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	Method	QC	Regular	Actual	Expected	Evaluation	
Laboratory Duplicates (DUP)							
Alkalinity by PC Titrator	ED037-P	2	11	18.2	10.0	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Conductivity by PC Titrator	EA010-P	2	16	12.5	10.0	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Major Cations - Dissolved	ED093F	2	18	11.1	10.0	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
pH	EA005	2	20	10.0	10.0	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Standard Anions	ED009	4	40	10.0	10.0	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Total Dissolved Solids	EA015	2	20	10.0	10.0	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Laboratory Control Samples (LCS)							
Alkalinity by PC Titrator	ED037-P	1	11	9.1	5.0	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Conductivity by PC Titrator	EA010-P	1	16	6.3	5.0	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Major Cations - Dissolved	ED093F	1	18	5.6	5.0	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Oil and Grease	EP020	2	40	5.0	5.0	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Standard Anions	ED009	2	40	5.0	5.0	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Total Dissolved Solids	EA015	1	20	5.0	5.0	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Method Blanks (MB)							
Conductivity by PC Titrator	EA010-P	1	16	6.3	5.0	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Major Cations - Dissolved	ED093F	1	18	5.6	5.0	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Oil and Grease	EP020	2	40	5.0	5.0	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Standard Anions	ED009	2	40	5.0	5.0	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Total Dissolved Solids	EA015	1	20	5.0	5.0	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Matrix Spikes (MS)							
Standard Anions	ED009	2	40	5.0	5.0	✓	ALS QCS3 requirement



Brief Method Summaries

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the US EPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request. The following report provides brief descriptions of the analytical procedures employed for results reported in the Certificate of Analysis. Sources from which ALS methods have been developed are provided within the Method Descriptions.

Analytical Methods	Method	Matrix	Method Descriptions
pH	EA005	WATER	APHA 21st ed. 4500 H+ B. pH of water samples is determined by ISE either manually or by automated pH meter. This method is compliant with NEPM (1999) Schedule B(3) (Appdx. 2)
Conductivity by PC Titrator	EA010-P	WATER	APHA 21st ed., 2510 B This procedure determines conductivity by automated ISE. This method is compliant with NEPM (1999) Schedule B(3) (Appdx. 2)
Total Dissolved Solids	EA015	WATER	APHA 21st ed., 2540C A gravimetric procedure that determines the amount of 'filterable' residue in an aqueous sample. A well-mixed sample is filtered through a glass fibre filter (1.2um). The filtrate is evaporated to dryness and dried to constant weight at 180+/-5C. This method is compliant with NEPM (1999) Schedule B(3) (Appdx. 2)
Standard Anions	* ED009	WATER	APHA 21st ed., 4110. This method is compliant with NEPM (1999) Schedule B(3) (Appdx. 2)
Alkalinity by PC Titrator	ED037-P	WATER	APHA 21st ed., 2320 B This procedure determines alkalinity by automated measurement (e.g. PC Titrate) using pH 4.5 for indicating the total alkalinity end-point. This method is compliant with NEPM (1999) Schedule B(3) (Appdx. 2)
Major Cations - Dissolved	ED093F	WATER	APHA 21st ed., 3120; USEPA SW 846 - 6010 The ICPAES technique ionises the 0.45um filtered sample atoms emitting a characteristic spectrum. This spectrum is then compared against matrix matched standards for quantification. This method is compliant with NEPM (1999) Schedule B(3) (Appdx. 2)
Ionic Balance by IC PCT and ICPAES	EN055 - IC ED009	WATER	APHA 21st Ed. 1030F. This method is compliant with NEPM (1999) Schedule B(3) (Appdx. 2)
Oil and Grease	EP020	WATER	APHA 21st ed., 5520 B Oil & grease is a gravimetric procedure to determine the amount of oil & grease residue in an aqueous sample. The sample is serially extracted three times n-hexane. The resultant extracts are combined, dehydrated and concentrated prior to gravimetric determination. This method is compliant with NEPM (1999) Schedule B(3) (Appdx. 2)



Summary of Outliers

Outliers : Quality Control Samples

The following report highlights outliers flagged in the Quality Control (QC) Report. Surrogate recovery limits are static and based on USEPA SW846 or ALS-QWI/EN/38 (in the absence of specific USEPA limits). This report displays QC Outliers (breaches) only.

Duplicates, Method Blanks, Laboratory Control Samples and Matrix Spikes

Matrix: **WATER**

Compound Group Name	Laboratory Sample ID	Client Sample ID	Analyte	CAS Number	Data	Limits	Comment
Matrix Spike (MS) Recoveries							
ED009: Anions	ES1011690-008	PFP214MW1	Chloride	16887-00-6	Not Determined	----	MS recovery not determined, background level greater than or equal to 4x spike level.

- For all matrices, no Method Blank value outliers occur.
- For all matrices, no Duplicate outliers occur.
- For all matrices, no Laboratory Control outliers occur.

Regular Sample Surrogates

- For all regular sample matrices, no surrogate recovery outliers occur.

Outliers : Analysis Holding Time Compliance

This report displays Holding Time breaches only. Only the respective Extraction / Preparation and/or Analysis component is/are displayed.

- No Analysis Holding Time Outliers exist.

Outliers : Frequency of Quality Control Samples

The following report highlights breaches in the Frequency of Quality Control Samples.

- No Quality Control Sample Frequency Outliers exist.

Attachment 6B

Quarterly Water Testing Results

TEST REPORT

CLIENT: P.F. FORMATION - MAROOTA

FILE No: 250/09

ADDRESS: 1774 Wisemans Ferry Road Maroota, NSW 2756

PROJECT: Testing of Water Samples from P.F. Formation - Maroota

TEST PROCEDURES:

APHA 4500 H⁺ B 21st Ed. - pH Value

APHA 2540 D 21st Ed. - Total Suspended Solids Dried at 103-105°C

APHA 2130 B 21st Ed. - Turbidity

APHA 2510 B 21st Ed. - Conductivity

APHA 5520 C 21st Ed. - Oil & Grease by Infra Red

Laboratory Sample No: 95984

Date Sampled: 4.09.09

Sample Description: Water -
Downstream Lot 198 -
12:30pm

Field No: 1

TEST RESULTS

pH	4.9
Total Suspended Solids (mg/L)	5.2
Turbidity (NTU)	4.4
Conductivity (µs/cm)	201
Oil & Grease (mg/L) *	<1

Sample analysed as received.

NOTE: * Solvent used in the determination of Solvent Extractable Matter for Oil & Grease analysis: Polychlorotrifluoroethylene (S316)

J.Graham, File

JUSTIN DOWSE

Approved Signatory

Date

9/09/09

Serial No.

80413

MATERIALS TECHNICAL SERVICES
BORAL RESOURCES (NSW) PTY LTD
ABN 51 000 756 507Unit 4, 3-5 Gibbon Road
Baulkham Hills NSW 2153 Australia
PO Box 400, Winston Hills NSW 2153
Telephone 61 2 9624 9900
Facsimile 61 2 9624 9999**Test Report**

CLIENT: P.F. FORMATION - MAROOTA

FILE No.: 250/09

PROJECT: Testing of Water Samples from P.F. Formation - Maroota

REQUEST No.: 36420

TEST PROCEDURE: APHA 4500 H+B – pH Value
APHA 2130 B - Turbidity
APHA 5520 C – Oil & Grease by Infra Red
APHA 4500 D - Total Suspended Solid Dried at 103-105 °C
APHA 2510 B – Conductivity

Laboratory Sample No.: 98680
Date Sampled: 1.12.09
Date Received: 2.12.09
Sample Description: Water -
Downstream -
Lot 198 -
10:00am
Field No.: 1

TEST RESULTS

pH 4.1
Turbidity (NTU) 3.9
Oil & Grease (mg/L) * <1
Total Suspended Solid (mg/L) 2.7
Conductivity (µm/cm) 222

Samples submitted by the Client.

NOTE: * Solvent used in the determination of Solvent Extractable Matter for Oil & Grease analysis:
Polychlorotrifluoroethylene (S316)

J. Graham, File.

MATERIALS TECHNICAL SERVICES
BORAL RESOURCES (NSW) PTY LTD
ABN 51 000 756 507Unit 4, 3-5 Gibbon Road
Baulkham Hills NSW 2153 Australia
PO Box 400, Winston Hills NSW 2153
Telephone 61 2 9624 9900
Facsimile 61 2 9624 9999**Test Report**

CLIENT: P.F.FORMATION

FILE No.: 250/10

ADDRESS: 1774 WISEMANN'S FERRY ROAD, MAROOTA, NSW 2756

PROJECT: Testing of Water Samples from P.F. Formation

REQUEST No.: 37086

TEST PROCEDURE: APHA 4500 H⁺B - pH Value
APHA 2130 B - Turbidity
APHA 5520 C - Oil & Grease by Infra Red
APHA 4500 D - Total Suspended Solid Dried at 103-105 °C
APHA 2510 B - Conductivity

Laboratory Sample No.: 100440
Date Sampled: 4.02.10
Date Received: 5.02.10
Sample Description: Water -
Downstream -
Lot 198 -
11:00am
Field No.: 1

TEST RESULTS

pH	4.7
Turbidity (NTU)	95
Oil & Grease (mg/L)	<1
Total Suspended Solid (mg/L)	77.6
Conductivity (µm/cm)	180

Samples submitted by the Client.

NOTE: * Solvent used in the determination of Solvent Extractable Matter for Oil & Grease analysis:
Polychlorotrifluoroethylene (S316)

J. Graham, File.

JUSTIN DOWSE

Approved Signatory

Date

17/02/10

Serial No.

84117

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Number: 9968

MATERIALS TECHNICAL SERVICES
BORAL RESOURCES (NSW) PTY LTD
ABN 51 000 756 507Unit 4, 3-5 Gibbon Road
Baulkham Hills NSW 2153 Australia
PO Box 400, Winston Hills NSW 2153
Telephone 61 2 9624 9900
Facsimile 61 2 9624 9999**Test Report**

CLIENT: P.F.FORMATION

FILE No.: 250/10

ADDRESS: 1774 WISEMANN'S FERRY ROAD, MAROOTA, NSW 2756

PROJECT: Testing of Water Samples from P.F. Formation

REQUEST No.: 38721

TEST PROCEDURE: APHA 4500 H⁺B - pH Value
APHA 2130 B - Turbidity
APHA 5520 C - Oil & Grease by Infra Red
APHA 4500 D - Total Suspended Solid Dried at 103-105 °C
APHA 2510 B - Conductivity

Laboratory Sample No.: 104747
Date Sampled: 7.06.10
Date Received: 7.06.10
Sample Description: Water -
Downstream -
Lot 198 -
9:00am

Field No.: 1

TEST RESULTS

pH	4.8
Turbidity (NTU)	24
Oil & Grease (mg/L)	<1
Total Suspended Solid (mg/L)	11.0
Conductivity (µm/cm)	196

Samples submitted by the Client.

NOTE: * Solvent used in the determination of Solvent Extractable Matter for Oil & Grease analysis:
Polychlorotrifluoroethylene (S316)

J. Graham, File.

JUSTIN DOWSE

Approved Signatory

Date 21/06/10

Serial No.

87 2 9 5

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COMPETENCE

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NATA Accredited Laboratory
Number: 9968

Chapter Seven

REHABILITATION

Introduction

A Landscape Management Plan has been prepared in compliance with the requirements of the current Project Approval and was approved by the Department of Planning on 26 August 2010. The following section therefore describes the current phase of site rehabilitation followed by responses to the issues raised in the court orders where appropriate. Reference is also made to the biodiversity offset strategy which is described in more detail in the Landscape Management Plan.

Earth bunding and rehabilitation

Bund construction and planting work has been completed in most areas, mainly sections of the northern and southern boundaries of the triangular shaped, northern portion of the site bounded by Old Northern Road and Wisemans Ferry Road.

Sections along Old Northern Road have been completed and will be reviewed in the next year.

Visual assessment

The periphery works will, in time provide an acceptable screen to ameliorate the visual impacts of the sand extraction operations. However, most parts of the extraction area are not visible from the external roads although material stockpiled adjacent to the slurry plant at the northern extremity of the site can be seen by drivers travelling south along Old Northern Road.

Conclusions

The works as proposed ensure that satisfactory screening and rehabilitation of the boundary areas of the Hitchcock Road site is achieved. The proposed method of earth bunding and planting will, in time, ameliorate the visual impacts of the site operations. In conjunction with further rehabilitation work, the site can be returned to a natural state on the completion of sand extraction.

Rehabilitation Issues

Rate of rehabilitation

Rehabilitation of the site is taking place generally in phase with the overall staging program. The removal of material from the first phases has been completed and extraction has continued as shown on the Site Survey Plan at **Attachment 2A**.

Rehabilitation of the project is dependent on two main factors:

- Material for backfilling does not become available until topsoil and overburden are removed from later phases as similar material from the first phase area is used to form peripheral mounds and the earthworks required for the tailings dams.
- Substantial parts of the operational area are occupied by a series of basins required for surface water treatment. These require capping prior to any major rehabilitation-taking place in the area. This cannot be undertaken until new basins are developed as part of the next phase development which in turn serve the whole project. In addition, capping cannot take place until the ponds are sufficiently dry to accommodate heavy vehicles with safety. This can take up to three years.

The timing of the rehabilitation of the initial phases is therefore dependent on a substantial start being made on the next phase. Activity to date has focussed on the provision of the peripheral mounds which are required for acoustic and visual reasons. These have been constructed, so far, in those areas particularly sensitive to these impacts. This work has now been completed.

A number of the early tailings dams have been capped and the area is in the process of rehabilitation. This is particularly the case in the western part of the site immediately to the south of the former Crown Road where several silt ponds have been capped and the ground contours reconfigured. The northern part has been seeded under the supervision of Greening Australia.

Maintenance of vegetated conservation zones and rehabilitated areas

Conservation zones identified in the Landscape Management Plan are regularly inspected as required in the Environmental Strategy (**Strategy 7.1**). These areas are signposted and the areas suitably protected. All existing vegetation around the periphery of the site will be protected within setbacks and buffer zones.

The peripheral bunds constructed to date have been planted. These are regularly inspected and the area maintained.

Retention and protection of vegetation within buffer zones

All existing vegetation within the defined buffer zones will be retained and protected. A setback with a minimum depth of 30 metres is being maintained along Hitchcock Road and all existing vegetation within this area will be retained.

Integration of the site rehabilitation with the surrounding terrain

Operations have been undertaken on the Hitchcock Road site under the previous consent since November 1998. These have inevitably concentrated on the site works required for the development including retention basins and the construction of the peripheral bunds. It is too early in the life of the development, with more than 20 years of life remaining, to consider the establishment of the final landform in any detail. The area to the south of the former Crown Road has been reformed with final batter slopes which give an indication of the way in which the final landform will integrate with the surrounding area.

The final landform of the Hitchcock Road site will be influenced by the depth of extraction, the location of commercially available resource 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 previous consent and part of this area has been rehabilitated.

The existing topography and setbacks is also shown on the Site Survey Plan. Two final landforms have been developed in response to the requirements of the proposed biodiversity offset strategy.

- Strategy A comprises a large gently sloping basin with steeper side slopes along the boundary to Old Northern Road. Some of the levels have been amended to reflect changes in the extraction areas to minimise vegetation removal.
- Strategy B accommodates the retention of the woodland on the highest slopes of the site. As the high point is retained, the landform would comprise steeper slopes from those in Strategy A with substantial inward facing slopes in the northern section of the site with a large more gently sloping area in the centre. The area to the south (Lot 214 DP752039) would be the same in both strategies. This strategy is constrained by the volume of overburden available for the reshaping of the site profile so that steep slopes are unavoidable.

A decision on which strategy is to be implemented will be dependent on the success achieved in creating a re-vegetated area containing a community with the characteristics of that to be removed from the area adjacent to the former trig reserve, namely *Sydney Hinterland Transition Woodland*. This process is described in more detail in the Landscape Management Plan.

Vegetative cover

Greening Australia were commissioned to prepare a plan of management for the rehabilitation area of 2.4 hectares previously planted and for the additional area of 1.5 hectares to be rehabilitated in the next year.

Flora and fauna monitoring program

Regular monitoring of flora and fauna is a requirement of the Environmental Strategy. Results to date are encouraging. A report prepared by Parson Brinkerhoff was completed in July 2010. They recommended that the next external assessment is not required until 2012 and the report is appended as **Attachment 7A**.

Conservation of threatened species, populations and ecological communities

It is a requirement of the Environmental Strategy that all those areas to be retained and defined as needing protection will be clearly identified. Signs have been placed at intervals around the areas needing protection.

Construction of acoustic and visual bunding

Construction of the peripheral bunds has already been noted. These have now been completed including those screening the sand slurry plant.

Compliance with current environmental laws, standards and practices

All the necessary management controls and related actions are in conformity with all relevant current laws, standards and practices as indicated in the document.

Conclusion

The site rehabilitation is necessarily more in focus in the latter stages of the development. 2.5 hectares of Sydney Hinterland Transition Woodland has been planted on site. Parsons Brinckerhoff have monitored this area by reviewing plant species within four fixed (20 x 20 metre) quadrants. In general the revegetation areas appear to be regenerating well. Recommendations to improve the re-vegetation is outlined in the Executive Summary in **Attachment 7A** and will be implemented during the next two years.

Attachment 7A

Monitoring of Revegetation

Monitoring of revegetation at Hitchcock Road, Maroota

August 2010

PF Formation



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Revision	Details	Date	Amended By
00	Original		

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Author: Selga Harrington- Senior Ecologist

Signed:



Reviewer: Martin Predavec- Technical Executive Ecology

Signed:



Approved by: Martin Predavec- Technical Executive Ecology

Signed:



Date: 2 August 2010

Distribution: PF Formation, PB file

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Appendices

Appendix A	Revegetation works to date
Appendix B	Photos
Appendix C	Quadrat results

Executive summary

Expansion of PF Formation's existing sand mine at Hitchcock Road required clearing of 3.7 hectares of Sydney Hinterland Transition Woodland. It was proposed to offset this clearing with revegetation and re-creation of this community within a 7.9 hectare area on the western boundary of the site where mining has been completed. To date an area of 3 hectares has been replanted. The objectives of revegetation within the Hitchcock Road site are to:

- rehabilitate and revegetate quarried areas
- revegetate with native vegetation characteristic of the community to be removed from adjacent to the trig reserve, namely Sydney Hinterland Transition Woodland
- re-create the existing characteristics of this community, to provide an area suitable for offsetting the clearing of this community at that time.

The Department of Planning has requested that the success of this revegetation be monitored regularly and assessed against defined criteria (five, ten and fifteen year targets) to provide some certainty that this revegetation will ultimately result in the creation of a naturally regenerating patch of Sydney Hinterland Transition Woodland. Monitoring of the rehabilitation of previously mined areas is required as part of annual environmental reporting.

This report aims to:

- present the results of the monitoring survey
- analyse the results against the criteria for monitoring the success of rehabilitation and progress towards five year targets
- provide recommendations on management actions required to assist in successful re-creation of Sydney Hinterland Transition Woodland within the site and to meet the long-term goals.

A site inspection was undertaken on 5 July 2010. Four fixed quadrats (20 x 20 metres) were set up, one within the 2004 and three within the 2006 revegetation area. Within each quadrat, every species of plant present was recorded and its cover abundance estimated.

In general the revegetation areas appear to be regenerating well:

- the 2004 revegetation area met all targets except that the shrub cover was lower than the target set
- although the results from the 2006 revegetation area were variable, it should be noted that it is not yet five years since this area was revegetated. Results to date indicate that:
 - vegetation height targets were met including canopy and ground cover height and cover targets
 - natural regeneration was observed
 - native species diversity and characteristic species diversity is below target values and shrub cover too sparse and shrub and canopy not present in some areas.

Despite some good regeneration, some measures to improve the revegetation were identified. Recommendations include:

- Review proposed planting list for appropriateness, restricting species to those characteristic to Sydney Hinterland Transition Woodland or occurring within the trig reserve.
- Undertake supplementary planting in the 2006 revegetation area. This should focus on shrub species and *Eucalyptus* spp. where canopy species are absent.
- Ensure that any supplementary planting or new rehabilitation areas are planted haphazardly rather than in rows.
- Consider spraying exotic grasses where they occur densely.
- Implement erosion control measures. This could include additional planting.
- Undertake monitoring of the site in two years time.
- Keep records of all management actions (including revegetation, erosion control, rehabilitation and weeding) undertaken along with any subsequent outcomes observed during monitoring.
- Develop a revegetation plan for future areas to be revegetated. This should take into consideration the successful methods used to date and recommendations for improvement.

1. Introduction

This report presents the findings of monitoring of a rehabilitation area within the sandmining operations at Hitchcock Road, Maroota.

1.1 Background

Expansion of an existing PF Formation sand mine at Hitchcock Road required clearing of 3.7 hectares of Sydney Hinterland Transition Woodland. It was proposed to offset this clearing with revegetation and re-creation of this community within a 7.9 hectare area on the western boundary of the site where quarrying has been completed. To date an area of 3 hectares has been replanted (approximately 1 hectares in 2004 and 2 hectares in 2006) with the aim to recreate the vegetation to be removed near the former trig reserve (see Appendix A for more detail).

The Department of Planning has requested that the success of this revegetation be monitored regularly and assessed against defined criteria to provide some certainty that this revegetation will ultimately result in the creation of a naturally regenerating patch of Sydney Hinterland Transition Woodland.

Monitoring of the rehabilitation of previously mined areas is required as part of annual environmental reporting. This monitoring needs to be undertaken annually by independent consultants (not those undertaking the revegetation works), including assessment against the success criteria developed for rehabilitation within the site, as included in the consent conditions for the project.

1.2 Objectives of revegetation

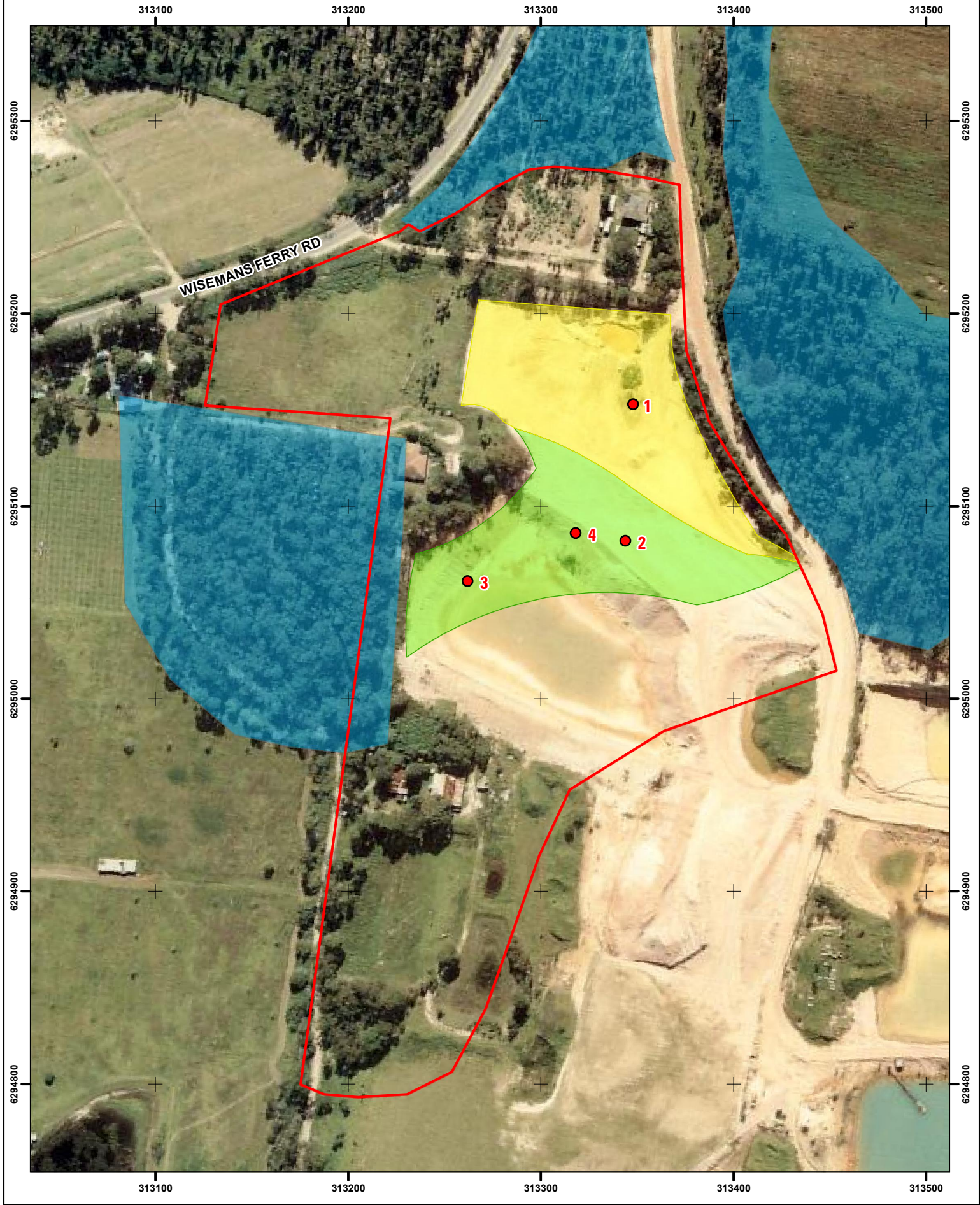
The objectives of revegetation within the Hitchcock Road site are to:

- rehabilitate and revegetate quarried areas
- revegetate with native vegetation characteristic of the community to be removed from adjacent to the trig reserve, namely Sydney Hinterland Transition Woodland
- re-create the existing characteristics of this community, to provide an area suitable for offsetting the clearing of this community at that time.

1.3 Aims of report

The aims of this report are to:

- present the results of the monitoring survey
- analyse the results against the criteria for monitoring the success of rehabilitation and progress towards five year target (Table 2-2)
- provide recommendations on management actions required to assist in successful re-creation of Sydney Hinterland Transition Woodland within the site and to meet the long-term goals.



Quadrats

Future proposed revegetation area

2004 revegetation area

2006 revegetation area

Sydney Hinterland Transition Woodland

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PDF File: 2162329A_GIS_F001_A1.mxd

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METRES

Title:

Revegetation areas
& survey sites

Project: Monitoring of revegetation at Hitchcock Road Sand Mine, Maroota

Client: PF Formation

Proj. No. 2162329A

Layout Size: A4

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PB
100%

**PARSONS
BRINCKERHOFF**

Datum: MGA 94 / Zone 56

Scale: 1:2,500

Drawn: VB

Date: 19th July, 2010

Designed: SH

Date: 19th July, 2010

Checked: SH

Date: 19th July, 2010

DWG. No: 2162329A_GIS_F001_A1

Fig. No: 1-1

2. Methodology

2.1 Nomenclature

Names of plants used in this document follow Harden (Harden 1992, 1993, 2000, 2002) with updates from PlantNet (Royal Botanic Gardens 2010) and the Australian Plant Census (Council of Heads of Australasian Herbaria 2010). Scientific names are used in this report for species of plant. Scientific and common names (where available) are provided in plant lists in Appendices A and B. Introduced species are identified within the text with an asterisk following the name, for example *Lantana camara**

2.2 Field survey

A site inspection was undertaken on 5 July 2010. Fixed quadrats (20 x 20 m) were set up with edges running in a north-south, east west direction. Quadrats were marked with stakes at the north western and south western corners of the quadrat.

Within each quadrat, every species of plant present was recorded and its cover abundance estimated using a modified braun blanquet scale:

1. <5%- rare or few individuals
2. <5% common
3. 5-25%
4. 25-50%
5. 50-75%
6. 75-100%

Additional information recorded at each quadrat site included:

- centre and south western corner of quadrat using GPS
- slope and aspect,
- landform
- soil type
- evidence of disturbance, condition
- evidence of canopy recruitment, natural regeneration
- fauna habitat values
- photographs from the south western corner of the quadrat (to the north, north east, east, south and west).

The location of quadrats is summarised in Table 2-1.

Table 2-1 Quadrat survey locations

Stratification	Quadrat identifier	Centre of site ¹		South West corner ²	
		Easting	Northing	Easting	Northing
2004 rehabilitation area	1	313348	6295163	313335	6295148
2006 rehabilitation area	2	313343	6295082	313333	6295087
	3	313262	6295061	313253	6295059
	4	313318	6295086	313306	6295077

Notes:

1) UTM, WGS 84

2) Location of photopoint and stake marking the south western corner of quadrat

2.3 Criteria to assess rehabilitation success

Field surveys were undertaken in 2008 of the vegetation to be cleared to provide data on the typical characteristics of the community provide baseline information against which the revegetation program can be assessed (Parsons Brinckerhoff 2008).

The criteria for assessment and the target values for these goals are provided in Table 2-2 on the following page.

Table 2-2 Criteria to monitor success of revegetation

Category	Criteria	Target			Condition of vegetation to be removed
		5 years	10 years	15 years	
Native species	Native species diversity (average number per 400 m ² quadrat)	20	35	40	46
	Average number of characteristic species for the site occurring within 400 m ²	15	20	27	34.5 (+/- 1.5)
	Native species cover (% of species in 400 m ² quadrat)	>50	>85	>95	99
Weeds	Weed abundance (% of vegetation cover in 400 m ² quadrat)	<50	<15	<5	<1
	Invasive or Noxious weed species (e.g. Lantana, Blackberry, exotic vines)	Controlled	Controlled	Controlled	Restricted
Vegetation structure	Vegetation structure	Canopy, shrublayer and groundcover species present. However, structure limited, generally consisting of low canopy and ground cover.	Canopy, shrublayer and groundcover species present. Structure beginning to develop.	Well structured and includes canopy, mid-storey and ground cover units	Well structured and includes canopy, mid-storey and ground cover units
Canopy ^a	Average canopy height (m)	4	8	12	12-16
	Native canopy cover (minimum % cover) [modified braun blanquet scale] ^b	5 [3]	5 [3]	5 [3]	5 [3]
Shrub layer ^a	Native shrub cover (minimum % cover) [modified braun blanquet scale] ^b	10 [3]	15 [3]	25 [4]	32.5 (+/-7.5) [4]
	Average shrub layer height (m)	0.5	1	1	1.25
Ground cover	Native ground cover (minimum % cover) [modified braun blanquet scale] ^b	5 [3]	10 [3]	10 [3]	15 (+/-5) [3]

Category	Criteria	Target			Condition of vegetation to be removed
		5 years	10 years	15 years	
Ecosystem function	Habitat values	Vegetation structure beginning to develop.	Woodland birds recorded. Habitat structure beginning to develop, including groundcover such as leaf litter and fallen timber.	Woodland birds recorded. Habitat structure beginning to develop, including groundcover such as leaf litter and fallen timber.	Provides minimal habitat for fauna, however, many woodland birds present. Well structured habitat, includes moderate levels of leaf litter and fallen timber.
	Natural regeneration indicating dispersal of seed into site and/or presence of soil seed bank	Yes	Yes	Yes	Yes
Native species	Native species diversity (average number per 400m ² quadrat)	20	35	40	46
	Average number of characteristic species for the site occurring within 400m ²	15	20	27	34.5 (+/- 1.5)
	Native species cover (% of species in 400m ² quadrat)	>50	>85	>95	99
Weeds	Weed abundance (% of vegetation cover in 400m ² quadrat)	<50	<15	<5	<1
	Invasive or Noxious weed species (e.g. Lantana, Blackberry, exotic vines)	Controlled	Controlled	Controlled	Restricted
Vegetation structure	Vegetation structure	Canopy, shrublayer and groundcover species present. However, structure limited, generally consisting of low canopy and ground cover.	Canopy, shrublayer and groundcover species present. Structure beginning to develop.	Well structured and includes canopy, mid-storey and ground cover units	Well structured and includes canopy, mid-storey and ground cover units
Canopy ^a	Average canopy height (m)	4	8	12	12-16
	Native canopy cover (minimum % cover) [modified braun blanquet scale] ^b	5 [3]	5 [3]	5 [3]	5 [3]

Category	Criteria	Target			Condition of vegetation to be removed
		5 years	10 years	15 years	
Shrub layer ^a	Native shrub cover (minimum % cover)	10	15	25	32.5 (+/-7.5)
	[modified braun blanquet scale] ^b	[3]	[3]	[4]	[4]
	Average shrub layer height (m)	0.5	1	1	1.25
Ground cover	Native ground cover (minimum % cover)	5	10	10	15 (+/-5)
	[modified braun blanquet scale] ^b	[3]	[3]	[3]	[3]
Ecosystem function	Habitat values	Vegetation structure beginning to develop.	Woodland birds recorded. Habitat structure beginning to develop, including groundcover such as leaf litter and fallen timber.	Woodland birds recorded. Habitat structure beginning to develop, including groundcover such as leaf litter and fallen timber.	Provides minimal habitat for fauna, however, many woodland birds present. Well structured habitat, includes moderate levels of leaf litter and fallen timber.
	Natural regeneration indicating dispersal of seed into site and/or presence of soil seed bank	Yes	Yes	Yes	Yes

Notes:

a) cover of canopy species and shrubs may be higher initially due to successional changes with dense growth potentially occurring initially particularly due to the presence of colonising species. Natural thinning is expected as colonising species senesce and canopy species mature, however, some thinning of vegetation may be required after 10 years if too dense.

b) Modified braun blanquet scale:

1. <5%- rare or few individuals
2. <5% common
3. 6-25%
4. 26-50%
5. 51-75%
6. 76-100%

3. Results

Photos of the vegetation within the former trig reserve and the rehabilitation area quadrat sites are provided in Appendix B. Species recorded, vegetation structure and other environmental characteristics of the quadrat sites are summarised in Appendix C.

3.1 Species of plant

A total of 74 species of plant was recorded within the site of which 60 (81%) are native. A full list of species recorded within each quadrat and the vegetation structure and is provided in Appendix C.

Fourteen introduced species were recorded within the rehabilitation area. One of these is listed as noxious under the *Noxious Weeds Act 1993* within the Hawkesbury River County Council noxious weed control area (includes Baulkham Hills Local Government Area): *Ageratina adenophora** (Crofton Weed) has a noxious weed rating of 4 meaning that the growth and spread of the plant must be controlled according to the measures specified in a management plan published by the local control authority. These are:

- Mechanical control: small areas can be dug out by hand; crowns must be removed to prevent re-growth. Heavy infestations can be controlled by regular slashing to prevent the plant from flowering.
- Chemical control- herbicide applications are most effective during late summer and autumn. Roundup®, Brushoff®, Tordon 75-D® and Banvel M® are registered for the control of crofton weed. Directions provided on herbicide label (Hawkesbury River County Council undated).

No Weed of National Significance was recorded.

3.2 Assessment against criteria

The results of the field survey were assessed against the criteria for successful revegetation, using the five year target (Table 3-1).

Generally, the targets were met for the 2004 revegetation area, except that the shrub cover was too sparse.

The results for the 2006 revegetation area were variable. Although vegetation height targets were met and canopy and ground cover targets were met and natural regeneration observed, native species diversity and characteristic species diversity is below target values and shrub cover too sparse and shrub and canopy not present in some areas.

Table 3-1 Criteria to monitor success of revegetation

Category	Criteria	Five year target	2004 revegetation area	2006 revegetation area
Native species	Native species diversity (average number per 400 m ² quadrat)	20	28	17
	Average number of characteristic species for the site occurring within 400 m ²	15	17	13
	Native species cover (% of species in quadrat that are native)	>50	88%	73%
Weeds	Weed abundance (% of vegetation cover in 400m ² quadrat)	<50	10	Variable (5-72%) Generally low, however high in patches.
	Invasive or Noxious weed species (e.g. Lantana, Blackberry, exotic vines)	Controlled	Controlled	Controlled
Vegetation structure	Vegetation structure	Canopy, shrublayer and groundcover species present. However, structure limited, generally consisting of low canopy and ground cover.	Yes	Generally true, however, some patches lack a canopy, shrub layer sparse to absent in patches
Canopy ^a	Average canopy height (m)	4	8	4.5
	Native canopy cover (minimum % cover) [modified braun blanquet scale] ^a	5 [3]	30 [4]	7 [3]
Shrub layer ^a	Native shrub cover (minimum % cover) [modified braun blanquet scale] ^a	10 [3]	2 [2]	3 [2]
	Average shrub layer height (m)	0.5	1.5m	1.6
Ground cover	Native ground cover (minimum % cover) [modified braun blanquet scale] ^a	5 [3]	23 [4]	39 [4]
	Natural regeneration indicating dispersal of seed into site and/or presence of soil seed bank	Yes	Yes	Yes (except in small localised areas)

Notes: green font indicates that target has been met or exceeded; red font indicates target hasn't been met.

4. Discussion and recommendations

In general the rehabilitation areas appear to be regenerating well:

- the 2004 revegetation area met all targets except that the shrub cover was lower than the target set
- although the results for the 2006 revegetation area were variable, it should be noted that it is not yet five years since this area was revegetated. To date indicate that:
 - vegetation height targets were met including canopy and ground cover height and cover targets
 - natural regeneration observed
 - native species diversity and characteristic species diversity is below target values and shrub cover too sparse and shrub and canopy not present in some areas.

Despite some good regeneration, some areas for improvement were identified and are summarised in **Error! Reference source not found.**

Table 4-1 Observations of the rehabilitation and recommendations to improve success

Observation	Recommendation
<i>Native species- composition and diversity</i>	
A number of species planted within the site have not been previously recorded within the Trig reserve or within Sydney Hinterland Transition Woodland.	Review proposed planting list for appropriateness, restricting species to those characteristic to Sydney Hinterland Transition Woodland or occurring within the trig reserve.
Native species diversity and number of characteristic species within 2006 revegetation area was below target	Supplementary planting should be undertaken in a haphazard pattern. This should focus on shrub species and <i>Eucalyptus</i> spp. where canopy species are absent. Plantings should be of species characteristic of Sydney Hinterland Transition Woodland. See Appendix C for suitable species.
<i>Natural regeneration</i> - was observed to be occurring within the site, both as seed dispersed into the site or from a seed bank as well as recruitment from the seed of plantings	None.
<i>Weeds</i>	
Weed abundance was generally low and restricted to the groundcover. Exotic grasses were dominant in patches.	Consider spraying exotic grasses where they occur densely.

Observation	Recommendation
Vegetation structure- Canopy, shrub layer and groundcover	
Plantings were generally done in rows, with a single or limited number of species planted for a section of the row or grid. Although some natural regeneration was noted outside the planted grid pattern, this method of planting has resulted in an artificial structure and patchy distribution of species.	Ensure that any supplementary planting or new rehabilitation areas are planted haphazardly rather than in rows.
<i>Canopy</i> growth was generally good with height and cover targets met overall. However, due to planting of single or limited number of species in an area, some areas lacked canopy species.	Supplementary planting should be undertaken in a haphazard pattern in areas lacking canopy species (i.e. lacking <i>Eucalyptus</i> spp., or <i>Syncarpia glomulifera</i>).
<i>Shrub layer</i> - Although the shrublayer height met the target, the shrublayer was sparse and did not meet the five year target for cover (% foliage cover).	Undertake supplementary planting of suitable shrub species, in a haphazard pattern.
<i>Groundcover</i> : generally good native cover.	Consider spraying exotic grasses where they occur densely.
Erosion	
Some erosion was observed within the 2006 revegetation area	Implement erosion control measures. This could include additional planting.
Monitoring and record keeping	
Monitoring has not been undertaken annually as recommended. However, based on the limited work undertaken and natural regeneration of the area, this has been appropriate.	Given that additional management of the site is unlikely to occur until next autumn and the rehabilitation is generally on target, monitoring next year is not considered necessary. Monitoring in two years time would be sufficient.
<i>Record keeping</i> of works done to date has been neglected.	Records of all management actions (including revegetation, erosion control, rehabilitation and weeding) undertaken are kept along with any subsequent outcomes observed during monitoring. This should include: <ul style="list-style-type: none"> • details of the area worked • the type of work carried out • any problems encountered • recommendations for changes in management.

Observation	Recommendation
Revegetation planning	
Revegetation has been undertaken with little documented planning	<p>A revegetation plan is developed for future areas to be revegetated. This should take into consideration the successful methods used to date and recommendations for improvement. The plan should outline the revegetation strategy for the site, including:</p> <ul style="list-style-type: none"> • identification of areas to be revegetated • topsoil storage requirements and methods of use • site preparation methods • techniques for planting including timing, use of mulch and watering • species to be used in future planting to ensure that ground cover and shrub layer species are represented • weed control methods • erosion control methods.

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Appendix A

Revegetation works to date

Revegetation works to date

To date an area of 3 hectares has been replanted with the aim to recreate the vegetation to be removed near the former trig reserve. The revegetation area is on the western boundary of the site (Figure 1-1) and further revegetation scheduled to the south as quarrying is completed. The revegetation area occurs adjacent to remnant vegetation, both within and adjacent to the site. This adjacent vegetation provides a potential seed source for natural seed dispersal into the revegetation area.

Greening Australia were commissioned to propagate tubestock from cuttings and seed from collected vegetation within the former trig reserve of the quarry to enable the revegetation of quarried areas. The first collection period occurred from late 2000 to February 2002.

Rehabilitation and revegetation has commenced with further revegetation scheduled to the south as quarrying is completed. In 2004 over one hectare of the quarry that had been previously extracted and used as a silt pond was reshaped and prepared for rehabilitation by PF Formation staff. The top soil had been stored from an adjacent area with Sydney Hinterland Transition Woodland and was spread over the site. Further seed collected over the previous 4 years was broadcast over the site in June 2004 to augment the natural soil borne native seed bank.

In 2006 an additional area of approximately two hectares that had been previously mined was prepared for revegetation. The stored top soil was distributed over the site. Greening Australia then provided over 10,000 seedlings and supervised the planting in September to November 2006 (Photo 1). An irrigation system was installed to water the plantings over that summer.

Following planting of the site, regular visual assessments of the site have been undertaken but manual weed removal has been minimal and no poisoning has been used. Observations of the establishment of revegetation within the site, suggest that weeds initially took over the site, providing soil stability but within 12 months native plants stabilized. The native plants start growing rapidly 1 to 2 years following planting and the weeds begin to die off (pers comm. P Cummins, PF Formation).

Top soil including seed bank has been stored for the next revegetation area, adjoining existing vegetated areas and the 2006 revegetated areas.



Photo 1 Revegetation works in 2006 showing planting into topsoil. Foreground area was planted in 2004

Appendix B

Photos

Vegetation within former trig site (2008)



Quadrat 1- 2004 rehabilitation area

North



East



North East- into centre of quadrat



South



West



Quadrat 2- 2006 rehabilitation

North



East



North East- into quadrat



South



West



Quadrat 3 - 2006 rehabilitation

North



East



North East- into quadrat



South



West



Quadrat 4 - 2006 rehabilitation

North



East



North East- into quadrat



South



West



Appendix C

Quadrat results

Table C. 1 **Vegetation structure**

Vegetation layer	Height: range (median) m	% foliage cover	Dominant species
Quadrat 1			
T1	4-10 (8)	30	<i>Acacia parramattensis</i> , <i>Allocasuarina littoralis</i> , <i>Eucalyptus oblonga</i> , <i>Angophora costata</i> , <i>Eucalyptus ?saligna</i>
S1	0.8-2 (1.5)	10	<i>Daviesia?</i> , <i>Acacia parramattensis</i> , <i>Allocasuarina littoralis</i> , <i>Eucalyptus spp.</i>
G1	0-0.6 (0.3)	30	<i>Entolasia stricta</i> , <i>Hypochaeris radicata</i> , <i>Paspalum dilatatum</i> , <i>Lomandra longifolia</i>
Notes:	Few weeds, good regeneration. Thin layer of leaf litter and some dead grass; No weedy shrubs, weeds present only in groundcover layer; good soil health- lots of mushrooms, soil lichens and moss; fauna habitat poor- no hollows or timber, limited groundcover, leaf litter developing; lots of birds present.		
Quadrat 2			
T1	4-8 (5)	10	<i>Acacia parramattensis</i> , <i>Angophora costata</i>
S1	1-3 (2)	10	<i>Syncarpia glomulifera</i> , <i>Hakea dactyloides</i> , <i>Hakea sericea</i>
G1	0-0.8 (0.3)	90	<i>Kikuyu</i> , <i>Senecio madagascariensis</i> , <i>Themeda australis</i> , <i>Andropogon virginicus</i> , <i>Paspalum dilatatum</i>
Notes:	Weeds dominating the groundcover; lots of native seedlings, especially of <i>Hakea sericea</i> , Poor soil health- no cryptograms or fungi; <i>Themeda australis</i> dominant in patches; poor fauna habitat - no hollows or timber, grass is dense		
Quadrat 3			
T1	2.5-5 (4)	10	<i>Acacia linifolia</i> , <i>Eucalyptus eugenioides</i> , <i>Allocasuarina littoralis</i>
S1	1-1.5 (1.2)	20	<i>Leptospermum trinervium</i> , <i>Eucalyptus eugenioides</i> , <i>Allocasuarina littoralis</i> , <i>Acacia brownii</i>
G1	0-0.8 (0.5)	80	<i>Eragrostis brownii</i> , <i>Entolasia stricta</i> , <i>Themeda australis</i> , <i>Andropogon virginicus</i> , <i>Lomandra longifolia</i>
Notes:	Few weeds, only occasional introduced grass; good regeneration of natives including seedlings from seedbank and mature plantings; good soil health- soil lichens and moss common; fauna habitat poor- no hollows or timber, sparse understory, limited leaf litter.		
Quadrat 4			
T1	-	-	-
S1	1-3 (1.6)	8	<i>Banksia ericifolia</i> , <i>Acacia spp.</i> , <i>Leptospermum trinervium</i>
G1	0-0.8 (0.2)	60	<i>Kikuyu</i> , <i>Themeda australis</i> , <i>Hypochaeris radicata</i> , <i>Andropogon virginicus</i>
Notes:	Some erosion evident; no eucalypts present; single species planted in rows; poor recruitment; fauna habitat poor- no hollows or timber, limited groundcover and leaf litter		

Notes: T1= Tree layer; S1= Shrub layer; G1=Groundcover

Table C. 2

Groundcover, vegetation cover, slope and aspect

Characteristic	Quadrat			
	1	2	3	4
Ground cover (% cover)				
Bare soil	5	6	13	33
Litter	57	2	5	0
Timber	1	0	0	0
Rock	5	2	1	5
Cryptogram	2	0	1	2
Vegetation	30	90	80	60
Ground cover vegetation (% cover)				
Native ground cover- grasses	20	15	70	25
Native ground cover- shrubs	2	2	5	2
Native ground cover- other	1	1	0	2
Exotic	7	72	5	30
Vegetation cover (% cover)				
Total native groundcover	23	18	75	24
Native overstorey	30	10	10	0
Native midstorey	10	10	20	8
Exotic cover (all layers)	10	72	5	30
Slope (degrees)	3	6	8	6
Aspect	S	S	SE	SE

Table C. 3 Species recorded

Scientific name	Common name	Exotic	Recorded within trig reserve	Species of Sydney Hinterland transition woodland	Quadrat			
					1	2	3	4
<i>Acacia brownii</i>	Heath Wattle			Y			2	2
<i>Acacia decurrens</i>	Black Wattle							
<i>Acacia falcata</i>				Y	1			
<i>Acacia fimbriata</i>	Fringed Wattle						3	1
<i>Acacia hispidula</i>				Y				
<i>Acacia linifolia</i>	Flax-leaved Wattle		Y	Y	1		1	
<i>Acacia longifolia</i>				Y				
<i>Acacia myrtifolia</i>	Red-stemmed Wattle		Y	Y	1			
<i>Acacia parramattensis</i>	Parramatta Wattle		Y	Y	4	3		
<i>Acacia parvipinnula</i>				Y				
<i>Acacia saligna</i>	Golden Wreath Wattle	*						
<i>Acacia suaveolens</i>	Sweet Wattle		Y	Y				1
<i>Acacia terminalis</i>	Sunshine Wattle		Y	Y	1	1	1	1
<i>Acacia trinervata</i>				Y				
<i>Acacia ulicifolia</i>	Heath Wattle		Y	Y			2	
<i>Acianthus fornicatus</i>	Pixie Caps		Y	Y				
<i>Actinotus helianthi</i>				Y				
<i>Ageratina adenophora</i>	Crofton Weed	*	Y					
<i>Allocasuarina littoralis</i>	Black Sheoak		Y	Y	4		3	2
<i>Allocasuarina torulosa</i>								
<i>Andropogon virginicus</i>	Whisky Grass	*				2	2	2
<i>Angophora bakeri</i>	Narrow-leaved Apple		Y	Y				
<i>Angophora costata</i>	Sydney Red Gum		Y	Y	2	3	2	
<i>Anisopogon avenaceus</i>				Y				
<i>Araujia sericifera</i>	Moth Vine	*	Y					

Scientific name	Common name	Exotic	Recorded within trig reserve	Species of Sydney Hinterland transition woodland	Quadrat			
					1	2	3	4
<i>Aristida benthamii</i>				Y				
<i>Aristida vagans</i>	Threeawn Speargrass		Y	Y				
<i>Aristida warburgii</i>				Y				
<i>Astroloma humifusum</i>				Y				
<i>Astroloma pinifolium</i>				Y				
<i>Austrodanthonia fulva</i>				Y				
<i>Austrodanthonia tenuior</i>				Y				
<i>Austrostipa pubescens</i>			Y	Y				
<i>Banksia ericifolia</i>	Heath Banksia							2
<i>Banksia integrifolia</i>								2
<i>Banksia oblongifolia</i>						2		1
<i>Banksia spinulosa</i> var. <i>spinulosa</i>				Y				
<i>Billardiera scandens</i>	Appleberry		Y	Y				
<i>Boronia polygalifolia</i>			Y					
<i>Bossiaea lenticularis</i>			Y	Y				
<i>Bossiaea lenticularis</i>					1			
<i>Bossiaea obcordata</i>			Y	Y				
<i>Bossiaea rhombifolia</i> subsp. <i>rhombifolia</i>				Y				
<i>Breynia oblongifolia</i>	Coffee Bush		Y					
<i>Brunoniella pumilio</i>	Dwarf Blue Trumpet		Y	Y	1			
<i>Bursaria spinosa</i>	Native Blackthorn							
<i>Caesia parviflora</i>				Y				
<i>Callistemon linearis</i>				Y				
<i>Callistemon rigidus</i>				Y				
<i>Cassytha glabella</i>				Y				

Scientific name	Common name	Exotic	Recorded within trig reserve	Species of Sydney Hinterland transition woodland	Quadrat			
					1	2	3	4
<i>Cassytha pubescens</i>				Y				
<i>Caustis flexuosa</i>				Y				
<i>Ceratopetalum apetalum</i>	Coachwood		Y					
<i>Cheilanthes sieberi</i>				Y				
<i>Clematis aristata</i>			Y					
<i>Comesperma ericinum</i>	Pyramid flower		Y					
<i>Conyza bonariensis</i>	Flaxleaf Fleabane	*	Y					
<i>Corymbia eximia</i>				Y				
<i>Corymbia gummifera</i>	Red Bloodwood		Y	Y				
<i>Cyathochaeta diandra</i>				Y				
<i>Cynodon dactylon</i>	Common Couch					3		4
<i>Daviesia acicularis</i>				Y				
<i>Daviesia corymbosa</i>				Y	2			
<i>Daviesia genistifolia</i>	Broom Bitter Pea			Y			1	
<i>Daviesia squarrosa</i>				Y				
<i>Dianella caerulea</i>			Y	Y				
<i>Dianella prunina</i>			Y	Y		1		1
<i>Dianella revoluta</i> var. <i>revoluta</i>				Y				
<i>Dillwynia acicularis</i>				Y				
<i>Dillwynia parvifolia</i>				Y				
<i>Dillwynia retorta</i>				Y			1	
<i>Dodonaea pinnata</i>				Y				
<i>Dodonaea triquetra</i>				Y				
<i>Drosera auriculata</i>				Y				
<i>Echinopogon caespitosus</i> var. <i>caespitosus</i>				Y				

Scientific name	Common name	Exotic	Recorded within trig reserve	Species of Sydney Hinterland transition woodland	Quadrat			
					1	2	3	4
<i>Einadia hastata</i>	Berry Saltbush		Y					
<i>Entolasia stricta</i>	Wiry Panic		Y	Y	4		3	
<i>Entolasia whiteana</i>				Y				
<i>Epacris pulchella</i>	NSW Coral Heath			Y				
<i>Epacris purpurascens</i> var. <i>purpurascens</i>				Y				
<i>Eragrostis benthamii</i>				Y				
<i>Eragrostis brownii</i>	Brown's Lovegrass			Y	2		3	
<i>Eriostemon australasius</i>				Y				
<i>Eucalyptus beyeriana</i>				Y				
<i>Eucalyptus crebra</i>				Y				
<i>Eucalyptus eugenioides</i>	Thin-leaved Stringybark		Y	Y			3	
<i>Eucalyptus notabilis</i>				Y				
<i>Eucalyptus oblonga</i>	Stringybark			Y	1			
<i>Eucalyptus pilularis</i>				Y				
<i>Eucalyptus punctata</i>	Grey Gum		Y	Y	1			
<i>Eucalyptus resinifera</i> subsp. <i>resinifera</i>				Y				
<i>Eucalyptus ?saligna</i>					2			
<i>Eucalyptus scias</i> subsp. <i>scias</i>				Y				
<i>Eucalyptus sclerophylla</i>			Y	Y				
<i>Eucalyptus sparsifolia</i>	Narrow-leaved Stringybark		Y	Y				
<i>Eucalyptus squamosa</i>				Y				

Scientific name	Common name	Exotic	Recorded within trig reserve	Species of Sydney Hinterland transition woodland	Quadrat			
					1	2	3	4
<i>Exocarpos cupressiformis</i>	Native Cherry				1			
<i>Exocarpos strictus</i>	Dwarf Cherry		Y	Y				
<i>Glycine clandestina</i>			Y	Y	2			
<i>Glycine tabacina</i>			Y	Y	1			
<i>Gnaphalium</i> sp.						1		1
<i>Gompholobium glabratum</i>	Dainty Wedge Pea		Y	Y				
<i>Gompholobium grandiflorum</i>				Y				
<i>Gompholobium inconspicuum</i>				Y				
<i>Gompholobium minus</i>				Y				
<i>Gompholobium pinnatum</i>				Y				
<i>Gompholobium uncinatum</i>				Y				
<i>Gonocarpus tetragynus</i>				Y				
<i>Gonocarpus teucroides</i>							1	
<i>Goodenia bellidifolia</i> subsp. <i>bellidifolia</i>			Y	Y				
<i>Goodenia hederacea</i> subsp. <i>hederacea</i>				Y				
<i>Goodenia heterophylla</i>			Y	Y				
<i>Grevillea buxifolia</i> subsp. <i>buxifolia</i>	Grey Spider Flower		Y	Y				
<i>Grevillea diffusa</i>				Y				
<i>Grevillea longifolia</i>				Y				
<i>Grevillea mucronulata</i>				Y				

Scientific name	Common name	Exotic	Recorded within trig reserve	Species of Sydney Hinterland transition woodland	Quadrat			
					1	2	3	4
<i>Grevillea parviflora</i> subsp. <i>parviflora</i>				Y				
<i>Grevillea phyllicoides</i>				Y				
<i>Grevillea sericea</i>				Y				
<i>Grevillea sphacelata</i>				Y				
<i>Haemodorum planifolium</i>				Y				
<i>Hakea dactyloides</i>	Broad-leaved Hakea			Y		2	2	1
<i>Hakea sericea</i>			Y	Y		2	2	2
<i>Hardenbergia violacea</i>	False Sarsaparilla		Y	Y	1			
<i>Hibbertia aspera</i> subsp. <i>aspera</i>				Y				
<i>Hibbertia circumdans</i>					2	1		
<i>Hibbertia bracteata</i>				Y				
<i>Hibbertia diffusa</i>				Y				
<i>Hibbertia serpyllifolia</i>				Y				
<i>Hibbertia</i> sp.							1	
<i>Hovea linearis</i>			Y	Y				
<i>Hybanthus monopetalus</i>				Y				
<i>Hypochaeris radicata</i>	Catsear	*			2	3	2	2
<i>Imperata cylindrica</i> var. <i>major</i>	Bladey Grass		Y	Y			2	
<i>Isopogon anemonifolius</i>				Y				
<i>Jacksonia scoparia</i>				Y				
<i>Juncus</i> sp.			Y					
<i>Kunzea ambigua</i>	Tick Bush			Y			1	

Scientific name	Common name	Exotic	Recorded within trig reserve	Species of Sydney Hinterland transition woodland	Quadrat			
					1	2	3	4
<i>Lagenifera gracilis</i>				Y				
<i>Lambertia formosa</i>	Mountain Devil			Y				
<i>Lasiopetalum ferrugineum</i>				Y				
<i>Lasiopetalum rufum</i>				Y				
<i>Laxmannia gracilis</i>				Y				
<i>Lepidosperma latens</i>				Y				
<i>Lepidosperma laterale</i>			Y	Y	1			
<i>Leptomeria acida</i>				Y				
<i>Leptospermum parvifolium</i>				Y				
<i>Leptospermum trinervium</i>				Y	3			2
<i>Leucopogon juniperinus</i>			Y				2	
<i>Leucopogon lanceolatus</i>	Lance Beard Heath		Y					
<i>Leucopogon muticus</i>				Y				
<i>Leucopogon virgatus</i>				Y				
<i>Lindsaea microphylla</i>				Y				
<i>Lissanthe sapida</i>				Y				
<i>Lissanthe strigosa</i>				Y				
<i>Lobelia gracilis</i>				Y				
<i>Logania pusilla</i>				Y				
<i>Lomandra confertifolia</i> subsp. <i>rubiginosa</i>				Y				
<i>Lomandra cylindrica</i>				Y				

Scientific name	Common name	Exotic	Recorded within trig reserve	Species of Sydney Hinterland transition woodland	Quadrat			
					1	2	3	4
<i>Lomandra filiformis</i> subsp. <i>coriacea</i>				Y				
<i>Lomandra filiformis</i> subsp. <i>filiformis</i>				Y				
<i>Lomandra glauca</i>				Y				
<i>Lomandra gracilis</i>			Y	Y				
<i>Lomandra longifolia</i>	Spiny-headed Mat-rush		Y		2		2	1
<i>Lomandra multiflora</i> subsp. <i>multiflora</i>			Y	Y				
<i>Lomandra obliqua</i>			Y	Y				
<i>Lomatia silaifolia</i>	Crinkle Bush		Y	Y				
<i>Macrozamia spiralis</i>			Y	Y				
<i>Melaleuca nodosa</i>				Y				
<i>Micrantheum ericoides</i>				Y				
<i>Mirbelia rubiifolia</i>				Y				
<i>Monotoca scoparia</i>				Y				
<i>Myrsiphyllum asparagoides</i>	Florist's Smilax	*	Y					
<i>Olearia microphylla</i>				Y				
<i>Opercularia diphylla</i>				Y				
<i>Opercularia varia</i>				Y				
<i>Oxalis perennans</i>					1			
<i>Oxylobium ilicifolium</i>	Prickly Shaggy Pea		Y		1			
<i>Ozothamnus diosmifolius</i>	White Dogwood		Y	Y	1			
<i>Pandorea pandorana</i>	Wonga Vine		Y					

Scientific name	Common name	Exotic	Recorded within trig reserve	Species of Sydney Hinterland transition woodland	Quadrat			
					1	2	3	4
<i>Panicum simile</i>	Two-colour Panic		Y	Y	2			
<i>Paspalum dilatatum</i>	Paspalum	*			2	2		2
<i>Passiflora sp.</i>	Passionfruit		Y					
<i>Patersonia glabrata</i>				Y				
<i>Patersonia longifolia</i>				Y				
<i>Patersonia sericea</i>				Y				
<i>Pennisetum clandestinum</i>	Kikuyu	*			2		2	
<i>Persoonia hirsuta</i>	Hairy Geebung			Y				
<i>Persoonia lanceolata</i>				Y				
<i>Persoonia laurina</i>				Y				
<i>Persoonia levis</i>	Broad-leaved Geebung			Y	1			
<i>Persoonia linearis</i>	Narrow-leaved Geebung		Y	Y				
<i>Persoonia oblongata</i>				Y				
<i>Persoonia pinifolia</i>				Y				
<i>Petrophile pulchella</i>				Y				
<i>Petrophile sessilis</i>				Y				
<i>Philothea hispidula</i>				Y				
<i>Phyllanthus hirtellus</i>				Y				
<i>Pimelea curviflora</i> var. <i>curviflora</i>				Y				
<i>Pimelea linifolia</i> subsp. <i>linifolia</i>				Y				
<i>Pittosporum undulatum</i>	Sweet Pittosporum		Y					
<i>Plantago lanceolata</i>	Lamb's Tongues	*				1	1	

Scientific name	Common name	Exotic	Recorded within trig reserve	Species of Sydney Hinterland transition woodland	Quadrat			
					1	2	3	4
<i>Platysace ericoides</i>				Y				
<i>Platysace lanceolata</i>			Y					
<i>Platysace linearifolia</i>				Y				
<i>Poa labillardierei</i> var. <i>labillardierei</i>			Y					
<i>Podolobium scandens</i>				Y				
<i>Polyscias sambucifolia</i>	Elderberry Panax		Y					
<i>Pomax umbellata</i>			Y	Y				
<i>Poranthera microphylla</i>			Y					
<i>Pratia purpurascens</i>	Whiteroot		Y	Y				
<i>Prostanthera howelliae</i>				Y				
<i>Pteridium esculentum</i>	Bracken		Y					
<i>Pteridium esculentum</i>	Bracken							
<i>Pterostylis acuminata</i>				Y				
<i>Pterostylis longifolia</i>				Y				
<i>Pultenaea ferruginea</i>				Y				
<i>Pultenaea microphylla</i>			Y					
<i>Pultenaea polifolia</i>				Y				
<i>Pultenaea scabra</i>			Y	Y				
<i>Pultenaea tuberculata</i>				Y				
<i>Pultenaea villosa</i>				Y				
<i>Scaevola ramosissima</i>			Y	Y				
<i>Schizaea bifida</i>				Y				

Scientific name	Common name	Exotic	Recorded within trig reserve	Species of Sydney Hinterland transition woodland	Quadrat			
					1	2	3	4
<i>Schoenus imberbis</i>				Y				
<i>Senecio madagascariensis</i>	Fireweed	*				2		2
<i>Setaria gracilis</i>	Slender Pigeon Grass	*						
<i>Sida rhombifolia</i>	Paddy's Lucerne	*	Y		1	1		1
<i>Solanum mauritianum</i>	Wild Tobacco Bush	*	Y					
<i>Solanum nigrum</i>	Black-berry Nightshade	*	Y					
<i>Sonchus oleraceus</i>	Common Sowthistle	*	Y					
<i>Stylidium</i> sp.							1	
<i>Styphelia laeta</i> subsp. <i>laeta</i>				Y				
<i>Syncarpia glomulifera</i> subsp. <i>glomulifera</i>	Turpentine		Y	Y		2	2	1
<i>Thelymitra pauciflora</i>				Y				
<i>Themeda australis</i>	Kangaroo Grass		Y	Y		3	3	3
<i>Thysanotus tuberosus</i> subsp. <i>tuberosus</i>				Y				
<i>Trachymene incisa</i> subsp. <i>incisa</i>				Y				
<i>Tricoryne simplex</i>				Y				
<i>Trifolium</i> sp.		*				2		
<i>Verbena bonariensis</i>	Purpletop	*				1		
<i>Veronica plebeia</i>	Trailing Speedwell		Y					
<i>Vicia sativa</i>		*				2		1
<i>Wahlenbergia stricta</i>	Tall Bluebell							
<i>Xanthorrhoea concava</i>				Y				

Scientific name	Common name	Exotic	Recorded within trig reserve	Species of Sydney Hinterland transition woodland	Quadrat			
					1	2	3	4
<i>Xanthorrhoea media</i>				Y				
<i>Xanthorrhoea minor subsp. minor</i>				Y				
<i>Xanthorrhoea resinifera</i>				Y				
<i>Xanthorrhoea sp.</i>	Grass tree		Y					
<i>Xanthosia pilosa</i>				Y				
<i>Xanthosia tridentata</i>				Y				
<i>Xylomelum pyriforme</i>	Woody Pear		Y	Y				
?Unknown native (rosette)						1		

Notes:

Cover abundance scores:

1. 5%- rare or few individuals
2. <5% common
3. 5-25%
4. 25-50%
5. 50-75%
6. 75-100%

Chapter Eight

SOCIAL IMPACT MANAGEMENT

Community representatives participate in the Community Consultative Committee which has met twice during the year. Minutes of these meetings are included as **Attachment 8A**.

**Community Consultative Committee
Hitchcock Road and Lot 198 Maroota
Sand Extraction and Rehabilitation Projects**

**Minutes
6 November 2009**

Attendance

Kristine McKenzie – Baulkham Hills Shire Council (BHSC) - Chairperson
Robert Buckham – Baulkham Hills Shire Council (BHSC)
Daniel Giffney – Baulkham Hills Shire Council (BHSC)
Marianne Sheumack – Resident
Shaunagh Hitchcock – Resident
David Fingland – DFA Consultants
John Graham – PF Formation
Peter Cummins – PF Formation

Apology

Liz McAuley – Resident
Kane Winwood – Planning NSW
Joshua Graham – PF Formation

Minutes of Previous Meeting

- Accepted

Report on Current Status of Operations by John Graham

- No complaints received in the previous six months
- Operations have continued in a stable manner
- The main extraction area is on the eastern side of the site.
- New steel rubber-lined pipeline is on site and will be installed by Christmas
- The Lot 198 sediment dam will be drained and cleaned out over the Christmas period to increase the storage capacity

Reporting

- The Noise Management Plan, Air Quality Monitoring Program, Water Management Plan and Environmental Strategy incorporating the above have been approved by the Department of Planning and are available for viewing on the website.
- A Landscape Management Plan including a Rehabilitation and Offset Management Plan and Quarry Closure Plan has been drafted and is awaiting approval by PB (PF Formation specialist consultants) and then the Department of Planning. Upon approval it will be placed on the website.
- An Annual Environment Management Report based on the year ending 30 June 2009 and covering both the old and new consent has been submitted and approved by the Department of Planning NSW. This report will be put up on the website in the next couple of weeks. A printed copy was given to Marianne Sheumack to be kept at the Maroota Resource Centre
- An Independent Environment Audit will be undertaken during this year and every three years after that.

Environmental Review

- Results for the dust deposit gauges were reviewed. The low results for September 2009 were surprising given the massive dust storm around the 23 September 2009.
- PM10 results at the school TEOM for the 12 month period to 1 March 2009 were discussed. The results were well within the DECCW goals for PM10 monitoring.
- The approach to noise monitoring has changed as the PF Formation monitoring equipment is broken and is getting repaired. Consultants will conduct testing within the reporting year to assess the noise and recommend future testing methods.

Site Visit

- A full site inspection was conducted.

Next Meeting

- Friday 10.00 am Friday 7 May 2010

**Community Consultative Committee
Hitchcock Road and Lot 198 Maroota
Sand Extraction and Rehabilitation Projects**

**Minutes
17 May 2010**

Attendance

Kristine McKenzie – Baulkham Hills Shire Council (BHSC) - Chairperson
Robert Buckham – Baulkham Hills Shire Council (BHSC)
Daniel Giffney – Baulkham Hills Shire Council (BHSC)
David Gathercole – Department of Environment, Climate Change & Water
Marianne Sheumack – Resident
Shaunagh Hitchcock – Resident
David Fingland – DFA Consultants
John Graham – PF Formation
Peter Cummins – PF Formation
Joshua Graham – PF Formation

Minutes of Previous Meeting

- Accepted

Report on Current Status of Operations by John Graham

- No complaints received in the previous six months
- Operations have continued in a routine manner
- The main project during the period was the de-silting of the main dam on Lot 198. The sediment out of the sand and surface run-off drains through a pre-sediment trap and into the dam below the production area. Capacity was reduced and in January the dam was emptied and cleaned out. A new submersible pump has been installed and is working well to prevent the silt entering the dam.
- The new steel rubber-lined pipeline has been installed.
- Greening Australia were commissioned over two months ago to prepare a plan to rehabilitate a further 1.5 hectares and supplement the area already planted. They are to advise on seeds in stock and recommendations as to how much further seed will have to be collected. Given the delays encountered the planting will probably now occur in autumn 2011.
- Quarterly Safety and Environmental meetings with staff have continued to encourage all staff to take responsibility for environment and rehabilitation matters.

Reporting

- The Noise Management Plan, Air Quality Monitoring Program, Water Management Plan and Environmental Strategy incorporating the above have been approved by the Department of Planning and are available for viewing on the website.
- The third draft of the Landscape Management Plan including a Rehabilitation and Offset Management Plan and Quarry Closure Plan has been sent to the Department of Planning. Upon approval it will be placed on the website.

- An Annual Environment Management Report based on the year ending 30 June 2009 and covering both the old and new consent has been submitted and approved by the Department of Planning NSW. This report is available on the website.
- An Independent Environment Audit will be undertaken during this year and every three years after that. We are awaiting approval from the Department of Planning of the nominated auditor. On receipt of this approval the audit will commence
- The 2010 Annual Environmental Management Report will be prepared during June and July.

Environmental Review

- Results for the dust deposit gauges were reviewed.
- Other environmental reporting was discussed

Other Matters

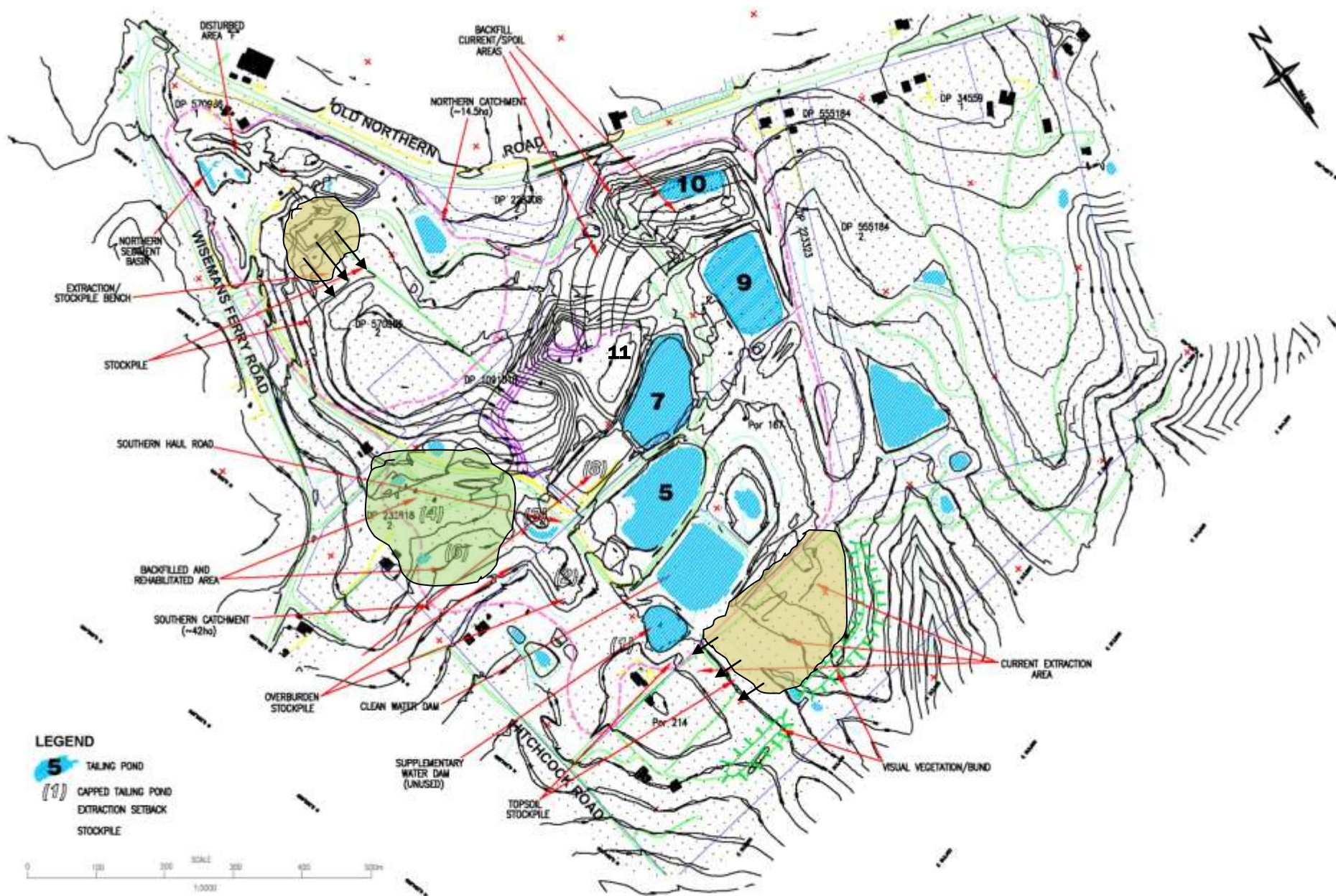
- Lot 1 DP 595538 (Accursos) has received approval from Hills Shire Council for this small development. The site has been cleared and all extraction should be completed within two years.
- Old Telegraph Road development was acquired in 2009 and the Annual Management Plan is currently being prepared. In conjunction with the annual reporting PF Formation is liaising with Hornsby Shire Council with regard to all the consent conditions.

Site Visit

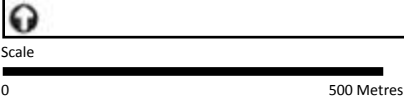
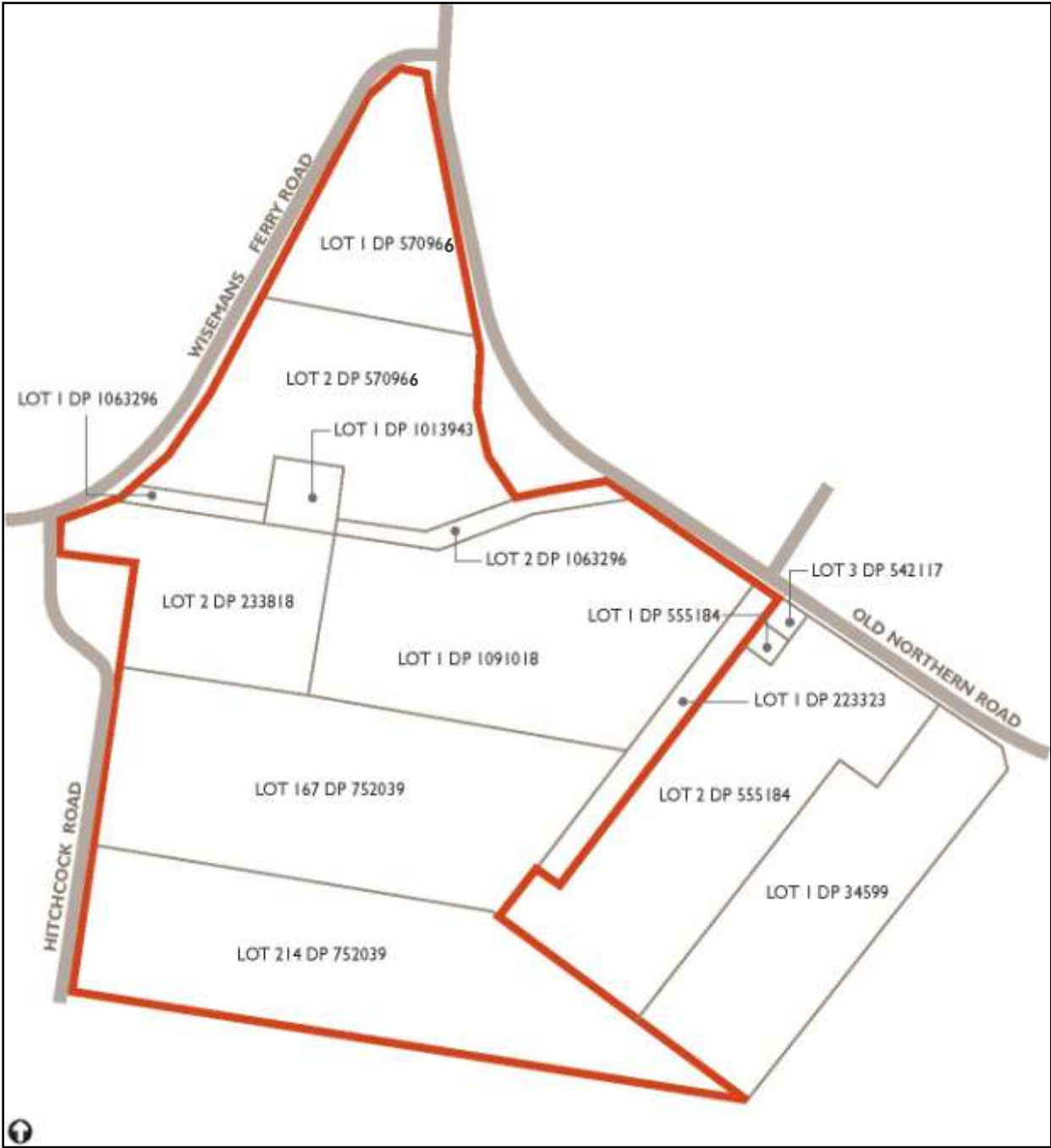
- A full site inspection including the Lot 1 DP595538 Old Northern Road Maroota site was conducted.

Next Meeting

- Friday 10.00 am Friday 5 November 2010



Site Survey Plan



LOTS INCLUDED IN THE DEVELOPMENT

Boundary of the proposed extraction area



Photo 1: Extraction area - Lot 214 DP572039



Photo 2: Extraction Area - Lot 1 DP570966



Photo 3: Tailings Pond 5



Photo 4: Tailings Pond 7



Photo 5: Tailings Pond 9 (in current use)



Photo 6: Tailings Pond 10 (in current use)



Photo 7: clean water dam, Lot 167



Photo 8: Lot 198 Dam being cleaned out in January 2010



Photo 9: Lot 198 Dam after clean out



Photo 10: Rehabilitation Area



Photo 11: Rehabilitation Area



Photo 12: Rehabilitation Area

Summary of Monitoring Results

Noise Monitoring	2010	2009
→ Noise from operational activities exceed guidelines	NIL	NIL
→ Complaints received	NIL	NIL
Air Quality		
Monthly dust deposit - average g/m ² /month (from all sources)		
→ Location 1 - behind Maroota Primary School	2.27	4.05 ①
→ Location 2 - Hitchcock & Wisemans Ferry Roads	2.18	6.04 ① ②
→ Location 3 - Jurd's Residence	2.55	3.14
① results impacted by back burning in September 2008 (10.66, 12.60 respectful)		
② results impacted by ploughing in July 2008 (21.97)		
→ Complaints received	NIL	NIL
→ Plant exhaust deficiency when vehicles serviced	NIL	NIL
Access & Traffic		
→ Traffic movements within limits	YES	YES
Erosion & Sediment Control		
→ Sediment leaving site	NIL	NIL
Water Management		
→ Evidence of issue with groundwater quality	NIL	NIL
Rehabilitation		
→ Area vegetated	2.4 hectares	2.4 hectares
Overall number of complaints received	NIL	NIL

Attachment 3B

Environmental Manager's Monthly Checklists

PF FORMATION

HITCHCOCK ROAD MAROOTA - Sand Extraction and Rehabilitation Project
EMP MANAGEMENT CONTROLS OPERATIONAL CHECKLIST - ENVIRONMENTAL MANAGER

June 2010

STRATEGY POINT	PAGE NO	DESCRIPTION	STATUS ✓ or ✗	COMPLAINTS RECEIVED	COMMENTS
A2	A3-A5	Noise	✓	Nil	Noise monitoring has been undertaken by Koikas Acoustics and a report will be prepared for the 2009-2010 AEMR
A3	A6-A10	Air Quality	✓	Nil	Deposited dust results for May 2010 show low levels at all locations.
A4	A11-A12	Access and Traffic	✓	Nil	Audit of trucks leaving site was undertaken on 10th June 2010. 7 trucks recorded leaving site between 6:00 and 7:00 am.
A5	A13-A16	Erosion & Sediment Control	✓	Nil	No water or sediment left site during this month. Downstream Lot 198 water samples were collected and sent to laboratory for analysis.
A6	A17-A20	Water	✓	Nil	URS attended site to collect bore monitoring data and groundwater samples. A groundwater report will be prepared for the AEMR.
A7	A21-A25	Rehabilitation & Vegetation offset	✓	Nil	A proposed rehabilitation plan has been received from Greening Australia and is being reviewed. PB also attended site to inspect
A8	A26-A27	Social Impact	✓	Nil	existing rehabilitation areas and advise of further action that may be required. A report from PB to be included in the AEMR.
A9	A28-A29	Heritage	✓	Nil	
A10	A30-A32	Visual Amenity	✓	Nil	
A11	A33-A35	Waste Management	✓	Nil	
A12	A36-A37	Emergency Response	✓	Nil	
A13	A38-A41	Hazard, Risk and Safety	✓	Nil	

Key:

✓ = Satisfactory

✗ = Unsatisfactory

Completed by Environmental Manager (Josh Graham)

Signed:

Adam

Date: 30th June 2010

PF FORMATION

HITCHCOCK ROAD MAROOTA - Sand Extraction and Rehabilitation Project
EMP MANAGEMENT CONTROLS OPERATIONAL CHECKLIST - ENVIRONMENTAL MANAGER

May 2010

STRATEGY POINT	PAGE NO	DESCRIPTION	STATUS ✓ or ✗	COMPLAINTS RECEIVED	COMMENTS
A2	A3-A5	Noise	✓	Nil	Koikas Acoustics will be preparing a Noise Report to be included in the 2009 - 2010 AEMR.
A3	A6-A10	Air Quality	✓	Nil	Deposited dust results for April 2010 show low levels at all locations.
A4	A11-A12	Access and Traffic	✓	Nil	Audit of trucks leaving site was undertaken on 29th May 2010. 6 trucks recorded leaving site between 6:00 and 7:00 am.
A5	A13-A16	Erosion & Sediment Control	✓	Nil	No water or sediment left site during this month despite heavy rain.
A6	A17-A20	Water	✓	Nil	BH02 is still not in use due to iron incrustation problems. URS will be preparing a Groundwater Report for the 09-10 AEMR.
A7	A21-A25	Rehabilitation & Vegetation offset	✓	Nil	An industrial weed sprayer has been purchased to spray weeds in topsoil so it can be used to rehabilitate more area.(1.5 ha)
A8	A26-A27	Social Impact	✓	Nil	Community Consultative Meeting held on 17th May 2010. Minutes are available on website.
A9	A28-A29	Heritage	✓	Nil	
A10	A30-A32	Visual Amenity	✓	Nil	
A11	A33-A35	Waste Management	✓	Nil	
A12	A36-A37	Emergency Response	✓	Nil	
A13	A38-A41	Hazard, Risk and Safety	✓	Nil	

Key:

✓ = Satisfactory

✗ = Unsatisfactory

Completed by Environmental Manager (Josh Graham)

Signed: 

Date: 31st May 2010

PF FORMATION

HITCHCOCK ROAD MAROOTA - Sand Extraction and Rehabilitation Project
EMP MANAGEMENT CONTROLS OPERATIONAL CHECKLIST - ENVIRONMENTAL MANAGER

April 2010

STRATEGY POINT	PAGE NO	DESCRIPTION	STATUS ✓ or ✗	COMPLAINTS RECEIVED	COMMENTS
A2	A3-A5	Noise	✓	Nil	An annual report by noise consultants will be prepared for the EMP.
A3	A6-A10	Air Quality	✓	Nil	Deposited dust results for March 2010 show low levels at all locations.
A4	A11-A12	Access and Traffic	✓	Nil	Audit of trucks leaving site was undertaken on 13th April 2010. 7 trucks recorded leaving site between 6:00 and 7:00 am
A5	A13-A16	Erosion & Sediment Control	✓	Nil	No water or sediment left site during this month.
A6	A17-A20	Water	✓	Nil	BH02 is still not in use due to iron incrustation problems. Pumping volumes for 10SL055663 have been forwarded to DWE as requested.
A7	A21-A25	Rehabilitation & Vegetation offset	✓	Nil	The Landscape Management Plan has yet to be approved by DOP.
A8	A26-A27	Social Impact	✓	Nil	
A9	A28-A29	Heritage	✓	Nil	
A10	A30-A32	Visual Amenity	✓	Nil	
A11	A33-A35	Waste Management	✓	Nil	
A12	A36-A37	Emergency Response	✓	Nil	
A13	A38-A41	Hazard, Risk and Safety	✓	Nil	

Key:

✓ = Satisfactory

✗ = Unsatisfactory

Completed by Environmental Manager (Josh Graham)

Signed:

Josh Graham

Date: 30th April 2010

PF FORMATION

HITCHCOCK ROAD MAROOTA - Sand Extraction and Rehabilitation Project
EMP MANAGEMENT CONTROLS OPERATIONAL CHECKLIST - ENVIRONMENTAL MANAGER

MARCH 2010

STRATEGY POINT	PAGE NO	DESCRIPTION	STATUS ✓ or ✗	COMPLAINTS RECEIVED	COMMENTS
A2	A3-A5	Noise	✓	Nil	No monitoring undertaken this month. An annual report by noise consultants will be prepared for the EMP.
A3	A6-A10	Air Quality	✓	Nil	Deposited dust results for Feb 2010 show low levels at Sites 2,3 & 4 but high results at Site 1. This is probably due to construction activity at MPS.
A4	A11-A12	Access and Traffic	✓	Nil	Audit of trucks leaving site was undertaken on 18th March 2010. 4 trucks recorded leaving site between 6:00 and 7:00 am
A5	A13-A16	Erosion & Sediment Control	✓	Nil	No water or sediment left site during this month. Downstream Lot 198 water samples were taken and results recorded. 178mm Rainfall for Feb 2010
A6	A17-A20	Water	✓	Nil	BH02 is still not in use due to iron incrustation problems.
A7	A21-A25	Rehabilitation & Vegetation offset	✓	Nil	The Landscape Management plan has yet to be finalised with DOP. DFA Consultants are handling recent RFI from the department.
A8	A26-A27	Social Impact	✓	Nil	
A9	A28-A29	Heritage	✓	Nil	
A10	A30-A32	Visual Amenity	✓	Nil	
A11	A33-A35	Waste Management	✓	Nil	
A12	A36-A37	Emergency Response	✓	Nil	
A13	A38-A41	Hazard, Risk and Safety	✓	Nil	

Key:

✓ = Satisfactory

✗ = Unsatisfactory

Completed by Environmental Manager (Josh Graham)

Signed: 

Date: 31st March 2010

PF FORMATION

HITCHCOCK ROAD MAROOTA - Sand Extraction and Rehabilitation Project
EMP MANAGEMENT CONTROLS OPERATIONAL CHECKLIST - ENVIRONMENTAL MANAGER

FEBRUARY 2010

STRATEGY POINT	PAGE NO	DESCRIPTION	STATUS ✓ or ✗	COMPLAINTS RECEIVED	COMMENTS
A2	A3-A5	Noise	✓	Nil	No monitoring undertaken this month. An annual report by noise consultants will be prepared for the EMP.
A3	A6-A10	Air Quality	✓	Nil	Deposited dust results for January 2010 show low levels at all locations.
A4	A11-A12	Access and Traffic	✓	Nil	Audit of trucks leaving site between 6-7am was undertaken on 1st February 2010. Five trucks recorded leaving leaving site.
A5	A13-A16	Erosion & Sediment Control	✓	Nil	No water or sediment left site during this month. De silting of the main clean water dam has been completed.
A6	A17-A20	Water	✓	Nil	BH02 is still not in use due to iron incrustation problems.
A7	A21-A25	Rehabilitation & Vegetation offset	✓	Nil	Greening Australia has undertaken an assessment of our new area to rehabilitate. (6/02/10) Recommendations have been noted.
A8	A26-A27	Social Impact	✓	Nil	
A9	A28-A29	Heritage	✓	Nil	
A10	A30-A32	Visual Amenity	✓	Nil	
A11	A33-A35	Waste Management	✓	Nil	
A12	A36-A37	Emergency Response	✓	Nil	
A13	A38-A41	hazard, Risk and Safet	✓	Nil	

Key:

✓ = Satisfactory

✗ = Unsatisfactory

Completed by Environmental Manager (Josh Graham)

Signed:

Josh Graham

Date: 26th February 2010

PF FORMATION

HITCHCOCK ROAD MAROOTA - Sand Extraction and Rehabilitation Project
EMP MANAGEMENT CONTROLS OPERATIONAL CHECKLIST - ENVIRONMENTAL MANAGER

January 2010

STRATEGY POINT	PAGE NO	DESCRIPTION	STATUS ✓ or ✗	COMPLAINTS RECEIVED	COMMENTS
A2	A3-A5	Noise	✓	Nil	No monitoring undertaken this month. An annual report by noise consultants will be prepared for the EMP.
A3	A6-A10	Air Quality	✓	Nil	Deposited dust results for December 2009 show low levels at all locations.
A4	A11-A12	Access and Traffic	✓	Nil	Audit of trucks leaving site between 6-7 am was undertaken on 14th January 2009. Five trucks recorded leaving site.
A5	A13-A16	Erosion & Sediment Control	✓	Nil	No water or sediment left site during this month. De silting of the main clean water dam has commenced. This will increase capacity for water storage.
A6	A17-A20	Water	✓	Nil	BH02 is still not in use due to iron incrustation problems.
A7	A21-A25	Rehabilitation & Vegetation offset	✓	Nil	A meeting with Greening Australia has been arranged for February to inspect current rehab sites and discuss methods for new rehab areas.
A8	A26-A27	Social Impact	✓	Nil	Normal
A9	A28-A29	Heritage	✓	Nil	Normal
A10	A30-A32	Visual Amenity	✓	Nil	Normal
A11	A33-A35	Waste Management	✓	Nil	Normal
A12	A36-A37	Emergency Response	✓	Nil	Normal
A13	A38-A41	Hazard, Risk and Safety	✓	Nil	Normal

Key:

✓ = Satisfactory
✗ = Unsatisfactory

Completed by Environmental Manager (Josh Graham)

Signed:



Date: 29th January 2010

PF FORMATION

HITCHCOCK ROAD MAROOTA - Sand Extraction and Rehabilitation Project
EMP MANAGEMENT CONTROLS OPERATIONAL CHECKLIST - ENVIRONMENTAL MANAGER

DECEMBER 2009

STRATEGY POINT	PAGE NO	DESCRIPTION	STATUS ✓ or x	COMPLAINTS RECEIVED	COMMENTS
A2	A3-A5	Noise	✓	Nil	No monitoring undertaken this month. An annual report by noise consultants will be prepared for the EMP.
A3	A6-A10	Air Quality	✓	Nil	Deposited dust results for November show low levels at Sites 1,2 and 3. Site 4 was unusually high. This site is not related to the Hitchcock Rd site.
A4	A11-A12	Access and Traffic	✓	Nil	Audit of trucks leaving site between 6 - 7 am was undertaken on 14th December 2009. Four trucks recorded leaving site.
A5	A13-A16	Erosion & Sediment Control	✓	Nil	No water or sediment left site during this month. Rubber lined steel pipe has replaced a large section of the sand line.
A6	A17-A20	Water	✓	Nil	Pumping has ceased in BH 02 due to iron incrustation problems.
A7	A21-A25	Rehabilitation & Vegetation offset	✓	Nil	Normal
A8	A26-A27	Social Impact	✓	Nil	Normal
A9	A28-A29	Heritage	✓	Nil	Normal
A10	A30-A32	Visual Amenity	✓	Nil	Normal
A11	A33-A35	Waste Management	✓	Nil	Normal
A12	A36-A37	Emergency Response	✓	Nil	Normal
A13	A38-A41	Hazard, Risk and Safety	✓	Nil	Normal

Key:

✓ = Satisfactory
x = Unsatisfactory

Completed by Environmental Manager (Josh Graham)

Signed:



Date: 24th December 2009

PF FORMATION

HITCHCOCK ROAD MAROOTA - Sand Extraction and Rehabilitation Project
EMP MANAGEMENT CONTROLS OPERATIONAL CHECKLIST - ENVIRONMENTAL MANAGER

NOVEMBER 2009

STRATEGY POINT	PAGE NO	DESCRIPTION	STATUS ✓ or x	COMPLAINTS RECEIVED	COMMENTS
A2	A3-A5	Noise	✓	Nil	Noise monitoring procedures are being reviewed. An annual report by noise consultants is being discussed. No monitoring undertaken this month.
A3	A6-A10	Air Quality	✓	Nil	Report on TEOM has been prepared by pae holmes and forwarded to DECC. Deposited dust results show low levels at all locations.
A4	A11-A12	Access and Traffic	✓	Nil	Audit of trucks leaving site between 6 - 7am was undertaken on 8th November 2009. Six trucks recorded leaving site.
A5	A13-A16	Erosion & Sediment Control	✓	Nil	Sediment fencing repaired in various areas within Lot 198. No sediment leaving site.
A6	A17-A20	Water	✓	Nil	Pumping has recommenced in bi-wash dam within Lot 198. BH01 & BH02 pumped 19.039MGL in last reporting period. (max = 50MGL)
A7	A21-A25	Rehabilitation & Vegetation offset	✓	Nil	Normal
A8	A26-A27	Social Impact	✓	Nil	Normal
A9	A28-A29	Heritage	✓	Nil	Normal
A10	A30-A32	Visual Amenity	✓	Nil	Normal
A11	A33-A35	Waste Management	✓	Nil	Normal
A12	A36-A37	Emergency Response	✓	Nil	None - No incidents
A13	A38-A41	Hazard, Risk and Safety	✓	Nil	Normal

Key:

✓ = Satisfactory

x = Unsatisfactory

Completed by Environmental Manager (Josh Graham)

Signed: 

Date: 30th November 2009

PF FORMATION

HITCHCOCK ROAD MAROOTA - Sand Extraction and Rehabilitation Project
EMP MANAGEMENT CONTROLS OPERATIONAL CHECKLIST - ENVIRONMENTAL MANAGER

October 2009

STRATEGY POINT	PAGE NO	DESCRIPTION	STATUS ✓ or ✗	COMPLAINTS RECEIVED	COMMENTS
A2	A3-A5	Noise	✓	nil	Noise Monitoring procedures are being reviewed. An annual report by noise consultants is being discussed. No monitoring undertaken this month.
A3	A6-A10	Air Quality	✓	nil	Deposited Dust results for September have been received and show low dust levels at all locations despite severe dust storms.
A4	A11-A12	Access and Traffic	✓	nil	Audit of trucks leaving site between 6 - 7am was undertaken on 29th October 2009. Six trucks recorded leaving site.
A5	A13-A16	Erosion & Sediment Control	✓	nil	Normal - No sediment leaving site.
A6	A17-A20	Water	✓	nil	Normal
A7	A21-A25	Rehabilitation & Vegetation offset	✓	nil	Normal
A8	A26-A27	Social Impact	✓	nil	Normal
A9	A28-A29	Heritage	✓	nil	Normal
A10	A30-A32	Visual Amenity	✓	nil	Normal
A11	A33-A35	Waste Management	✓	nil	Normal
A12	A36-A37	Emergency Response	✓	nil	None - No Incidents
A13	A38-A41	Hazard, Risk and Safety	✓	nil	Normal

Key:

✓ = Satisfactory

✗ = Unsatisfactory

Completed by Environmental Manager (Josh Graham)

Signed:

Josh Graham

Date: 30th October 2009

PF FORMATION

HITCHCOCK ROAD MAROOTA - Sand Extraction and Rehabilitation Project
EMP MANAGEMENT CONTROLS OPERATIONAL CHECKLIST - ENVIRONMENTAL MANAGER

September 2009

STRATEGY POINT	PAGE NO	DESCRIPTION	STATUS ✓ or ✗	COMPLAINTS RECEIVED	COMMENTS
A2	A3-A5	Noise	✓	nil	Noise monitoring was unable to be undertaken this month due to faulty sound monitoring equipment.
A3	A6-A10	Air Quality	✓	nil	High dust readings expected due to dust storms.
A4	A11-A12	Access and Traffic	✓	nil	Audit of trucks leaving site undertaken on 30-09-09 4 trucks left site between 6 & 7am.
A5	A13-A16	Erosion & Sediment Control	✓	nil	Normal
A6	A17-A20	Water	✓	nil	Pumping has recommenced in Por 167 spring.
A7	A21-A25	Rehabilitation & Vegetation offset	✓	nil	Normal
A8	A26-A27	Social Impact	✓	nil	Normal
A9	A28-A29	Heritage	✓	nil	Normal
A10	A30-A32	Visual Amenity	✓	nil	Normal
A11	A33-A35	Waste Management	✓	nil	Normal
A12	A36-A37	Emergency Response	✓	nil	None - No incidents.
A13	A38-A41	Hazard, Risk and Safety	✓	nil	Normal

Key:

✓ = Satisfactory

✗ = Unsatisfactory

Completed by Environmental Manager (Josh Graham)

Signed: 

Date: 30-09-09.

PF FORMATION

HITCHCOCK ROAD MAROOTA - Sand Extraction and Rehabilitation Project
EMP MANAGEMENT CONTROLS OPERATIONAL CHECKLIST - ENVIRONMENTAL MANAGER

August 2009

STRATEGY POINT	PAGE NO	DESCRIPTION	STATUS ✓ or x	COMPLAINTS RECEIVED	COMMENTS
A2	A3-A5	Noise	✓	nil	Normal
A3	A6-A10	Air Quality	✓	nil	Dust monitoring results from July were low.
A4	A11-A12	Access and Traffic	✓	nil	Audit of trucks leaving site undertaken on 24-08-09. 3 trucks left site between 6-7am
A5	A13-A16	Erosion & Sediment Control	✓	nil	Inspection Report from Douglas Partners has been received and recommendations noted.
A6	A17-A20	Water	✓	nil	Normal - Dry conditions, low rainfall
A7	A21-A25	Rehabilitation & Vegetation offset	✓	nil	Normal
A8	A26-A27	Social Impact	✓	nil	Normal
A9	A28-A29	Heritage	✓	nil	Normal
A10	A30-A32	Visual Amenity	✓	nil	Normal
A11	A33-A35	Waste Management	✓	nil	Normal
A12	A36-A37	Emergency Response	✓	nil	None - No incidents.
A13	A38-A41	Hazard, Risk and Safety	✓	nil	Normal

Key:

✓ = Satisfactory
x = Unsatisfactory

Completed by Environmental Manager (Josh Graham)

Signed:

Josh Graham

Date: 31-08-09.

PF FORMATION

HITCHCOCK ROAD MAROOTA - Sand Extraction and Rehabilitation Project
EMP MANAGEMENT CONTROLS OPERATIONAL CHECKLIST - ENVIRONMENTAL MANAGER

July 2009

STRATEGY POINT	PAGE NO	DESCRIPTION	STATUS ✓ or x	COMPLAINTS RECEIVED	COMMENTS
A2	A3-A5	Noise	✓	nil	Noise testing undertaken in June. No quarry noise was recorded.
A3	A6-A10	Air Quality	✓	nil	Dust monitoring results from June were low.
A4	A11-A12	Access and Traffic	✓	nil	Audit of trucks leaving site undertaken on 29-07-09. 4 trucks left site between 6-7am.
A5	A13-A16	Erosion & Sediment Control	✓	nil	Excavation of pipeline trenching has commenced. Silt traps are satisfactory.
A6	A17-A20	Water	✓	nil	Downstream water sampling undertaken in June. Results are satisfactory.
A7	A21-A25	Rehabilitation & Vegetation offset	✓	nil	Normal
A8	A26-A27	Social Impact	✓	nil	Normal
A9	A28-A29	Heritage	✓	nil	Normal
A10	A30-A32	Visual Amenity	✓	nil	Normal
A11	A33-A35	Waste Management	✓	nil	Normal
A12	A36-A37	Emergency Response	✓	nil	None - No incidents.
A13	A38-A41	Hazard, Risk and Safety	✓	nil	Normal

Key:

✓ = Satisfactory
x = Unsatisfactory

Completed by Environmental Manager (Josh Graham)

Signed:

Josh Graham

Date: 30th July 2009.

Attachment 3C

Annual Environmental Operations Procedures Checklist

2.3 Management controls

OPERATIONAL PHASE

Strategy 2.1: Ensure that the site operations are undertaken in a manner that minimises the impacts of noise and vibration.

Actions	Responsibility	Date/Initials	Comments
2.1.1 Manage site activities so that any necessary high noise and vibration levels occur at times of least impact.	Site Manager		
2.1.2 Advise neighbouring properties at least 24 hours in advance of the extent and expected duration of especially noisy activities.	Site Manager/ Environmental Manager	1/04/10 JB	
2.1.3 Undertake all site activities incorporating noise attenuation measures such as restricting working hours for certain works required close to sensitive receptors	Site Manager	13-4-10	
2.1.4 Ensure that panels and covers of silenced plant are kept shut and plant and equipment switched off when not in use.	Site Manager	13.4.10	
2.1.5 Ensure that mechanical equipment is silenced by the best practical means using current technology, prior to use. Noise suppression devices should be fitted according to manufacturer's instructions. Residential class mufflers should be used where possible. Noise control kits should be fitted to noisy mobile equipment and shrouds provided around stationary equipment where necessary.	Site Manager	13.4.10	
2.1.6 Working hours will be limited to 7.00am to 6.00pm, Monday to Saturday and at no time on Sundays and public holidays. A maximum of ten laden vehicles will be permitted to enter and leave the site between the hours of 6.00am and 7.00am, Monday to Saturday, excluding Sundays and public holidays.	Site Manager		SALE AS PER 6.00AM CONDITION. OPERATOR START AT 6.00 BUT CHECK EQUIP IN COMPOUND PRIOR TO COMMENCING PRODUCTION.
2.1.7 Arrange for all plant and equipment to be inspected regularly to ensure that it is well maintained to minimise noise emissions.	Site Manager	13.4.10	
2.1.8 Conduct compliance monitoring of noise levels at the defined locations and keep records of measurements.	Environmental Manager	1/04/10 JB	AS per monthly EMP operational checklist.
Performance indicator	Noise from operational activities does not exceed the guideline limits.		
	Number of complaints received	1/04/10 JB	No complaints received.

3.3 Management controls

OPERATIONAL PHASE

Strategy 3.1: Ensure that the site operations are undertaken in a manner that minimises and controls dust and vehicle emissions.

Actions		Responsibility
3.1.1	Conduct ambient air quality monitoring at identified sites	Environmental Manager
3.1.2	Fit dust suppression equipment to all processing plant on the site. This is to be regularly inspected and maintained in good working order at all times.	Site Manager/ Environmental Manager
3.1.3	Define trafficable areas to prevent unnecessary vehicle movement into others	Site Manager
3.1.4	Keep all unsealed trafficable areas and working areas damp to minimise dust emissions by spraying regularly with a water cart, water sprays or sprinklers. Frequency of spraying to be determined based on weather conditions, soil erodibility and the observation of any visible dust.	Site Manager/ Environmental Manager
3.1.5	Apply speed controls to all unsealed areas (maximum speed of 20 km/h) and signpost accordingly.	Site Manager
3.1.6	Vegetate all semi-permanent stockpiles with suitable groundcover and regularly water until the vegetation is well established.	Site Manager
3.1.7	Cease work on any extraction activity producing dust due to high winds that cannot be controlled by watering or other means. Work will not resume until the wind velocity decreases and any dust generation can be controlled by normal means.	Site Manager
3.1.8	Ensure that all loaded trucks leaving the central processing plant on Lot 198 DP595538 have their payloads fully covered by a suitable material to prevent spillage.	Site Manager
3.1.9	Construct dust screens such as earth bunds and vegetated barriers.	Site Manager
3.1.10	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.	Site Manager
3.1.11	No fires to be permitted on-site.	Site Manager

Performance indicator Ambient air quality data compiled.

Dust generated from site activities to comply at all times with DECC specified air quality criteria.

1/04/10 JB Refer to EMP Operational Checklist

1/04/10 JB Monthly reporting
Refer to EMP Checklist

1/04/10 JB

1/04/10 JB
Haul roads and working
areas are kept damp at
all times.

13.4.10 RW.

13.4.10 RW.

13.4.10 RW.

13.4.10 RW.

13.4.10 RW.

13.4.10 RW.

13.4.10 RW.

Monitoring	Dust monitoring at identified locations.
	Compilation of a complaints register.

Reporting	Documentation of air quality in a monthly report on dust emissions.
	Annual reporting in the AEMR. Monitoring results will be suitably summarised for posting on the PF Formation website.

JB 1/04/10.

Strategy 3.2: Minimise and control vehicle and plant exhaust emissions.

Actions		Responsibility
3.2.1	Inspect all exhausts from vehicles and plant/equipment to ensure that they are maintained at an acceptable level.	Environmental Manager
3.2.2	Regularly service all vehicles to ensure that exhaust emissions comply with the regulations. Maintain appropriate service records.	Site Manager
3.2.3	Identify any opportunities to minimise machinery use and ensure that all equipment used on the site is energy efficient.	Site Manager

JB 1/04/10. Refer to weekly checklists.
 13.4.10 VEHICLES REGULARLY SERVICED NO WAY TO TEST EXHAUST
 13.4.10 RW-

Performance Indicator	Vehicle and plant emissions comply with the regulations.
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Monitoring	Regular vehicle and plant inspections.
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Reporting	Annual reporting of inspection results in the AEMR.
------------------	---

1.3 Management controls**OPERATIONAL PHASE****Strategy 4.1: Minimise the impact of operational traffic on the local community.**

Actions	Responsibility
4.1.1 Ensure that the number of laden vehicle movements does 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.	Site Manager/ Environmental Manager <i>Jb 1/04/10.</i>
4.1.2 Undertake operations involving the transportation of material on the site only between 6.00am and 6.00pm, Monday to Saturday.	Site Manager/ Environmental Manager <i>Jb 1/04/10</i>
4.1.3 Allow a maximum of ten laden vehicles to enter and leave the site between 6.00am and 7.00am, Monday to Saturday only. Ensure that vehicles do not arrive at the site prior to 5.45am on any day.	Site Manager/ Environmental Manager <i>Jb 1/04/10 Refer to Monthly EMP Checklist.</i>
4.1.4 Ensure that all vehicle loads leaving the site are suitably covered.	Site Manager <i>h/ 13/4/10</i>

Performance Indicator	Minimum of complaints from the community.
------------------------------	---

Monitoring	Number and type of complaints received.
	Weighbridge records of arrival and departure times.

Reporting	Bi-annual report on complaints received.
------------------	--

1.4 Monitoring and reporting

The Site Manager will be responsible for the monitoring of complaints on traffic issues from the community. Annual reports will be compiled on community complaints and reported in the AEMR.

OPERATIONAL PHASE**Strategy 5.1: Provide for treatment of stormwater runoff from extraction areas, stockpiles and access roads.**

Actions	Responsibility
5.1.1 Construct temporary erosion and sedimentation control structures such as detention basins and catch drains as appropriate to collect runoff from cleared land including extraction areas and access roads.	Site Manager/ Environmental Manager <i>JB 1/04/10 Refer to EMP checklist.</i>
5.1.2 Erect silt traps and erosion control fencing as appropriate along extraction area boundaries and drainage lines.	Site Manager/ Environmental Manager <i>JB 1/04/10 Refer to EMP checklist.</i>
5.1.3 Design sediment basins with a minimum storage capacity of 400 m ³ per hectare of catchment. Spillway capacity and stability will be designed as follows: <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 • life greater than 10 years, adopt the 100 year t_c event. 	Site Manager <i>RW 13.4.10</i>
5.1.4 Undertake regular inspections to assess stormwater control measures and conduct routine inspections to ensure that compliance with best practice guidelines and relevant legislation is achieved.	Site Manager/ Environmental Manager <i>JB 1/04/10 Refer to EMP checklist.</i>
Performance indicator	Stormwater control measures are in place prior to commencement of extraction in the particular phase of development and are effective in reducing sedimentation to acceptable levels.
Monitoring	Review effectiveness of the stormwater basins and treatment methods during and following major rainfall events.
Reporting	Report on effectiveness of control measures once sedimentation works completed and then on an annual basis.

Strategy 5.2: Plan site operations to minimise opportunities for soil erosion and sedimentation.

Actions	Responsibility
5.2.1 Select locations for topsoil and material stockpiles on level ground and away from drainage lines. Install diversion drains up slope and sediment filter fences as appropriate	Site Manager/ Environmental Manager <i>JB 1/04/10</i>
5.2.2 Provide training to operational personnel on the importance of erosion control measures and inform drivers of the damage that can be caused by to the environment by heavy vehicles	Site Manager/ Environmental Manager <i>JB 1/04/10</i>

Performance Indicator	Soil erosion control measures are incorporated in the operational activities on the site and are effective in reducing soil erosion.
Monitoring	Monitor suspended solid concentrations in stormwater runoff from the undisturbed parts of the site.
Reporting	Report on the effectiveness of soil erosion control measures prior to extraction.

Strategy 5.3: Ensure that suspended solid levels in stormwater discharging from the site meets the guidelines for the protection of aquatic ecosystems (ANZECC 2000)

Actions	Responsibility
5.3.1 Keep areas of exposed land to a minimum compatible with operational requirements.	Site Manager
5.3.2 Where practicable, provide silt fences to minimise erosion and sedimentation from exposed areas.	Site Manager/ Environmental Manager
5.3.3 Stabilise exposed areas that are not in use with an appropriate cover crop and water until well established.	Site Manager/ Environmental Manager
5.3.4 Construct sediment retention basins with a capacity of at least 300m ³ per hectare of catchment, which will necessitate regular cleaning out, and a minimum freeboard of one metre.	Site Manager
5.3.5 Monitor erosion and sediment controls regularly and immediately following a rainfall event. Monitoring will take place initially on a weekly basis, then monthly once operating correctly. Clear sediment when the traps have collected 60% of the capacity of the basin or where sediment build-up is less than 300mm below the spillway crest. Remove sediment to a location where further pollution to downslope lands and waterways will not occur.	Site Manager/ Environmental Manager
5.3.6 Undertake maintenance of erosion and sediment controls when any deterioration is identified or when replacement is necessary.	Site Manager/ Environmental Manager
5.3.7 Reuse stored stormwater for dust control and the watering of site vegetation.	Site Manager/ Environmental Manager
5.3.8 Seed material stockpiles where these are to remain unused for a period in excess of four weeks. Water the area until the vegetation is well established.	Site Manager/ Environmental Manager
5.3.9 Control vehicle movement on the site by the identification of the haul road and current working areas.	Site Manager

Refer to EMP Checklist.

JG 1/04/10

RW 13.4.10

JG 1/04/10

JG 1/04/10

JG 1/04/10




JG 1/04/10

RW 13.4.10

3.3 Management controls

OPERATIONAL PHASE

Strategy 6.1: Plan site operations to minimise potential impacts on groundwater

Actions	Responsibility
6.1.1 Restrict maximum depth of extraction to 2 metres above the wet weather high groundwater level as determined following at least 12 months site specific groundwater monitoring data.	Site Manager 
6.1.2 Ensure that the groundwater is not breached or contaminated. In the event that either should occur, operations are to cease and the Department of Water and Energy and the Department of Planning consulted to determine the basis on which extraction may recommence.	Site Manager 
6.1.3 Design the sediment retention basins to accommodate the 100-year t_c event. The minimum basin capacities are as follows: <ul style="list-style-type: none"> Southern catchment (Basin 1) 19,400 m³ Northern catchment (Basin 2) 7,800 m³ The volume of these basins can be varied depending on the extent of the area exposed for extraction within each catchment.	Site Manager 
6.1.4 Arrange for regular inspection of the capacity and stability of all retention basins and report on their effectiveness.	Site Manager/ Environmental Manager 1/04/10 JB
6.1.5 Install a minimum of two groundwater monitoring bores. One should 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 is to meet the requirements of the Department of Water and Energy and the Department of Planning.	Site Manager/ Environmental Manager 1/04/10 JB refer to URS reports.

Performance indicator	Maintenance of groundwater quality. Existing water levels and groundwater quality will be determined from data derived from the bores on the site.
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Monitoring	Regular monitoring of water levels and water quality data from the on-site bores. Assessment in relation to the conclusions of the Maroota Groundwater Study when this becomes available.
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7.3 Management controls**OPERATIONAL PHASE****Strategy 7.1: Implement measures to ensure the protection of native vegetation, including threatened species.**

Actions	Responsibility
7.1.1 Clearly identify and mark out all areas which are not to be disturbed.	Site Manager/ Environmental Manager 1/04/10 JB
7.1.2 Assess areas where trees are to be removed to determine the commercial value of any which are too large to mulch. Any with commercial value are to be marked and arrangements made for removal.	Environmental Manager 1/04/10 JB
7.1.3 Prepare an assessment of the species mix of the Sydney Hinterland Transition Woodland and arrange for collection of seeds from the vegetation to be removed and adjacent areas. Mulch vegetation removed from the area and stockpile 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. Protect young plants from predation by feral pests.	Environmental Manager 1/04/10 JB Assisted by Greening Australia.
7.1.5 Restrict access to bushland to minimise the potential for damage. Suitably identify and mark out these areas to ensure that this prohibition is made clear.	Site Manager/ Environmental Manager 1/04/10 JB
7.1.6 Separate topsoil for use in rehabilitation works.	Site Manager/ Environmental Manager 1/04/10 JB
7.1.7 Incorporate flora and fauna issues in the education program so that the site operatives are aware of the requirements of this EMP.	Environmental Manager 1/04/10 JB
7.1.8 Once each extraction phase is complete, initiate the rehabilitation and revegetation program as set out in the Landscape management Plan.	Site Manager/ Environmental Manager 1/04/10 JB
Performance indicator	All areas of significant flora and fauna habitat are protected prior to the start of extraction.
Monitoring	Ensure that all the above are implemented prior to the commencement of extraction activities in the area. Monitor condition of flora and fauna habitats on a regular basis.

Reporting

A report with appropriate maps identifying the areas fenced and defined areas for access and extraction activity is to be prepared.

Map disturbed areas on an annual basis and report on any impacts on bushland and rehabilitated areas.

Prepare an annual report on the status of the flora of the site for inclusion in the AEMR.

Strategy 7.2: Undertake the rehabilitation of the site to achieve an agreed and acceptable landform with appropriate planting.

Actions	Responsibility
7.2.1 Review and amend the Landscape Management Plan as necessary to reflect changing operational conditions. This should include a revised phasing plan and implementation program.	Site Manager/ Environmental Manager 1/04/10 JB
7.2.2 Define setbacks to all roads and adjacent properties taking account of existing trees and other features. Undertake the construction of the peripheral mounding focussing initially on those areas where views are available from external roads and where houses on adjacent property are close to the site boundary. Carry out programs of screen planting in these areas. All plant material used should reflect the species mix existing in the area.	Environmental Manager 1/04/10 JB
7.2.3 Mulch all suitable plant material for reuse on the site as a seed and planting medium. Store all topsoil in appropriately marked low stockpiles for reuse in locations as close as possible to their source. Care should be taken to ensure that this does not become contaminated with the seeds of exotic species and weeds.	Environmental Manager 1/04/10 JB
7.2.5 Rehabilitate the site in stages leaving areas exposed for as short a time as possible. This should 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 should be as gentle as possible depending on the availability of fill material.	Site Manager/ Environmental Manager 1/04/10 JB
7.2.6 Sow all stockpiles and exposed areas where no activity is to take place for more than four weeks with an appropriate vegetation cover.	Site Manager/ Environmental Manager 1/04/10 JB
7.2.7 Undertake revegetation of the site on the following basis: <ul style="list-style-type: none"> re-establish the Sydney Hinterland Transition Woodland using seed and mulch collected from the area rehabilitate other areas to native species with a light sowing of cereal and allowing natural regeneration lime, fertilise and sow areas where improved grass cover is required suitably turf surfaces expected to experience high surface flows leaving the site 	Environmental Manager 1/04/10 JB Assisted by Greening Australia

7.2.8	Establish a maintenance program aimed at promoting and protecting the growth of the rehabilitated areas.	Site Manager/ Environmental Manager
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Performance Indicator	Completion of site rehabilitation in conformity with the approved Landscape Management Plan.
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Monitoring	Regular site inspections to ensure that the following is achieved: <ul style="list-style-type: none">• rate of rehabilitation is in conformity with the staging program• conservation zones and rehabilitated areas are being appropriately maintained• vegetative covers are being established• site works such as bunding and the establishment of re-vegetated areas are progressing in accordance with the Landscape Management Plan• all sensitive flora and fauna habitat is being adequately protected from damage
------------	---

Reporting	Reports of site inspections and annual reviews in the AEMR.
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7.4 **Monitoring and reporting**

The Environmental Manager will be responsible for monitoring the effectiveness of the measures included for the protection of native vegetation on the site and the progress of site rehabilitation. Bi-annual reports will be prepared by the Environmental Manager and annual reports prepared for inclusion in the AEMR.

3.3 Management controls

OPERATIONAL PHASE

Strategy 8.1: Consider community feedback in determining operating procedures to minimise negative impacts.

Actions	Responsibility
3.1.1 Provide material concerning activities at the site for publication in existing community newsletters which receive wide dissemination in the Maroota area.	Site Manager/ Environmental Manager 1/04/10 SG
3.1.2 Maintain an open door policy . Widely publish contact phone number and provide an early response to all queries, comments and requests for information.	Site Manager/ Environmental Manager 1/04/10 SG
3.1.3 Provide access to all relevant environmental management documentation and monitoring results on the PF Formation web site.	Environmental Manager 1/04/10 SG
3.1.4 Organise and manage bi-annual meetings of the Community Consultative Committee to discuss issues in relation to environmental management of sand extraction on the site.	Environmental Manager 1/04/10 SG
3.1.5 Establish a complaints register incorporating date and time, type of communication, contact details of the complainant, nature of the complaint and response taken.	Site Manager/ Environmental Manager 1/04/10 SG

Performance indicator Minimal complaints from the community.

Monitoring Number and type of responses and complaints raised by the community and improved performance.

Reporting Annual reporting of community responses and complaints together with an assessment of any changes put in place to minimise any future difficulties for inclusion in the AEMR.

3.3 Management controls

OPERATIONAL PHASE

Strategy 9.1: Protect items of heritage value during site operations.

Actions		Responsibility
9.1.1	Cease all work if an archaeological or heritage item is identified during extraction operations and consult the National Parks and Wildlife Service, the Deerubbin Aboriginal Land Council or the Heritage Office to determine any appropriate course of action prior to recommencement of the work. Obtain any required permits and submit together with supporting information. Notify Baulkham Hills Shire Council to ensure compliance with the conditions of approval.	Site Manager/ Environmental Manager 1/04/10 JB
9.1.2	Undertake additional survey work required for submittal of application to destroy artefact scatters located in the later stages of the development. Comply with the reasonable requirements of the National Parks and Wildlife Service, the Deerubbin Aboriginal Land Council and the Heritage Office arising out of any additional studies and notify Baulkham Hills Shire Council to ensure compliance with the conditions of the approval.	Environmental Manager 1/04/10 JB
Performance Indicator		Any item of heritage significance is protected during site operations.
Monitoring		The protection of any heritage items identified during site operations is to be monitored. Access to the Trig Reserve site is to be monitored.
Reporting		Any heritage item identified during site operations is to be documented.

3.4 Monitoring and reporting

The Environmental Manager will be responsible for the reporting of any heritage items identified during the course of site activities. Annual reports will be prepared by the Environmental Manager.

10.3 Management controls**OPERATIONAL PHASE**

Strategy 10.1: Ensure that impacts on visual amenity are minimised during site activities and following completion.






Actions	Responsibility
10.1.1 Clearly mark all vegetation to be retained.	Site Manager/ Environmental Manager 1/04/10 JB
10.1.2 Construct peripheral bunding within the established setbacks. These should 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	Site Manager/ Environmental Manager 1/04/10 JB
10.1.3 Undertake screen planting works to the peripheral areas to an agreed specification using mulch to allow for native plant regeneration. Reinforce this species mix using appropriate plantings at specified intervals.	Environmental Manager 1/04/10 JB
10.1.4 Undertake a tree planting program within areas defined in the Landscape Management Plan to establish a dense plantation using an appropriate mix of species reflecting that of the existing community.	Environmental Manager 1/04/10 JB Assisted by Greening Australia.
10.1.5 Re-establish the landform of the extraction areas to that shown in the Landscape Management Plan.	Site Manager RW 13.4.10
10.1.6 Complete the rehabilitation of the site in conformity with the proposals set out in the Landscape Management Plan.	Site Manager RW 13.4.10
10.1.7 Remove all temporary fencing when no longer required.	Site Manager RW 13.4.10
10.1.8 Re-establish vegetation in areas suitable for agricultural/horticultural uses.	Site Manager RW 13.4.10
10.1.9 Remove all site infrastructure including the slurry plant and its associated pipelines. Restore those areas affected by the plant and rehabilitate.	Site Manager RW 13.4.10
10.1.10 Remove all waste materials and dispose of in an appropriate manner.	Site Manager RW 13.4.10
10.1.11 Review Quarry Closure Plan and prepare proposals for future use of the area.	Site Manager

Performance Indicator

No complaints received regarding visual amenity during site operations and following completion.

Completion of the development in conformity with the requirements of the Rehabilitation Plan.

11.3 Management controls**OPERATIONAL PHASE****Strategy 11.1: Appropriate management and disposal of wastes generated during site operations.**

Actions	Responsibility	
11.1.1 Clearly delineate waste handling areas.	Site Manager	RW 13.4.10 RUBBISH BIN SCRAP BIN MTMAGRAM
11.1.2 Define specific areas for the collection of materials for reuse and recycling and clearly label.	Site Manager	RW 13.4.10
11.1.3 Process cleared vegetation on site for use as mulch within the landscape program.	Environmental Manager	1/04/10 JG
11.1.4 Store all topsoil in stockpiles for later use in site rehabilitation.	Environmental Manager	1/04/10 JG
11.1.5 Provide bins or skips 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 DP595538. Waste food will be removed on a daily basis and stored in a vermin proof bin for collection by waste contractor. Paper waste generated from site offices, plastics and glass are to be collected separately for recycling.	Site Manager	RW 13.4.10
11.1.6 Separate hazardous wastes (including empty drums, rags, soil contaminated with oil) from non-hazardous wastes and manage in accordance with the relevant legislation.	Site Manager	RW 13.4.10
11.1.7 Temporarily store liquid wastes (chemicals, oils and greases) in an appropriately bunded area and dispose of via a licensed contractor. Direct washdown water to an appropriate settlement basin if quality is acceptable. Otherwise, store and dispose as a liquid waste.	Site Manager	RW 13.4.10
11.1.8 Retain copies of current licences of all waste removal contractors on site.	Site Manager	
11.1.9 Keep all documentation relating to waste removal and disposal on file at the site. This documentation includes dockets for the removal and disposal of waste at a licensed facility.	Site Manager	
11.1.10 Progressively separate and stockpile waste material in designated areas for collection. Adequately secure waste disposal areas to prevent access by wildlife.	Site Manager	
11.1.11 Review all waste licences and monitor terms and conditions for compliance.	Site Manager	
11.1.12 Recycle or dispose of any materials and waste remaining on the site following completion of extraction operations. All should be disposed of in an appropriate manner.	Site Manager	

12.3 Management controls**OPERATIONAL PHASE****Strategy 12.1: Ensure that procedures and controls are implemented to prevent, or if necessary, control any potential environmental emergency**

Actions	Responsibility
12.1.1 Ensure that all personnel on site during operations have been trained in appropriate procedures including site induction, materials handling and response procedures.	Site Manager
12.1.2 Develop and put in place emergency response procedures. Appoint appropriate individuals as emergency services liaison officers.	Site Manager
12.1.3 Establish an emergency response table listing contact details of all relevant parties required in an environmental emergency.	Site Manager
12.1.4 Establish a Register of Environmentally Hazardous Materials to be stored and used on site.	Site Manager
12.1.5 Ensure that appropriate safety and spill response equipment has been made available.	Site Manager
12.1.6 Clearly label all materials to be used and stored on site.	Site Manager
12.1.7 Review and update emergency response procedures bi-annually.	Site Manager
12.1.8 Ensure that appropriate safety and response equipment is available at all times.	Site Manager

13.4.10

IN SAFETY BOOK & INSTRUCTIONS

SPILL KIT AT BATCH HUT

SAFETY.

Performance indicator Emergency response procedures, controls and training adequate for potential emergencies.


Monitoring Regular monitoring of response procedures and equipment.

Reporting Annual report on incidents.

12.4 Monitoring and reporting

The Site Manager will be responsible for maintaining the currency of the emergency procedures and reporting on incidents.

13.3 Management controls**OPERATIONAL PHASE****Strategy 13.1: Minimise the risks associated with the storage and handling of hazardous materials.**

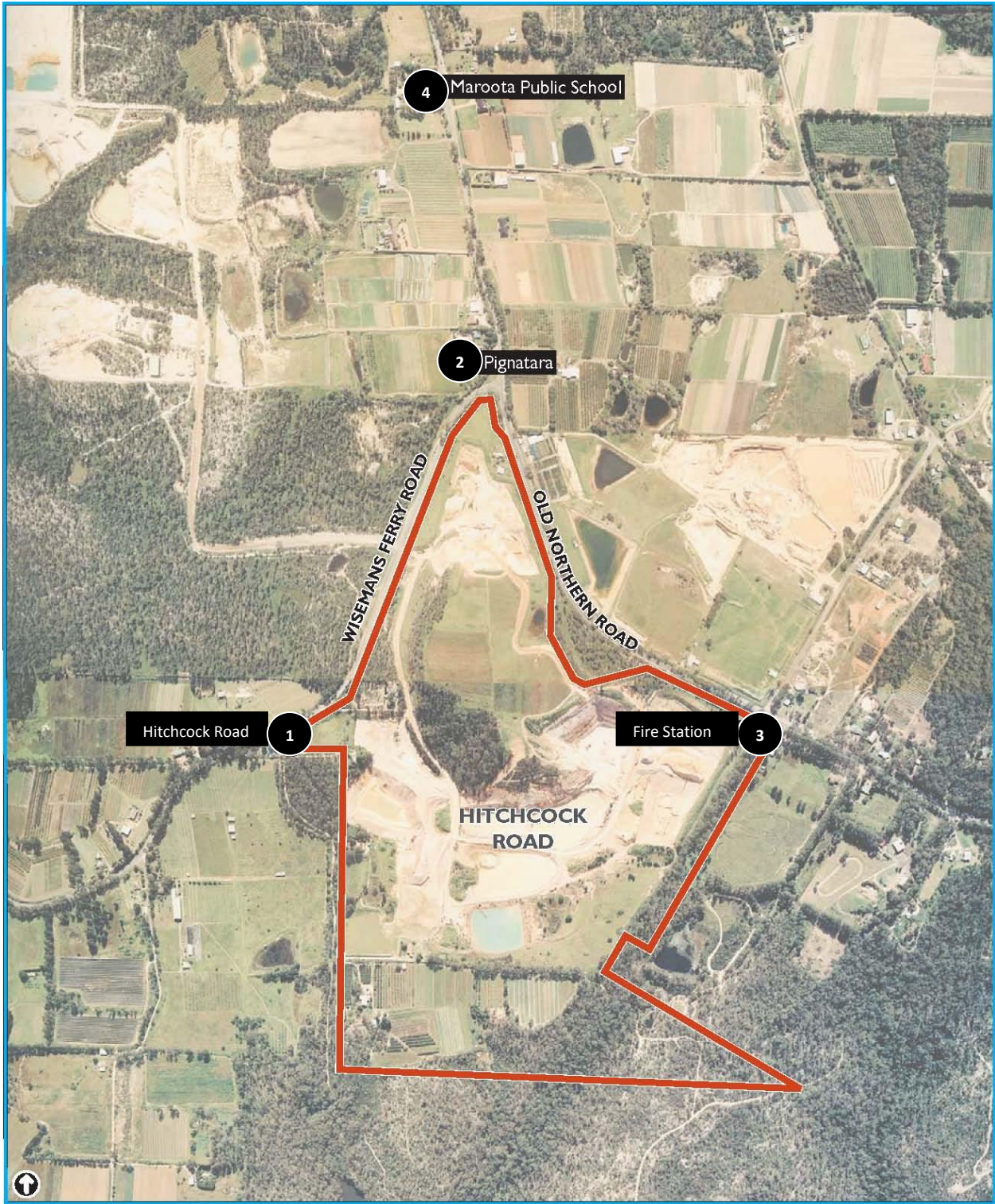
Actions	Responsibility
13.1.1 Obtain a licence to keep dangerous goods from WorkCover NSW for all materials stored on site which require licensing	Site Manager <i>None required. RB. 27/4/10.</i>
13.1.2 Establish a Register of Hazardous Materials setting out details of quantities, storage and specific handling requirements for all relevant materials stored on site.	Site Manager/ Environmental Manager <i>1/04/10 JG</i>
13.1.3 Obtain Material Safety Data Sheets for all hazardous materials stored on site.	Site Manager/ Environmental Manager <i>1/04/10 JG</i>
13.1.4 Provide appropriate storage and secondary containment facilities for all hazardous materials stored on site. All bunded areas must be designed to contain at least 110% of the volume of materials stored within the area.	Site Manager 
13.1.5 Appoint a Safety Officer for the development.	Site Manager
13.1.6 Locate all flammable material storage areas at least ten metres from possible ignition sources.	Site Manager/ Environmental Manager <i>1/04/10 JG</i>
14.1.7 Clearly label the contents of all above ground storage areas.	Site Manager/ Environmental Manager <i>1/04/10 JG</i>
13.1.8 Secure all hazardous and dangerous goods storage areas and display appropriate signage. Segregate all incompatible material.	Site Manager/ Environmental Manager <i>1/04/10 JG</i>
13.1.9 Train all personnel in the handling and safety procedures required for the hazardous materials stored and used on site.	Site Manager/ Environmental Manager <i>1/04/10 JG</i>

Performance Indicator	Storage and handling of hazardous materials complies with legislative requirements and demonstrates due diligence.
Monitoring	Regular audit of compliance with legislative requirements for the storage and handling of hazardous materials.
Reporting	Regular audit reports.

Strategy 13.2: Ensure that procedures are implemented and facilities made available for clean up in the event of a pollution incident.

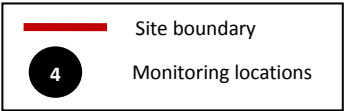
Actions		Responsibility
13.2.1	Emergency Response Plan in place (see Chapter 12).	Site Manager
13.2.2	Provide a mobile spill control kit containing appropriate absorbent materials, neutralising chemicals and other spill containment equipment.	Site Manager
13.2.3	Provide personal protective equipment and instruct personnel on its use.	Site Manager
13.2.4	Clean up any spills beyond the bunded area immediately and dispose of the contaminated material in an appropriate manner.	Site Manager
13.2.5	Contact the relevant authorities in the event of a leak or spill. Follow any instructions provided. Remediate any contamination to the satisfaction of the regulatory authorities.	Site Manager
13.2.6	Collect any spills or hazardous wastes that cannot be recycled and arrange for disposal by a licensed waste contractor. Maintain all records of waste removal on site.	Site Manager
Performance Indicator		All pollution incidents contained and cleaned up without impact on the environment or injury to personnel. All incidents recorded.
Monitoring		Stormwater and soil contamination monitoring undertaken following any spill and subsequent clean up.
Reporting		Report on all pollution events and the results of any clean up.

[Handwritten signatures and notes]
Baren HVT



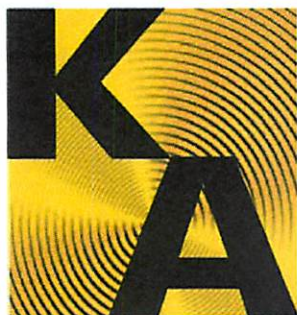
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NOISE IMPACT ASSESSMENT MONITORING LOCATIONS



Attachment 4B

Noise Survey Results



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ACOUSTIC ASSESSMENT HITCHCOCK ROAD SAND PROJECT, MAROOTA NSW

Project No.: 1933

Date: 2 September 2010

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**ACOUSTIC ASSESSMENT
HITCHCOCK ROAD SAND PROJECT,
MAROOTA NSW**

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ACOUSTIC ASSESSMENT HITCHCOCK ROAD SAND PROJECT, MAROOTA NSW

1.0 CONSULTANT'S BRIEF

Koikas Acoustics Pty Ltd was engaged by PF Formation Trust to undertake noise compliance testing during the sand extraction operations at various sites in the Maroota area adjacent to Hitchcock Road Sand Project.

The assessment provides the following:

- a discussion of the applicable noise criteria at each site, and
- attended noise monitoring survey results.

Koikas Acoustics has been advised that sand extraction has been undertaken in this area for many years and that there have been no complaints received from the local community regarding noise from the sand mining extraction works since periodic noise surveys have been undertaken.

All monitoring procedures were done in accordance with the requirements of the Project Approval of 3rd February 2009. Some measurements, for example the assessment of sleep disturbance, could not be taken 1 metre from a bedroom window and therefore, sound level measurements were taken from the boundary. Measurements taken from the boundary were under those circumstances closer to the noise source and therefore noise levels would have been higher than when taken outside a bedroom window.

2.0 SITE DESCRIPTION

2.1 SITE ADDRESSES

The southern sand mining extraction and processing site is bounded by:

- Old Northern Road along the east,
- Wisemans Ferry Road to the west (intersecting with the Old Northern Road to the north), and
- other rural properties to the south.

Details of the topography are attached as a rendered aerial photograph in the Hitchcock Road Sand Extraction and Rehabilitation Project, Maroota Noise Management Plan prepared by DFA Consultants Pty Ltd (undated) and a document called Project Approval dated 3rd February 2009 signed by the NSW Minister for Planning.

2.2 HOURS OF OPERATION

Activity	Day	Time [Hours]
Construction	Monday to Friday Saturday Sunday and Public Holiday	0700 – 1800 0800 – 1300 None
Quarrying and processing including overburden removal	Monday to Saturday Sunday and Public Holiday	0700 – 1800 None
Product Transportation	Monday to Saturday Sunday and Public Holiday	0600 – 1800 None
Maintenance	Monday to Saturday Sunday and Public Holiday	0700 – 1800 None

2.3 AMBIENT NOISE PROFILE OF THE NOISE MONITORING SITES (RECEIVERS)

The assessment site is located in a rural-residential area. The main roads passing through this area being Old Northern Road and Wisemans Ferry Road carry light and heavy vehicles.

During the daytime, the perceived intrusiveness of noise of cars and trucks traversing along these roads whilst residents are inside or outside their homes would be significantly greater compared to the noise of sand mining extraction activities.

The rustling of leaves with slight wind speeds would normally raise background noise levels. For periods when the wind is calm, background noise levels would be that of distant noise from cars, and the sound of insects and birds.

On account of the large distances which sound travels from the sand mining extraction activities to the surrounding residential premises, it is often not measureable because it is either less than the prevailing background noise or because it is inaudible.

The noise criterion derived from ambient background noise levels measured and pertaining for the hours of operation is therefore not exceeded.

2.4 MONITORING LOCATIONS

Noise monitoring was conducted in the Maroota area at the following locations on 28th June 2010:

1. Young property Hitchcock Road (@ driveway);
2. Pignatara property, corner of Wisemans Ferry Road and Old Northern Road;
3. Jurds property – back of fire shed, adjacent to Old Northern Road;
4. Maroota Public School, rear of school, and
5. Old Telegraph Road.

Noise monitoring was also conducted on 6th July 2010 at the following locations:

1. Young property, Hitchcock Road (@ driveway);
2. Pignataro property, corner of Wisemans Ferry Road and Old Northern Road;
3. Jurds property – back of fire shed, adjacent to Old Northern Road;
6. Western boundary 4713 Old Northern Road

The site locations are attached as an aerial photo in Appendix A.

3.0 NOISE CRITERIA

3.1 EPA INDUSTRIAL NOISE POLICY

The INP defines two criteria, the Intrusive Noise Criterion and the Amenity Noise Criterion. The EPA requires that compliance with both the intrusive and amenity criteria be achieved for the purpose of controlling the intrusive nature of the industrial noise in the short term and also maintaining the noise level amenity of the area for residences and other land uses.

For the purpose of applying the INP the following time periods apply:

- Daytime 7am to 6pm Monday to Saturday
8am to 6pm Sunday
- Evening 6pm to 10pm Monday to Sunday
- Night-time 10pm to 7am Monday to Saturday
10pm to 8am Sunday

3.1.1 Intrusive Noise Criterion

The intrusiveness of an industrial noise source is generally considered acceptable by people if the equivalent continuous (A-weighted) noise level ($L_{Aeq, 15 \text{ minutes}}$) does not exceed the background noise level by more than 5 dB. The intrusive noise criterion is defined as:

$$L_{Aeq, 15 \text{ minutes}} = (\text{rating background level}) L_{90, \text{Period}} + 5\text{dB}$$

When the noise source contains annoying characteristics such as prominent tonal, impulsive, intermittent, irregular and dominant low frequency components, adjustments are made.

3.1.2 Noise Amenity Criterion

In order to limit the continuing increase in noise, the EPA has nominated recommended acceptable and maximum ambient noise levels for various receiver sites from industrial noise.

Table 2.1 of the EPA's INP (below) specifies the following acceptable and maximum recommended $L_{Aeq, Period}$ noise levels for this project specific type area. In this case, the area is described as being Rural.

The EPA refers to 'rural' as:

Rural—means an area with an acoustical environment that is dominated by natural sounds, having little or no road traffic. Such areas may include:

- an agricultural area, except those used for intensive agricultural activities
- a rural recreational area such as resort areas
- a wilderness area or national park
- an area generally characterised by low background noise levels (except in the immediate vicinity of industrial noise sources).

This area may be located in either a **rural, rural-residential, environment protection zone or scenic protection zone**, as defined on a council zoning map (Local Environmental Plan (LEP) or other planning instrument).

Table 2.1 of the EPA INP

Type of Receiver	Indicative Noise Amenity	Time of Day	Recommended $L_{Aeq, Period}$	
			Acceptable	Recommended Maximum
Residential	Rural	Day	50	55
		Evening	45	50
		Night	40	45
Schools	All	Noisiest 1 hour period when in use	35	40
Commercial	All Areas	Day	65	70
		Evening		
		Night		
Industrial	All Areas	Day	70	75
		Evening		
		Night		

Table 2.2 of the EPA INP (below) specifies the modification to the acceptable noise level to account for the existing level of industrial noise when additional industrial noise sources are proposed for the site:

Table 2.2 of the EPA INP

Total existing L_{Aeq} noise level from industrial sources, dB(A)	Maximum L_{Aeq} noise level from new sources alone, dB(A)
Acceptable noise level plus 2	If existing noise level is <i>likely</i> to decrease in future: acceptable noise level minus 10 If existing noise level is <i>unlikely</i> to decrease in future: existing level minus 10
Acceptable noise level plus 1	Acceptable noise level minus 8
Acceptable noise level	Acceptable noise level minus 8
Acceptable noise level minus 1	Acceptable noise level minus 6
Acceptable noise level minus 2	Acceptable noise level minus 4
Acceptable noise level minus 3	Acceptable noise level minus 3
Acceptable noise level minus 4	Acceptable noise level minus 2
Acceptable noise level minus 5	Acceptable noise level minus 2
Acceptable noise level minus 6	Acceptable noise level minus 1
< Acceptable noise level minus 6	Acceptable noise level

The amendments to the EPA INP (2006) state that both the predicted amenity noise level criterion and the intrusive noise level criteria need to be satisfied, which supersedes the requirement of assessing only the most stringent of the two noise criterion. In clearly obvious cases, one or the other noise criterion is considered. In this case, the intrusive noise criterion has been considered as it is clearly the most stringent due to the low Rating Background Level (RBL).

3.1.3 Background Noise

Both the Intrusive and Amenity noise criterion have been derived from previous noise surveys (DFA Consultants – Hitchcock Road Sand Extraction and Rehabilitation Project Noise Management Plan) undertaking ‘long term’ ambient noise level measurements at a representative site. The background noise level was determined over consecutive 15 minute periods for a duration of at least one week. From this data of $L_{A90, 15 \text{ minutes}}$ noise levels, the 10 percentile lowest background noise levels were determined for each of the days. The *rating background level* was then determined by calculating the median value of the daily 10 percentile background noise levels for each of the three specific time periods: daytime, evening and night time.

The rating background level result is used to determine the noise criteria applicable for the surrounding residential properties in accordance with the EPA’s (INP) assessment procedures.

The background noise level $L_{A90, 15 \text{ minutes}}$ is normally determined in the absence of extraneous noise such as traffic, wind, rain, conversation, birds chirping, insect noise and unnatural increases in noise from distant sources due to local air movement. The EPA defines such sources as *incidental noise* which can cause the masking of offensive noise from a specific source. When traffic or other incidental noises cannot be excluded, then it is considered that these noise sources are part of the background noise.

3.2 NOMINATED NOISE CRITERIA

The criterion that applies at each of the sites is based on unattended surveys conducted over a week long period. These surveys were previously conducted by other acoustic consultants and have been included in Environmental Reports.

The Operational Noise Assessment criterion levels are summarised below in Table 3.

Table 3 Operational Criterion Levels (Ref.: The Department of Planning Development Consent – Project Approval)

<u>Site Location</u>	<u>Day</u> L _{Aeq} , 15 min	<u>Night</u> L _{Aeq} , 15 min	<u>Night</u> L _{A1} , 1 min
1. Young property Hitchcock Rd (@ driveway)	40	35	45
2. Pignatara property	42	35	45
3. Jurds property – Back of fire shed	40	35	45
4. Maroota Public School	36 L _{Aeq} , 1 hr	N/A	N/A
5. Old Telegraph Road	35	35	45
6. Western boundary 4713 Old Northern Road	35	35	45

4.0 NOISE SURVEYS

4.1 NOISE MONITORING PROCEDURES

All measurement methodologies and equipment used comply with the relevant Australian Standards:

AS1259.2-1990 “Acoustics - Sound Level Meters - Integrating - Averaging”, and
AS1055 “Acoustics - Description and measurement of environmental noise”.

All sound and noise level measurements were A-frequency and Fast-time weighted.

4.2 ATTENDED NOISE MONITORING

Attended noise monitoring was conducted on the afternoon of 28th June 2010, and the early morning of 8th July 2010 to quantify the existing operational noise levels.

The measurements were conducted with a 01dB Stell Integrating Sound Level Meter and calibrated with a Luton – 94 dB/1000 Hertz Sound Level Calibrator.

5.0 NOISE SURVEY RESULTS

Table 4 refers to the measured noise levels obtained at each of the locations on Monday 28th June 2010.

Table 4. **Daytime** Noise Survey Results
Monday 28th June 2010
[dB(A)]

Site Location	Leq, 15min Criterion	Leq Measured	L90 Measured
Young Hitchcock Road (@ driveway)	40	54 Note 1	45
Pignataro	42	59 Note 2	37
Jurds – Back of fire shed	40	45.6 Note 3	34
Maroota Public School [Leq, 1 hour]	36	42.3 Note 4	38
Old Telegraph Road	35	37.5 Note 5	31
Western boundary 4713 Old Northern Road	35	46 Note 6	37

Note 1. Dominant noise source is that of traffic and birds chirping. Quarry noise was just audible during lulls in traffic, but not measurable. Therefore the noise from quarry was less than the noise criterion.

Note 2. Dominant noise source is that of traffic. Quarry noise was just audible during lulls in traffic, but not measurable. Therefore the noise from quarry was less than the noise criterion.

Note 3. Dominant noise source is that of traffic. Water pump noise between 31 – 33 dB(A) during lulls in traffic. Therefore the noise from quarry was less than the noise criterion.

Note 4. Dominant noise source is that of traffic. Trucks between 41 – 44 dBA, engine brakes about 46 dB(A), overhead aircraft about 38 dB(A). Quarry noise was just audible during lulls in traffic, but not measurable. Therefore the noise from quarry was less than the noise criterion.

Note 5. Dominant noise source is that of birds chirping. Road traffic noise was audible. Quarry noise was just audible only during lulls in traffic, but not measurable. Therefore the noise from quarry was less than the noise criterion.

Note 6. Noise level measurements were taken during the day on 6th July 2010. Road traffic noise was about 53 dB(A). Natural sound was about 37 dB(A) and included birds chirping and rustling of leaves. Quarry noise was just audible during lulls in traffic, but not measurable. Therefore the noise from quarry was less than the noise criterion.

At all the noise monitoring sites, the noise emanating from the Hitchcock Sand Project currently is less than the nominated noise criterion during the daytime.

Table 5 refers to the measured noise levels obtained at each of the locations on Tuesday 6th July 2010 during the night time.

Table 5. **Night Time** Noise Survey Results
Tuesday 6th July 2010
[dB(A)]

Site Location	Leq,15min Criterion	Leq Measured	L90 Measured	L1 Criterion	L1 Measured
Young Hitchcock Road (@ driveway)	35	51 Note 7	37	45	62 Note 7
Pignataro	35	59 Note 8	42	45	57 Note 8
Jurds – Back of fire shed	35	46 Note 9	39	45	53 Note 9
Maroota Public School [Leq, 1 hour]	N/A	N/A	N/A	N/A	N/A
Old Telegraph Road	35	-	-	45	-
Western boundary 4713 Old Northern Rd	35	-	-	45	-

Note 7. Dominant noise source is that of traffic. Quarry noise was not audible even during lulls in traffic. Therefore quarry noise was not measurable. Therefore the noise from quarry was less than the noise criterion.

Note 8. Dominant noise source is that of traffic. Quarry noise was inaudible during lulls in traffic. Insect noise was about 40 dB(A). Birds chirping and roosters crowing about 48 dB(A). Therefore the noise from quarry was less than the noise criterion.

Note 9. Dominant noise source is that of traffic around 53 dB(A). Natural sound including birds chirping, leaves rustling about 41 dB(A). Water pump noise was just audible but not measurable during lulls in traffic. Therefore the noise from quarry was less than the noise criterion.

At all the noise monitoring sites, the noise emanating from the Hitchcock Sand Project currently is less than the nominated noise criterion during the night time.

6.0 CONCLUSIONS

Koikas Acoustics was requested to undertake noise level surveys around the Maroota sand mining extraction and processing quarry and ascertain whether the noise from the extraction and processing works currently exceed the nominated noise criteria as determined from previous unattended noise surveys at various site locations near the subject quarries.

The results of the noise surveys clearly show that the site currently complies with the nominated noise criteria.

At most sites, quarry activities are either just audible or inaudible and in both cases, the noise emanating from the site was found not to be measureable on account of that the natural noise (which includes birds chirping, insects, rustling of leaves) and un-natural noise (being cars and trucks traversing along the main roads).

There are no noise mitigation measures necessary to be implemented to any of the subject quarry sites.

Koikas Acoustics therefore certifies that the subject Maroota Quarries currently comply with the nominated noise criteria despite that the measured noise levels (predominantly that of traffic and other natural sound sources) are currently producing sound levels in-excess of the nominated noise criteria.

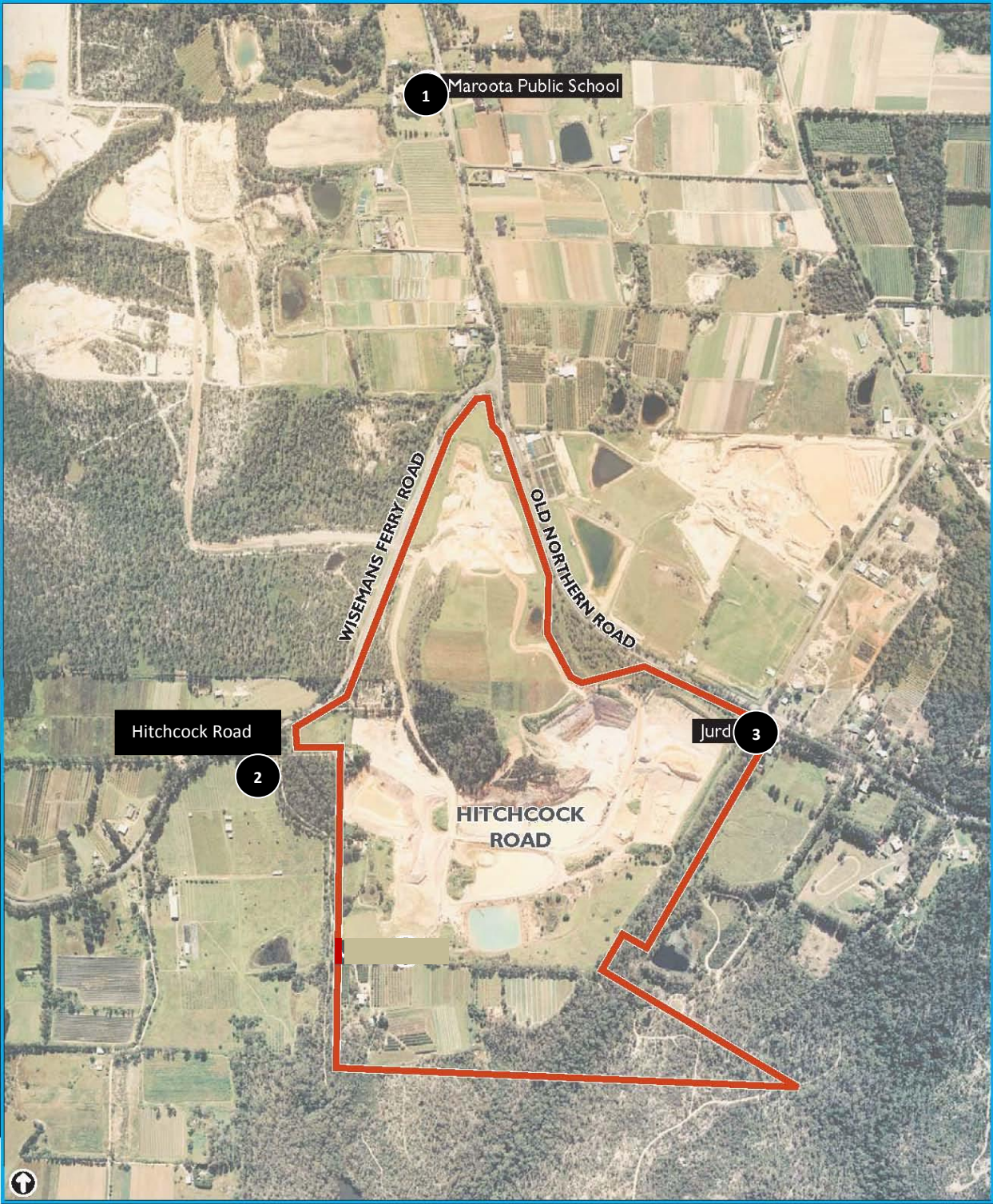
APPENDIX A

A P P E N D I X A

APPENDIX A



1. Young property Hitchcock Road (@ driveway);
2. Pignatara property, corner of Wisemans Ferry Road and Old Northern Road;
3. Jurds property - back of fire shed, adjacent to Old Northern Road;
4. Maroota Public School, rear of school, and
5. Old Telegraph Road.
6. Western boundary 4713 Old Northern Road



Scale
0 500 Metres

AIR QUALITY MONITORING LOCATIONS

Site boundary

3

Monitoring locations

		Summary of Dust Deposition Monitoring Results (g/m2/month)								
		Location 1 - Maroota School			Location 2 - Hitchcock Road			Location 2 (Jurd residence)		
Month/Year		Insoluble Solids	Ash	Total Solids	Insoluble Solids	Ash	Total Solids	Insoluble Solids	Ash	Total Solids
2009	June	1.1	0.53	3.37	2.85	2.22	5.56	1.48	0.83	7.83
	July	1.56	1.3	3.41	1.5	1.27	3.1	1.52	1.37	2.5
	August	2.09	1.42	3.69	2.95	2.06	5.64	3.96	3.14	6.78
	September	2.9	2.36	6.84	3.32	2.6	7.2	2.54	2.13	4.23
	October	4.19	2.61	4.72	2.23	1.66	2.51	6.04	2.8	7.11
	November	3.1	2.03	5.33	2.9	1.92	5.24	3.21	2.23	5.35
	December	2.78	2.28	3.64	1.71	1.34	3.57	2.49	1.69	3.15
2010	January	1.41	1.3	4.49	1.81	1.61	4.61	2.8	2.3	3.97
	February	5.06	3.26	5.24	1.48	1.13	5.5	2.63	1.7	3.03
	March	0.97	0.63	3.09	1.52	0.64	2.63	0.72	0.43	1.11
	April	1.26	1.03	4	2.56	1.77	4.48	2.28	1.27	4.01
	May	0.82	0.67	2.65	1.32	0.77	4.24	0.98	0.59	1.57
Monthly Average		2.27			2.18			2.55		

Attachment 5C

Monthly Dust Monitoring Results

TEST REPORT

CLIENT : P.F.FORMATION

File No:250/09

PROJECT: Gravimetrical Dust Monitoring at Maroota (P.F.Formation) for the month of July 2009

SAMPLE : Dust

TEST PROCEDURE : AS3580.10.1 - 2003 - Methods for sampling and analysis of ambient air.
Method 10.1 : Determination of particulate Deposited Matter - Gravimetric Method.

Field No :	1	2	3	4
Lab.Sample No :	95219	95220	95221	95222
Location :	Site 1	Site 2	Site 3	Site 4
Date sampled from:	1.07.09	to		3.08.09
Results :				
Insoluble solids g/m ² month :	1.56	1.50	1.52	0.89
Ash g/m ² month :	1.30	1.27	1.37	0.83
Combustible matter g/m ² month :	0.26	0.22	0.15	0.06
Soluble matter g/m ² month :	1.86	1.61	0.98	1.28
Total Solids g/m ² month :	3.41	3.10	2.50	2.17
Volume of liquid in the gauge,mL :	700	800	600	700

Refer to attached graph.

JOSHUA GRAHAM
File

M.ABDULNEBE

TEST REPORT

CLIENT : P.F.FORMATION

File No:250/09

PROJECT: Gravimetrical Dust Monitoring at Maroota (P.F.Formation) for the month of August 2009

SAMPLE : Dust

TEST PROCEDURE : AS3580.10.1 - 2003 - Methods for sampling and analysis of ambient air.
Method 10.1 : Determination of particulate Deposited Matter - Gravimetric Method.

Field No :	1	2	3	4
Lab.Sample No :	96178	96179	96180	96181
Location :	Site 1	Site 2	Site 3	Site 4
Date sampled from:	3.08.09	to		1.09.09
Results :				
Insoluble solids g/m ² month :	2.09	2.95	3.96	2.38
Ash g/m ² month :	1.42	2.06	3.14	1.68
Combustible matter g/m ² month :	0.67	0.89	0.81	0.69
Soluble matter g/m ² month :	1.60	2.69	2.83	0.83
Total Solids g/m ² month :	3.69	5.64	6.78	3.21
Volume of liquid in the gauge,mL :	600	700	800	500

Refer to attached graph.

JOSHUA GRAHAM

File

M.ABDULNEBE

TEST REPORT

CLIENT : P.F.FORMATION

File No:250/09

PROJECT: Gravimetrical Dust Monitoring at Maroota (P.F.Formation) for the month of September 2009

SAMPLE : Dust

TEST PROCEDURE : AS3580.10.1 - 2003 - Methods for sampling and analysis of ambient air.
Method 10.1 : Determination of particulate Deposited Matter - Gravimetric Method.

Field No :	1	2	3	4
Lab.Sample No :	96999	97000	97001	97002
Location :	Site 1	Site 2	Site 3	Site 4
Date sampled from:	1.09.09	to		1.10.09
Results :				
Insoluble solids g/m ² month :	2.90	3.32	2.54	2.24
Ash g/m ² month :	2.36	2.60	2.13	1.98
Combustible matter g/m ² month :	0.54	0.71	0.41	0.25
Soluble matter g/m ² month :	3.94	3.88	1.69	3.97
Total Solids g/m ² month :	6.84	7.20	4.23	6.21
Volume of liquid in the gauge,mL :	900	900	800	900
Refer to attached graph.				
JOSHUA GRAHAM				
File				

M.ABDULNEBE



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Date 2-10-09 Serial No. 81126

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TEST REPORT

CLIENT : P. F. FORMATION

File No: 250/09

PROJECT: Gravimetric Dust Monitoring at Maroota (P.F.Formation) for the month of October 2009

SAMPLE : Dust

TEST PROCEDURE : AS3580.10.1 - 2003 - Methods for sampling and analysis of ambient air.
Method 10.1 : Determination of particulate Deposited Matter - Gravimetric Method.

Field No :	1	2	3	4
Lab.Sample No :	98113	98114	98115	98116
Location :	Site 1	Site 2	Site 3	Site 4
Date sampled from:	1.10.09	to		2.11.09
Results :				
Insoluble solids (g/m ² month) :	4.19	2.23	6.04	1.75
Ash (g/m ² month) :	2.61	1.66	2.80	1.46
Combustible matter (g/m ² month) :	1.59	0.57	3.25	0.30
Soluble matter (g/m ² month) :	0.53	0.28	1.07	0.14
Total Solids (g/m ² month) :	4.72	2.51	7.11	1.89
Volume of liquid in the gauge,mL :	2000	2000	2000	1800

Refer to attached graph.

Joshua Graham, File


M. Abdulnebe



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TEST REPORT

CLIENT : P. F. FORMATION

File No: 250/09

PROJECT: Gravimetrical Dust Monitoring at Maroota (P.F.Formation) for the month of November 2009

SAMPLE : Dust

TEST PROCEDURE : AS3580.10.1 - 2003 - Methods for sampling and analysis of ambient air.
Method 10.1 : Determination of particulate Deposited Matter - Gravimetric Method.

Field No :	1	2	3	4
Lab.Sample No :	98714	98715	98716	98717
Location :	Site 1	Site 2	Site 3	Site 4
Date sampled from:	2.11.09		to	1.12.09
Results :				
Insoluble solids (g/m ² month) :	3.10	2.90	3.21	7.87
Ash (g/m ² month) :	2.03	1.92	2.23	2.63
Combustible matter (g/m ² month) :	1.08	0.98	0.98	5.24
Soluble matter (g/m ² month) :	2.23	2.34	2.14	3.66
Total Solids (g/m ² month) :	5.33	5.24	5.35	11.53
Volume of liquid in the gauge,mL :	550	600	600	600

Refer to attached graph.

Joshua Graham, File

M. Abdulnebe



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Facsimile 61 2 9624 9999

TEST REPORT**CLIENT :** P. F. FORMATION**File No:** 250/10**PROJECT:** Gravimetric Dust Monitoring at Maroota (P.F.Formation) for the month of December 2009**SAMPLE :** Dust

TEST PROCEDURE : AS3580.10.1 - 2003 - Methods for sampling and analysis of ambient air.
Method 10.1 : Determination of particulate Deposited Matter - Gravimetric Method.

Field No :	1	2	3	4
Lab.Sample No :	99886	99887	99888	99889
Location :	Site 1	Site 2	Site 3	Site 4
Date sampled from:	1.12.09	to		4.01.10
Results :				
Insoluble solids (g/m ² month) :	2.78	1.71	2.49	1.45
Ash (g/m ² month) :	2.28	1.34	1.69	1.08
Combustible matter (g/m ² month) :	0.51	0.37	0.80	0.37
Soluble matter (g/m ² month) :	0.86	1.86	0.66	4.03
Total Solids (g/m ² month) :	3.64	3.57	3.15	5.48
Volume of liquid in the gauge, mL :	1700	1800	2000	1700

Refer to attached graph.

Note: sample collected outside period of time as stipulated in the test method.

Joshua Graham, File

M. Abdulnebe

Approved Signatory

Date 21.01.10 Serial No. 83476

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TEST REPORT**CLIENT :** P. F. FORMATION**File No:** 250/10**PROJECT:** Gravimetrical Dust Monitoring at Maroota (P.F.Formation) for the month of January 2010**SAMPLE :** Dust
TEST PROCEDURE : AS3580.10.1 - 2003 - Methods for sampling and analysis of ambient air.
 Method 10.1 : Determination of particulate Deposited Matter - Gravimetric Method.

Field No :	1	2	3	4
Lab.Sample No :	100504	100505	100506	100507
Location :	Site 1	Site 2	Site 3	Site 4
Date sampled from:	4.01.10	to		1.02.10
Results :				
Insoluble solids (g/m ² month) :	1.41	1.81	2.80	2.68
Ash (g/m ² month) :	1.30	1.61	2.30	2.11
Combustible matter (g/m ² month) :	0.12	0.19	0.50	0.57
Soluble matter (g/m ² month) :	3.08	2.81	1.18	1.44
Total Solids (g/m ² month) :	4.49	4.61	3.97	4.12
Volume of liquid in the gauge,mL :	1200	1200	1000	1400

Refer to attached graph.

Joshua Graham, File

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TEST REPORT**CLIENT :** P. F. FORMATION**File No:** 250/10**PROJECT:** Gravimetric Dust Monitoring at Maroota (P.F.Formation) for the month of February 2010**SAMPLE :** Dust
TEST PROCEDURE : AS3580.10.1 - 2003 - Methods for sampling and analysis of ambient air.
 Method 10.1 : Determination of particulate Deposited Matter - Gravimetric Method.

Field No :	1	2	3	4
Lab.Sample No :	101428	101429	101430	101431
Location :	Site 1	Site 2	Site 3	Site 4
Date sampled from:	1.02.10	to		1.03.10
Results :				
Insoluble solids (g/m ² month) :	5.06	1.48	2.63	1.35
Ash (g/m ² month) :	3.26	1.13	1.70	0.93
Combustible matter (g/m ² month) :	1.79	0.35	0.93	0.42
Soluble matter (g/m ² month) :	0.18	4.02	0.40	1.16
Total Solids (g/m ² month) :	5.24	5.50	3.03	2.51
Volume of liquid in the gauge,mL :	2100	2000	2200	2100

Refer to attached graph.

Joshua Graham, File

M. Abdulnebe


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Date 12-03-10

Serial No.

84678

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TEST REPORT

CLIENT : P. F. FORMATION

File No: 250/10

PROJECT: Gravimetrical Dust Monitoring at Maroota (P.F.Formation) for the month of March 2010

SAMPLE : Dust

TEST PROCEDURE : AS3580.10.1 - 2003 - Methods for sampling and analysis of ambient air.
Method 10.1 : Determination of particulate Deposited Matter - Gravimetric Method.

Field No :	1	2	3	4
Lab.Sample No :	102472	102473	102474	102475
Location :	Site 1	Site 2	Site 3	Site 4
Date sampled from:	1.03.10	to		1.04.10
Results :				
Insoluble solids (g/m ² month) :	0.97	1.52	0.72	0.89
Ash (g/m ² month) :	0.63	0.64	0.43	0.74
Combustible matter (g/m ² month) :	0.33	0.88	0.29	0.15
Soluble matter (g/m ² month) :	2.13	1.11	0.39	0.63
Total Solids (g/m ² month) :	3.09	2.63	1.11	1.52
Volume of liquid in the gauge,mL :	1400	1300	1400	1400

Refer to attached graph.

Joshua Graham, File

M. Abdulnebe



Approved Signatory _____

Date 14.04.10

Serial No. 85513

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TEST REPORT**CLIENT :** P.F. FORMATION**File No.:** 250 / 10**PROJECT:** Gravimetrical Dust Monitoring at Maroota (P.F.Formation) for the month of April 2010**SAMPLE :** Dust

TEST PROCEDURE : AS3580.10.1 - 2003 - Methods for sampling and analysis of ambient air.
Method 10.1 : Determination of particulate Deposited Matter - Gravimetric Method.

Field No.:	1	2	3	4
Lab. Sample No.:	103714	103715	103716	103717
Location:	Site 1	Site 2	Site 3	Site 4
Date sampled from:	1.04.10	to		1.05.10
Results :				
Insoluble solids (g/m ² month) :	1.26	2.56	2.28	1.36
Ash (g/m ² month) :	1.03	1.77	1.27	0.67
Combustible matter (g/m ² month) :	0.24	0.78	1.02	0.70
Soluble matter (g/m ² month) :	2.74	1.92	1.72	2.44
Total Solids (g/m ² month) :	4.00	4.48	4.01	3.80
Volume of liquid in the gauge, mL :	1000	1100	1200	1000

Refer to attached graph.

J.Graham, File.



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Approved Signatory S. Krishnamoorthy

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TEST REPORT

CLIENT : P.F. FORMATION

File No.: 250 / 10

PROJECT: Gravimetric Dust Monitoring at Maroota (P.F. Formation) for the month of May 2010

SAMPLE : Dust

TEST PROCEDURE : AS3580.10.1 - 2003 - Methods for sampling and analysis of ambient air.
Method 10.1 : Determination of particulate Deposited Matter - Gravimetric Method.

Field No.:	1	2	3	4
Lab. Sample No.:	104716	104717	104718	104719
Location:	Site 1	Site 2	Site 3	Site 4
Date sampled from:	1.05.10	to		1.06.10
Results :				
Insoluble solids (g/m ² month) :	0.82	1.32	0.98	0.21
Ash (g/m ² month) :	0.67	0.77	0.59	0.18
Combustible matter (g/m ² month) :	0.14	0.55	0.40	0.03
Soluble matter (g/m ² month) :	1.84	2.93	0.59	3.49
Total Solids (g/m ² month) :	2.65	4.24	1.57	3.70
Volume of liquid in the gauge,mL :	1750	1700	1800	1600

Refer to attached graph.

J.Graham, File.

S.Krishnamoorthy



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Approved Signatory *[Signature]*Date 10.6.10 Serial No. 87046

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TEST REPORT**CLIENT :** P.F. FORMATION**File No.:** 250 / 10**PROJECT:** Gravimetrical Dust Monitoring at Maroota (P.F.Formation) for the month of June 2010**SAMPLE :** Dust

TEST PROCEDURE : AS3580.10.1 - 2003 - Methods for sampling and analysis of ambient air.
Method 10.1 : Determination of particulate Deposited Matter - Gravimetric Method.

Field No.:	1	2	3	4
Lab. Sample No.:	105914	105915	105916	105917
Location:	Site 1	Site 2	Site 3	Site 4
Date sampled from:	1.06.10	to		1.07.10
Results :				
Insoluble solids (g/m ² month) :	1.41	1.77	0.94	0.73
Ash (g/m ² month) :	0.99	1.17	0.51	0.57
Combustible matter (g/m ² month) :	0.42	0.60	0.44	0.15
Soluble matter (g/m ² month) :	0.80	0.99	0.52	0.41
Total Solids (g/m ² month) :	2.21	2.77	1.46	1.14
Volume of liquid in the gauge, mL :	2100	2200	2200	2200

Refer to attached graph.

J.Graham, File.

S.Krishnamoorthy

Approved Signatory



Date 14.7.10

Serial No.

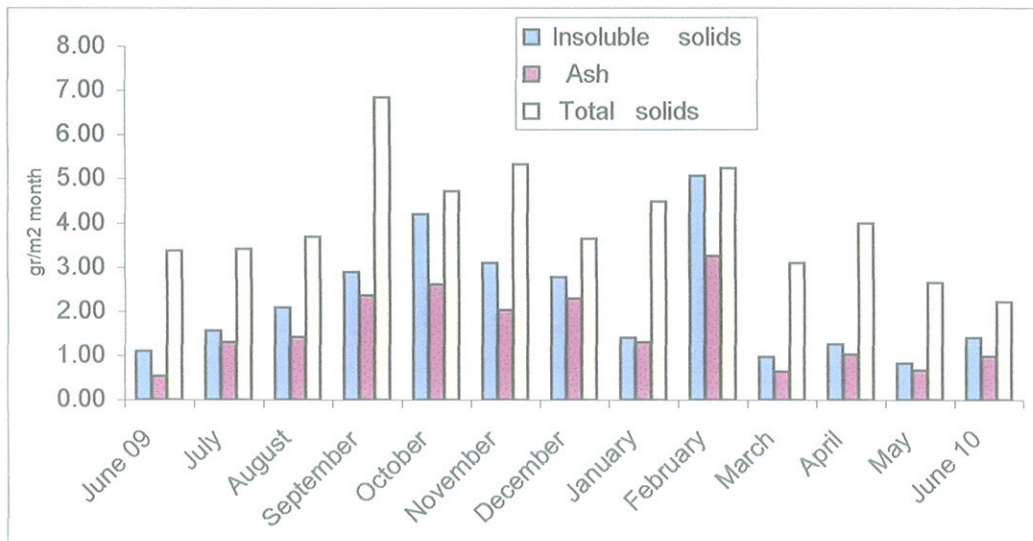
87 963

Dust Monitoring

Maroota Site 1

Maroota Public School

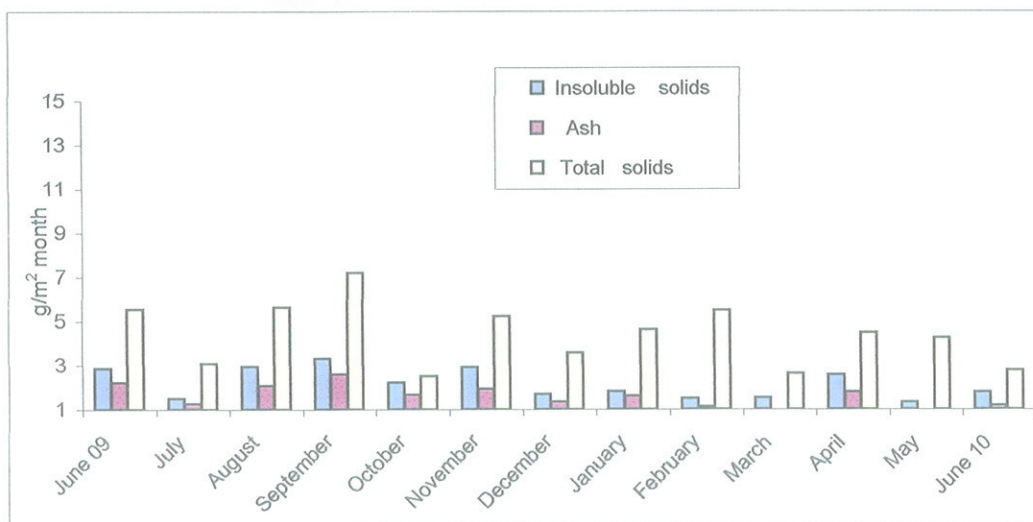
	Insoluble solids	Ash	Total solids
June 09	1.10	0.53	3.37
July	1.56	1.30	3.41
August	2.09	1.42	3.69
September	2.90	2.36	6.84
October	4.19	2.61	4.72
November	3.10	2.03	5.33
December	2.78	2.28	3.64
January	1.41	1.30	4.49
February	5.06	3.26	5.24
March	0.97	0.63	3.09
April	1.26	1.03	4.00
May	0.82	0.67	2.65
June 10	1.41	0.99	2.21



Dust Monitoring

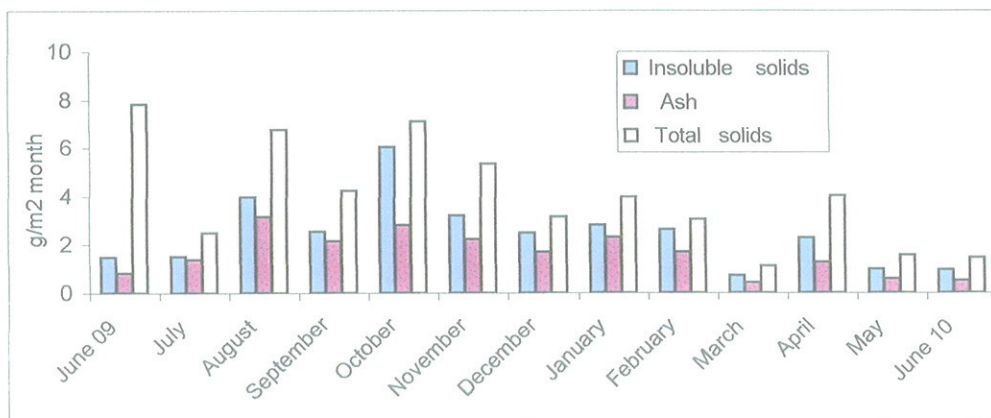
Maroota Site 2
Hitchcock Rd

	Insoluble solids	Ash	Total solids
June 09	2.85	2.22	5.56
July	1.50	1.27	3.10
August	2.95	2.06	5.64
September	3.32	2.60	7.20
October	2.23	1.66	2.51
November	2.90	1.92	5.24
December	1.71	1.34	3.57
January	1.81	1.61	4.61
February	1.48	1.13	5.50
March	1.52	0.64	2.63
April	2.56	1.77	4.48
May	1.32	0.77	4.24
June 10	1.77	1.17	2.77



Dust Monitoring
Maroota Site 3
Jurd's Property

	Insoluble solids	Ash	Total solids
June 09	1.48	0.83	7.83
July	1.52	1.37	2.50
August	3.96	3.14	6.78
September	2.54	2.13	4.23
October	6.04	2.80	7.11
November	3.21	2.23	5.35
December	2.49	1.69	3.15
January	2.80	2.30	3.97
February	2.63	1.70	3.03
March	0.72	0.43	1.11
April	2.28	1.27	4.01
May	0.98	0.59	1.57
June 10	0.94	0.51	1.46



PM10 Dust Action Plan

Background

As Dixon Sands have a PM10 monitoring location at Maroota on the property adjoining the Maroota Public School they have agreed to contact us in the event the rolling 24-hour average PM10 result nears or exceeds 42 ug/m³ in working hours. (This is after Dixon's themselves are notified by their consultants.) We have agreed to the following Plan in the event we become aware of high PM10 dust recordings in the Maroota area. The aim is to determine whether PF Formation operations could be a source or contributor to the high results and if this is the case and if there could be a potential impact on the school to take measures to reduce this potential impact.

Plan

In the event PF Formation are contacted by Dixon Sands advising that the PM10 result is near or exceeds the trigger then:

1. John Graham, Peter Watt, Joshua Graham, Luke Graham and Peter Cummins (management team) are all to be advised by telephone/two-way immediately
2. The current wind direction is to be assessed by them at the weather monitoring station.
3. If the wind direction is from our operations to the Dixon monitoring location then action must be taken to reduce PF Formation's PM10 emissions.
4. The management team are to advise all staff to assess all dust generating activities for all areas that could impact the Maroota Public School except for activities solely undertaken to reduce dust impacts
5. The management team is to evaluate the conditions, liaise with Dixon Sands regarding the status of the rolling 24-hour PM10 average and undertake necessary dust suppression activities such as watering roads, exposed areas and stockpiles.
6. If the dust levels have not reduced to allowable levels within 1 hour of ceasing dust generating activities and it is within school hours plus 30 minutes then all dust generating activities within the relevant area must stop.

Attachment 5E

Weather Condition Results

PF FORMATION WEATHER CHART

JULY 2009

DATE	TEMP-MIN	TEMP-MAX	WIND-SPD	WIND-DIR	BAR	RAIN	CONDITION
1/07/2009	16	21	10-65	NNW-WNW	999.1	NIL	FINE
2/07/2009	9	18	10-45	N-NW	1002.5	NIL	FINE
3/07/2009	9	16	25-35	WNW-SSW	998.1	NIL	FINE
4/07/2009	5	16	0-25	WNW	1006.1	NIL	FINE
6/07/2009	4	15	0-10	NW-S	1016.1	NIL	FINE
7/07/2009	7	13	0-10	SSE	1018.7	NIL	FINE
8/07/2009	8	15	0-5	SW-SE	1020.7	3mm	FINE
9/07/2009	9	15	0-10	S	1024.8	2mm	OVERCAST
10/07/2009	8	16	0-10	S-NE	1022.2	2mm	OVERCAST
11/07/2009	8	16	0-5	NNE-WSW	1015.9	NIL	FINE
13/07/2009	12	17	0-5	NW-WSW	1001.3	NIL	FINE
14/07/2009	9	15	10-25	NW-W	1001.1	NIL	FINE
15/07/2009	5	15	0-10	NW-WSW	1003.5	NIL	FINE
16/07/2009	6	15	0-25	WSW-SSE	1005.9	2.5mm	FINE
17/07/2009	7	15	0-20	WSW-SE	1011.1	NIL	FINE
18/07/2009	4	15	0	ESE	1015	NIL	FINE
20/07/2009	7	20	0-12	NNE-NNW	1018.8	NIL	FINE
21/07/2009	8	23	0-5	NNW-NW	1014.2	NIL	FINE
22/07/2009	16	23	20-25	NW-NNW	1006.7	NIL	FINE
23/07/2009	7	20	0-10	NNW-SW	1005.2	NIL	FINE
24/07/2009	7	17	0-15	S-NE	1019	NIL	FINE
25/07/2009	5	15	0-10	NNW	1019	NIL	FINE
26/07/2009						5.5mm	
27/07/2009	6	17	0-15	W-WNW	1008.8	NIL	FINE
28/07/2009	5	19	0-15	WNW-WSW	1015	NIL	FINE
29/07/2009	5	20	0-15	W-SW	1017.2	NIL	FINE
30/07/2009	5	19	0-5	SSW-WNW	1019.8	NIL	FINE
31/07/2009	6	17	0-20	NW-WNW	1013.9	NIL	FINE

PF FORMATION WEATHER CHART

AUGUST 2009

DATE	TEMP-MIN	TEMP-MAX	WIND-SPD	WIND-DIR	BAR	RAIN	CONDITION
1/08/2009	5	18	0-10	W-WNW	1019.3	NIL	FINE
2/08/2009							
3/08/2009	7	20	0-15	W-SE	1013.6	NIL	FINE
4/08/2009	7	19	0-10	S-SE	1015.6	NIL	FINE
5/08/2009	5	20	0-5	SE-S	1015	NIL	FINE
6/08/2009	6	20	0-20	NNE	1016.1	NIL	FINE
7/08/2009	7	21	0-35	NW-SW	1009	NIL	FINE
8/08/2009	5	18	0-25	SSW	1016	NIL	FINE
9/08/2009							
10/08/2009	4	17	0-15	ENE	1011.9	NIL	FINE
11/08/2009	9	17	0-20	WNW	1008.9	2mm	FINE
12/08/2009	8	20	0-15	WSW	1005.4	NIL	FINE
13/08/2009	7	22	0-15	NNW-SW	1007	NIL	FINE
14/08/2009	7	21	0-10	WNW-SE	1012.8	NIL	FINE
15/08/2009	6	21	0-10	ESE-NE	1012.5	NIL	FINE
16/08/2009							
17/08/2009	17	23	0-35	WSW-SW	1005.3	NIL	FINE
18/08/2009	5	21	0-20	S-N	1021	NIL	FINE
19/08/2009	6	19	0-25	NE-NW	1021.4	NIL	FINE
20/08/2009	8	22	0-5	NNW-NNE	1012.7	NIL	FINE
21/08/2009	12	23	0-10	N-NNW	1004.6	NIL	FINE
22/08/2009	13	25	0-20	NNW	1006.7	NIL	FINE
23/08/2009							
24/08/2009	20	26	0-60	N-NW	1006.2	NIL	FINE
25/08/2009	17	20	65-10	WSW-NNW	1007.2	NIL	FINE
26/08/2009	13	22	30-55	W-SW	1015.3	NIL	FINE
27/08/2009	9	25	0-25	W-NNW	1014.6	NIL	FINE
28/08/2009	9	26	0-25	NNW	1019.6	NIL	FINE
29/08/2009	14	20	0-15	NW	1012.2	NIL	FINE
30/08/2009							
31/08/2009	6	21	0-20	NW	1019.7	NIL	FINE

PF FORMATION WEATHER CHART

SEPTEMBER 2009

DATE	TEMP-MIN	TEMP-MAX	WIND-SPD	WIND-DIR	BAR	RAIN	CONDITION
1/09/2009	8	23	5-20	ENE-E	1022.8	NIL	FINE
2/09/2009	7	22	5-15	N-NE	1026.2	NIL	FINE
3/09/2009	8	16	0-10	ENE-WNW	1023.4	5mm	FINE
4/09/2009	12	24	10-20	NNE-NW	1016.8	1.5mm	FINE
5/09/2009	12	22	0-15	NE-WNW	1017.1	NIL	FINE
6/09/2009							
7/09/2009	12	17	0-25	N-WNW	1012.1	1.5mm	FINE
8/09/2009	9	20	0-20	NW-SW	1008.2	NIL	FINE
9/09/2009	8	21	0-20	W-SW	1013	NIL	FINE
10/09/2009	6	23	0-20	NW	1015.4	NIL	FINE
11/09/2009	6	24	0-10	N-NW	1019.9	NIL	FINE
12/09/2009	11	29	0-20	NW	1023.4	NIL	FINE
13/09/2009							
14/09/2009	19	22	0-25	NW-SW	1018.8	NIL	FINE
15/09/2009	15	23	0-15	SE-NNE	1023.7	NIL	FINE
16/09/2009	15	21	0-12	S-NW	1025.7	NIL	FINE
17/09/2009	14	31	5-35	NNW-WNW	1020.3	NIL	FINE
18/09/2009	13	30	0-20	NNW-SW	1021.3	NIL	FINE
19/09/2009	15	24	0-20	NNW	1021.2	NIL	FINE
20/09/2009							
21/09/2009	14	20	0-15	SW-NNW	1016.5	0.5mm	FINE
22/09/2009	15	29	8-48	NW	1006.3	NIL	FINE
23/09/2009	19	21	30-55	NNW	998.5	NIL	FINE
24/09/2009	13	22	0-35	WSW	1012.4	NIL	FINE
25/09/2009	11	26	8-20	NNW-WNW	1015.3	NIL	FINE
26/09/2009	18	22	20-35	SW-NW	1004.7	NIL	FINE
27/09/2009							
28/09/2009	9	22	0-15	W-WSW	1010.3	NIL	FINE
29/09/2009	8	22	0-15	SSW-E	1014.8	NIL	FINE
30/09/2009	8	28	0-15	NNE-W	1020.2	NIL	FINE

PF FORMATION WEATHER CHART

OCTOBER 2009

DATE	TEMP-MIN	TEMP-MAX	WIND-SPD	WIND-DIR	BAR	RAIN	CONDITION
1/10/2009	15	33	0-25	NNW-W	1016.8	NIL	FINE
2/10/2009	15	30	0-15	S-SW	1014.1	10mm	FINE
3/10/2009	14	22	0-20	SSW-S	1011.4	28mm	STORM
4/10/2009							
5/10/2009							
6/10/2009	9	21	0-10	SE-ESE	1021.9	3mm	OVERCAST
7/10/2009	11	20	0-20	ENE-SW	1016.5	NIL	CLOUDY
8/10/2009	8	17	15-35	SSE-SSW	1019.7	NIL	FINE
9/10/2009	8	17	5-30	SW-SSW	1028.4	1.5mm	CLOUDY
10/10/2009	8	17	5-25	SSW-SSE	1032.6	4mm	CLOUDY
11/10/2009							
12/10/2009	10	21	0-20	N-NNW	1013.6	NIL	CLOUDY
13/10/2009	14	23	0-45	NNW-NW	1002.7	NIL	FINE
14/10/2009	14	21	5-35	NW-W	1003.4	5mm	CLOUDY
15/10/2009	13	21	5-30	NW-W	1009.8	NIL	FINE
16/10/2009	9	21	0-30	WSW-W	1013	NIL	FINE
17/10/2009	8	21	0-25	WSW	1016.2	NIL	FINE
18/10/2009							
19/10/2009	9	28	0-10	NE-ENE	1029	NIL	FINE
20/10/2009	13	32	0-26	ESE-S	1026.4	NIL	FINE
21/10/2009	13	36	0-10	E-SW	1022.4	NIL	FINE
22/10/2009	18	25	0-20	SE-NNE	1026.7	NIL	FINE
23/10/2009	13	34	0-10	NNW-SW	1019.7	NIL	FINE
24/10/2009	17	32	0	S-N	1020.6	NIL	FINE
25/10/2009						22mm	
26/10/2009	13	22	10-25	SE-SSW	1022	23mm	OVERCAST
27/10/2009	13	25	0-15	SSW-NW	1030.1	NIL	FINE
28/10/2009	12	26	0-10	S-NE	1027.6	NIL	FINE
29/10/2009	16	22	0-10	S-SSW	1026.7	NIL	FINE
30/10/2009	16	29	0-15	N-NW	1024.5	NIL	FINE
31/10/2009	18	26	0-20	NNW-NW	1025.7	NIL	FINE

PF FORMATION WEATHER CHART

NOVEMBER 2009

DATE	TEMP-MIN	TEMP-MAX	WIND-SPD	WIND-DIR	BAR	RAIN	CONDITION
1/11/2009							
2/11/2009	18	32	0-20	SSE	1022	NIL	FINE
3/11/2009	18	36	Jul-20	NNE-NW	1014.9	NIL	FINE
4/11/2009	18	21	0-5	NE-SE	1015.7	NIL	FINE
5/11/2009	16	22	0-10	E-S	1021	2mm	FINE
6/11/2009	16		0-5	SE	1029.2	NIL	FINE
7/11/2009	17	21	0-15	SE-NE	1028.3	NIL	FINE
8/11/2009						4.5mm	OVERCAST
9/11/2009	17	27	0-10	NE-SE	1029	NIL	FINE
10/11/2009	12	30	0-15	N-NNE	1024.3	NIL	FINE
11/11/2009	14	30	0-15	E-NE	1023.8	NIL	FINE
12/11/2009	14	35	0-15	NE-E	1022.1	6.5mm	FINE
13/11/2009	18	22	8-28	ESE-SSE	1018.8	NIL	FINE
14/11/2009	13	32	0-10	ESE	1018.5	NIL	FINE
15/11/2009							
16/11/2009	19	35	0-15	ESE-NE	1011	NIL	FINE
17/11/2009	19	25	0-10	ESE	1009.7	NIL	FINE
18/11/2009	16	28	0-10	SE-NNE	1014.4	NIL	FINE
19/11/2009	17	35	0-15	N-NE	1012.1	NIL	FINE
20/11/2009	22	42	0-25	ENE	1009.9	3mm	STORM
21/11/2009	22	36	5-15	S-SSW	1011.4	NIL	FINE
22/11/2009							
23/11/2009	20	21	10-20	SSE-SSW	1021.3	NIL	FINE
24/11/2009	15	20	5-15	SSW	1028.4	1.5mm	FINE
25/11/2009	17	29	0-15	SSW-NE	1023.6	NIL	FINE
26/11/2009	19	32	0-15	NE	1018.7	3mm	FINE
27/11/2009	20	33	0-25	WNW-WSW	1011.2	NIL	FINE
28/11/2009	20	34	0-5	WSW	1007.2	NIL	FINE
29/11/2009							
30/11/2009	16	25	0-25	SW-SE	1006.3	12mm	STORM

PF FORMATION WEATHER CHART

DECEMBER 2009

DATE	TEMP-MIN	TEMP-MAX	WIND-SPD	WIND-DIR	BAR	RAIN	CONDITION
1/12/2009	12	23	0-10	S-SE	1017.6	2mm	FINE
2/12/2009	13	22	0-10	S-SE	1023	NIL	FINE
3/12/2009	15	29	0-15	SE-ENE	1018.9	NIL	FINE
4/12/2009	16	30	0-10	N-NW	1014.9	NIL	FINE
5/12/2009	17	30	0-10	WNW	1016	NIL	FINE
6/12/2009							
7/12/2009	19	36	0-15	WNW	1010.4	NIL	FINE
8/12/2009	19	37	0-15	S-SSW	1009.5	NIL	FINE
9/12/2009	18	27	0-20	SSW-SSE	1009.8	NIL	FINE
10/12/2009	19	30	0-25	ENE-NNW	1012.3	NIL	FINE
11/12/2009	20	30	0-25	NNW-SSW	1012.9	NIL	FINE
12/12/2009	15	31	0-15	SE	1019.2	NIL	FINE
13/12/2009							
14/12/2009	20	22	0-10	SE	1020.3	NIL	FINE
15/12/2009	18	26	0-10	SE-N	1023.7	NIL	FINE
16/12/2009	20	35	0-15	N-NE	1021.6	NIL	FINE
17/12/2009	21	40	0-66	NW	1015.2	7mm	LATE STORM
18/12/2009	22	27	0-10	NE	1012.8	20mm	RAIN
19/12/2009	17	29	0-10	SSE-SW	1017.3	NIL	FINE
20/12/2009							
21/12/2009	17	28	0-20	N-NW	1017.4	NIL	FINE
22/12/2009	20	30	0-15	NW-WNW	1012.3	1mm	FINE
23/12/2009	19	32	0-15	WNW-ENE	1017.1	NIL	FINE
24/12/2009	22	32	0-10	N	1013.9	NIL	FINE
25/12/2009	NOTE - 70mm RAIN BETWEEN 24-12-09 AND 4-01-10						
26/12/2009							
27/12/2009							
28/12/2009							
29/12/2009							
30/12/2009							
31/12/2009							

PF FORMATION WEATHER CHART

JANUARY 2010

DATE	TEMP-MIN	TEMP-MAX	WIND-SPD	WIND-DIR	BAR	RAIN	CONDITION
1/01/2010							
2/01/2010							
3/01/2010							
4/01/2010	17	24	0-10	NNW-NE	1022.4	NIL	FINE
5/01/2010	17	33	0-20	NNE-NE	1018.8	NIL	FINE
6/01/2010	20	31	0-10	NW-SE	1014.7	NIL	FINE
7/01/2010	20	23	0-15	SSE-SE	1017.7	1mm	FINE
8/01/2010	18	27	0-10	SW	1021.8	NIL	FINE
9/01/2010	19	34	0-15	N-SSE	1018.7	NIL	FINE
10/01/2010							
11/01/2010	21	30	0-20	S-E	1021.1	NIL	FINE
12/01/2010	22	39	0-25	N-NNW	1013.7	NIL	FINE
13/01/2010	26	35	0-20	N-S	1009.4	18mm	FINE
14/01/2010	19	27	0-15	S-SSW	1017.1	3mm	FINE
15/01/2010	18	26	0-10	SSW-ENE	1019	NIL	FINE
16/01/2010	20	30	0-5	ENE	1015.1	7mm	FINE
17/01/2010							
18/01/2010	16	26	0-45	SW-WNW	1003.2	NIL	FINE
19/01/2010	12	27	0-25	SSE-SSW	1009.6	NIL	FINE
20/01/2010	14	33	0-10	W-N	1010.4	NIL	FINE
21/01/2010	17	37	0-10	ENE-NE	1011.9	NIL	FINE
22/01/2010	21	39	0-25	S-W	1014.1	NIL	FINE
23/01/2010	28	42	10-20	NNW	1009.5	NIL	FINE
24/01/2010							
25/01/2010	20	30	0-15	NW	1013.9	NIL	FINE
26/01/2010							
27/01/2010	23	28	0-0	SSW-E	1015.1	NIL	FINE
28/01/2010	20	33	0-20	W-SW	1013.1	7mm	FINE
29/01/2010	19	32	0-25	W-SW	1008.1	NIL	FINE
30/01/2010	21	24	0-25	SSW-SSE	1019.5	18mm	RAIN
31/01/2010							

PF FORMATION WEATHER CHART

FEBRUARY 2010

DATE	TEMP-MIN	TEMP-MAX	WIND-SPD	WIND-DIR	BAR	RAIN	CONDITION
1/02/2010	19	30	0-10	NNE-SE	1015.7	3mm	FINE
2/02/2010	20	27	0-5	SSE-ESE	1017.8	8mm	FINE
3/02/2010	20	27	0-15	SE-E	1014.9	17mm	OVERCAST
4/02/2010	22	27	0-10	ENE-NNW	1013.8	19mm	OVERCAST
5/02/2010	22	27	0-20	N-NE	1009.8	8	OVERCAST
6/02/2010	20	32	0-15	SSE	1017.2	90mm	OVERCAST
7/02/2010							
8/02/2010	21	25	0-15	N-SW	1022.3	1mm	FINE
9/02/2010	20	28	0-10	W-NE	1024.3	0	FINE
10/02/2010	20	32	0-5	NE-ENE	1017.6	0	FINE
11/02/2010	20	32	0-15	NNE-NE	1017.3	0	FINE
12/02/2010	24	36	0-25	NNE-NW	1009.1	10mm	FINE
13/02/2010	22	24	0-24	WSW-SE	1011.9		FINE
14/02/2010						22mm	
15/02/2010	20	31	0-15	S-NNW	1006.5	0	FINE
16/02/2010	20	25	0-10	WSW-SE	1011.5	0	FINE
17/02/2010	17	27	0-10	SSE	1018.9	0	FINE
18/02/2010	17	25	0-15	SSE-SE	1022.1	0	FINE
19/02/2010	16	23	0-10	SE-NE	1026.8	0	FINE
20/02/2010							
21/02/2010							
22/02/2010	21	36	0-25	WNW-NW	1015.1	0	FINE
23/02/2010	23	34	0-20	NNW-ESE	1013.2	0	FINE
24/02/2010	19	23	0-5	S-ESE	1022.1	0	FINE
25/02/2010	14	24	0-0	NE-SSW	1027.6	0	FINE
26/02/2010	16	25	0-0	NNE	1028	0	FINE
27/02/2010	17	27	0-0	NNE-NNW	1022.9	0	FINE
28/02/2010							

PF FORMATION WEATHER CHART

MAR 10

DATE	TEMP-MIN	TEMP-MAX	WIND-SPD	WIND-DIR	BAR	RAIN	CONDITION
1/03/2010	17	18	0-5	SSW-S	1019.2	3	CLOUDY
2/03/2010	15	20	0-15	SSE	1021.4	1	CLOUDY
3/03/2010	16	23	0-10	SSE-NNE	1018.4	0	FINE
4/03/2010	16	20	0-10	NNE	1018.1	0	FINE
5/03/2010	19	22	0-5	NNE-WSW	1011	2	CLOUDY
6/03/2010	20	27	0-5	WNW	1012.6	0	FINE
7/03/2010	SUNDAY						
8/03/2010	20	29	0-8	NNE-N	1010	0	FINE
9/03/2010	17	29	0-9	SSW-WNW	1014	0	FINE
10/03/2010	16	19	0-9	WNW-ESS	1023	9	CLOUDY
11/03/2010	17	21	0-12	SSW-SSW	1031.8	1	FINE
12/03/2010	NIL	NIL	NIL	NIL	NIL	NIL	NIL
13/03/2010	NIL	NIL	NIL	NIL	NIL	NIL	NIL
14/03/2010	NIL	NIL	NIL	NIL	NIL	NIL	NIL
15/03/2010	16	26	0-0	S-E	1027	0-0	CLOUDY
16/03/2010	16	27	0-5	E-N	1023.9	0-0	FINE
17/03/2010	14	28	0-0	NNE-N	1027.1	0-0	FINE
18/03/2010	15	30	0-0	N-NNE	1026.9	0-0	FINE
19/03/2010	16	32	0-0	NNE-NNE	1023.6	0-0	FINE
20/03/2010	18	31	0-0	NNE-NNE	1021.7	0-0	FINE
21/03/2010	SUNDAY						
22/03/2010	21	27	0-10	NNE-NNE	1019.4	0-0	CLOUDY
23/03/2010	17	28	0-0	NNE-NNE	1021.1	0-0	FINE
24/03/2010	17	28	0-0	WNW-NNE	1020.5	0-0	CLOUDY
25/03/2010	19	28	0-5	S-NNE	1024.1	0-0	FINE
26/03/2010	19	29	0-5	NNE	1091.4	0-0	FINE
27/03/2010	22	30	0-0	NNE	1018.7	0-0	CLOUDY
28/03/2010	SUNDAY						
29/03/2010	22	28	0-0	WNN	1015.4	0-0	CLOUDY
30/03/2010	20	20	0-0	NNE	1017.9	12	CLOUDY
31/03/2010	17		0-10	NNE	1020.5	6	CLOUDY

PF FORMATION WEATHER CHART

APR 10

DATE	TEMP-MIN	TEMP-MAX	WIND-SPD	WIND-DIR	BAR	RAIN	CONDITION
1/04/2010	24	27	0-10	NNE	1019.8	0	FINE
2/04/2010	-	-	-	-	-	-	-
3/04/2010	-	-	-	-	-	-	
4/04/2010	-	-	-	-	-	-	-
5/04/2010	-	-	-	-	-	-	-
6/04/2010	16		0	NNE	1022.6	0	CLOUDY
7/04/2010	17		0	NNE	1018.4	0	CLOUDY
8/04/2010	19	25	0	NNE	1013	0	CLOUDY
9/04/2010	15	26	0	NNE-SEE	1016.4	0	CLOUDY
10/04/2010	16	23	0	N	1010	0	CLOUDY
11/04/2010	-	-	-	-	-	-	-
12/04/2010	12	26	0	nne	1015.7	0	FINE
13/04/2010	9	23	9	NNE	1023	0	FINE
14/04/2010	10	26	0	NNE	1024.9	0	FINE
15/04/2010	9	25	0	S-W	1022.9	0	FINE
16/04/2010	16	22	0	S-S	1027.4	0	CLOUDY
17/04/2010	15	24	0	S-S	1029-4	0	FOG-FINE
18/04/2010	-	-	-	-	-	-	-
19/04/2010	16	24	0	NNE-ES	1027.4	0.25	FOG-CLOUDY
20/04/2010	17	25	0	N-NNE	1026.4	0	FOG-CLOUDY
21/04/2010	15	26	0	NNE-NE	1024.3	0	FOG-FINE
22/04/2010	14	30	0	NNE-ES	1023.9	0	FOG-FINE
23/04/2010	14	29	0	NNE-NNE	1021.7	0	FINE
24/04/2010	20	25	9	N	1016.1	0	CLOUDY
25/04/2010	-	-	-	-	-	-	-
26/04/2010	-	-	-	-	-	-	-
27/04/2010	9	18	0	N-NW	1022.9	21	CLOUDY
28/04/2010	11	25	0	W-N	1023.1	0	FINE
29/04/2010	10	25	0-7	W-WWN	1021.6	0	FINE
30/04/2010	10	16	0-5	NNE-SSE	1026.4	0	CLOUDY

PF FORMATION WEATHER CHART

MAY 10

DATE	TEMP-MIN	TEMP-MAX	WIND-SPD	WIND-DIR	BAR	RAIN	CONDITION
1/05/2010	13	0	0	SSE-SSE	1029.3	3	RAIN
2/05/2010	-	-	-	-	-	-	-
3/05/2010	13	20	0-0	ES-W	1029.9	0	CLOUDY
4/05/2010	15	23	0-10	W-NNW	1023.7	0	FOG-FINE
5/05/2010	14	0	0	W-W	1015.1	4	CLOUDY
6/05/2010	7	22	0	W-SSE	1022.2	0	FINE
7/05/2010	7	23	0	SSW-N	1025.5	0	FINE
8/05/2010	7	21	0	E-W	1024.6	0	FINE
9/05/2010	-	-	-	-	-	-	-
10/05/2010	11	25	0	WWN-N	1022.2	0	FINE
11/05/2010	11	25	5-10	N-N	1015.7	0	FINE - WINDY
12/05/2010	7	22	0-10	SSW-SSE	1019.8	0	FINE
13/05/2010	5	21	0-5	EES-SWW	1021.9	0	FINE
14/05/2010	7	21	16-8	EES-EES	1019.6	0	FINE
15/05/2010	7	20	0-0	S-EES	1020.1	0	FINE-CLOUDY
16/05/2010	-	-	-	-	-	-	-
17/05/2010	10	16	0-5	W-W	1022.9	0	CLOUDY
18/05/2010	12	16	0-5	E-E	1020.4	3	CLOUDY
19/05/2010	10	18	0-0	SSW-ESE	1023.8	3	CLOUDY
20/05/2010	8	16	0-5	E-NWW	1023.8	0	FOG-CLOUDY
21/05/2010	10	16	0-0	W-SE	1023	0	CLOUDY-FINE
22/05/2010	10	18	0-15	S-S	1023	0	CLOUDY-FINE
23/05/2010	-	-	-	-	-	-	-
24/05/2010	9	15	0-0	S-S	1024	0	CLOUDY
25/05/2010	13	15	0-0	SSW-ESE	1014.5	15	RAIN
26/05/2010	13	17	0-0	NNE-SSE	1005.7	35	RAIN
27/05/2010	11	17	0-11	S-S	1018.6	5	RAIN
28/05/2010	10	16	0-5	SSW-ESE	1023.2	0	FOG-CLOUDY
29/05/2010	13	15	0-9	N-WNN	1010.6	2	RAIN
30/05/2010	-	-	-	-	-	-	-
31/05/2010	11	13	0-0	SSW-SSW	1009.7	18	RAIN

PF FORMATION WEATHER CHART

JUN 10

DATE	TEMP-MIN	TEMP-MAX	WIND-SPD	WIND-DIR	BAR	RAIN	CONDITION
1/06/2010	10	18	0-0	SSW-SSE	1019.3	0	CLOUDY
2/06/2010	10	15	0-0	S-NIL	1023.2	2	CLOUDY
3/06/2010	13	15	0-15	S-NIL	1025	35	FOG -CLOUDY
4/06/2010	14	14	0-17	EES-S	1020.9	39	FOG CLOUDY
5/06/2010	11	19	0-0	SSW-S	1016.9	50	CLOUDY
6/06/2010	-	-	-	-	-	-	-
7/06/2010	7	18	0-10	S-NIL	1026.8	0	CLOUDY
8/06/2010	8	16	0-10	S-NIL	1026.3	0	CLOUDY
9/06/2010	8	16	0-25	NWN	1017	0	FINE
10/06/2010	8	17	7-0	W-SSE	1018.1	0	FINE
11/06/2010	4	17	0-0	SSW-W	1024-1	0	FINE
12/06/2010	4	16	0-0	S-E	1024.8	0	FINE
13/06/2010	-	-	-	-	-	-	-
14/06/2010	-	-	-	-	-	-	-
15/06/2010	6	18	0-0	E-NE	1037.2	0	FINE
16/06/2010	7	17	0-0	WW-NIL	1030.3	0	FINE
17/06/2010	12	17	0-28	N-NNW	1018.2	0	CLOUDY
18/06/2010	7	18	0-8	W-SSW	1019.4	0	FINE
19/06/2010	5	17	0-0	N-NNW	1021.8	0	FINE
20/06/2010	-	-	-	-	-	-	-
21/06/2010	7	18	0-10	S-S	1034.8	0	CLOUDY
22/06/2010	11	18	0-0	SS-EES	1039.3	0	CLOUDY
23/06/2010	11	14	0-0	S-W	1039.2	6	CLOUDY
24/06/2010	11	16	0-0	EES-W	1033.6	0	FOG CLOUDY
25/06/2010	11	14	0-0	NNE-NE	1027-7	2	CLOUDY
26/06/2010	13	14	0-6	N-WW	1020.9	0	CLOUDY
27/06/2010	-	-	-	-	-	-	-
28/06/2010	3	15	0-0	S-N	1024.6	0	FINE
29/06/2010	2	14	0-0	W-WW	1022.2	0	FINE
30/06/2010	1	15	0-0	N-NNW	1024.4	0	FINE

Attachment 6A

Annual Groundwater Management Plan



Report

Hitchcock Road Site

2010 Annual Groundwater Management Plan

30 JUNE 2010

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Appendix B	Analytical Laboratory Reports

Introduction

1.1 Introduction

PF Formation (PFF) is required under the Development Approval conditions set for the Maroota Hitchcock Road property area to prepare an annual Water Management Plan (WMP) report to the Baulkham Hills Shire Council (BHSC). The WMP is part of the overall Environmental Management Plan and addresses the surface water and groundwater aspects of the sand extraction operations at the site.

URS Australia Pty Ltd (URS), as part of the on-going involvement with the project, has been retained by PFF to prepare the groundwater component of the above report, which is presented in the following sections.

The WMP for the year July 2009 to June 2010 also includes all the monitoring data collected from 1996 to date for the Hitchcock Road site and for Portion 198.

Groundwater Management Facilities

2.1 General

At the Hitchcock Road site, groundwater is monitored at five locations:

1. monitoring bore PF167MW1, located in Portion 167;
2. monitoring bore PF166MW1, located in Portion 166;
3. supply dam PF167DAM, located in Portion 167;
4. monitoring bore PFL2HitchMW1, located in Lot 2; and
5. monitoring bore PFP214MW1, located in Portion 214.

In addition, groundwater pumpage and chemical records are also collected from the two water supply bores in Portion 198, PF198PB1 and PF198PB2.

Groundwater monitoring has been carried out at the sites since 1996. Initially, water levels in bores PF166MW1 and PF167MW1 were measured manually at weekly intervals together with chemical field parameters such as pH and Electrical Conductivity (EC). The manual measurements continued until December 1998. In January 1999, the two bores were equipped with Dataflow Systems automatic data loggers.

Dataloggers have been downloaded quarterly between January 1999 and June 2000. Since June 2000, the dataloggers have been downloaded biannually. In January 2006, the old style Dataflow dataloggers were replaced with Solinst Levellogger 3001 units, capable of storing 40 000 readings in the memory, with a battery life span of around 10 years. The new Solinst dataloggers allow data annual downloading, a monitoring interval started on July 2006.

Groundwater samples for chemical analysis have been collected at the same time for the monitoring and pumping bores. The analytical results have been plotted on individual graphs that are continuously updated to assess possible trends with time.

Water samples from five bores were collected and submitted for chemical analysis under Chain of Custody procedures to Australian Laboratory Services Pty Ltd. The laboratory reports are presented in Appendix B.

A groundwater sample from bore PF198PB2 could not be collected as the pump was out of service and in the process of being repaired.

The analytical list for all bores, which was discussed and agreed upon with the DLWC (now the NSW Office of Water) has included:

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

2 Groundwater Management Facilities

2.1.1 Monitoring Bore PF167MW1

Groundwater monitoring at bore PF167MW1 commenced in March 1996. The data between March 1996 and December 1998 (manual collection) have been plotted in the graph of Figure 2, together with EC and rainfall records collected by PFF.

Figure 3 presents the combined Dataflow and Solinst dataloggers records for bore PF167MW1. Some minor data gaps exist and a slight difference between the manual data and the start of the automatic recording is evident in the graph, which are due to the time intervening between the end of the manual and start of the automatic recording methods.

2.1.2 Monitoring Bore PF166MW1

Groundwater monitoring at bore PF166MW1 commenced in March 1998 in the same manner as for bore PF167MW1. The data between March 1998 and December 1998 (manual collection) have been plotted in the graph of Figure 4, together with EC and rainfall records collected by PFF.

The plots of bore PF167MW1 records collected after the installation of the Dataflow datalogger and those of the Solinst dataloggers are presented in Figure 5.

2.1.3 Monitoring Bore PFP214MW1

Bore PFP214MW1 was installed in March 2009 as part of an extended groundwater monitoring network following the Development Approval for Portion 214, located at the southern boundary of the Hitchcock Road site.

A datalogger was installed in the bore in early April 2009 (Solinst Levellogger Gold 3001, serial no.51040540) and downloaded for the first time in July 2009. Figure 6 shows Bore PFP214MW1 hydrograph.

2.1.4 Monitoring Bore PFL2HitchMW1

Bore PFL2HitchMW1 was also installed in March 2009. This bore is located midway along the eastern boundary of the Hitchcock Site and monitors the full sequence of the Maroota Sand.

A datalogger was installed in the bore in early April 2009 (Solinst Levellogger Gold 3001, serial no.510405840) and downloaded for the first time in July 2009. Figure 7 shows Bore PFL2HitchMW1 hydrograph.

2.1.5 Portion 167 Dam

At the early stages of the site development, an excavation (PF167DAM) was carried out to the top of the Hawkesbury Sandstone to an approximate level of 178 m AHD. The excavation collects groundwater and surface water and was eventually licensed by the DLWC (No.10BL157308) as part of the water supply of the operation.

Water levels measured against surveyed pegs have been collected at the dam since September 1996 and pumpage records kept since January 1997.

Plots of the water levels in the dam and of the rainfall in the same period are presented in Figure 8 and a plot of the pumpage records in Figure 9.

2 Groundwater Management Facilities

Water quality in the dam is not monitored because the dam collects incident rainfall, run-off and groundwater and, as a result, water quality would vary according to the proportion of each component at the time of measurement.

2.1.6 Portion 198 Water Supply Bores

The two water supply bores in Portion 198 (PF198PB1 and PF198PB2) have been monitored manually since their installation in March 1998. Groundwater samples have been collected quarterly for the last four quarters to March 2000, biannually up to July 2006 and annually since then. Pumpage records are collected and totalised fortnightly.

Water quality data have been plotted for selected parameters and the graphs are presented in Appendix A and the laboratory reports in Appendix B.

3 Data Assessment

Data Assessment

3.1 Groundwater Levels

Groundwater levels in the Maroota Sand measured in the monitoring bores indicate that the aquifer is variable and contains numerous perched water tables. The plots of bore PF167MW1, which taps the full saturated thickness of the Maroota Sand, and bore PF166MW1, which taps an unconfined aquifer perched at a higher elevation, indicate a rapid response to periods of sustained rainfall. Records for the two new monitoring bores, PFP214MW1 and PFL2HitchMW1, indicate a moderate response to rainfall.

The average yearly rainfall for the year July 2009 - June 2010 has been 797 mm, below the long term average of 884.8 mm. The rainfall data are reported from the PFF data recording system, as the Bureau of Meteorology data have not been quality controlled for the last year.

3.1.1 Bore PF167MW1

After a significant rain event in June 2007, the water level rose by 4.5 m to a level similar to the highest recorded value in mid 2000.

The unexpected rise in the water level in this bore exceeded the datalogger 10 m pressure sensor range and data were not recorded for the last six months. The datalogger suspension wire has been shortened by 3 m and the logger reset. However, the plot shows the July manual water level measurement at 182.44 m AHD, confirming the rising water level trend at this site. Since July 2008 the water level in this bores has followed a familiar pattern of decline with occasional small rises following major rainfall events.

3.1.2 Bore PF166MW1

Since June 2007, following a period of significant and sustained rainfall, the water level in this bore has risen by 1.5 m, less than 1 m of the highest level recorded in the first half of 2002. This bore taps a perched aquifer with variable responses to major rainfall events.

3.1.3 Bore PFP214MW1

Bore PFP214MW1 taps the full thickness of the Maroota Sand towards its southern edge. Since its installation in March 2009, the water shows a slow declining trend, with only a minor response to the major rainfall events in February and May 2010. It is possible that increased recharge from rainfall at this site is rejected as surface flow down the steep slope to the south.

3.1.4 Bore PFL2HitchMW1

Bore PFL2HitchMW1 is the deepest bore in the Hitchcock Road site, as it is located in the vicinity of the former trigonometric station, which is the highest elevation on the site and taps the full thickness of the Maroota Sand aquifer.

3 Data Assessment

The hydrograph shows that after an initial settlement period after drilling, the water level has stabilised at an RL level of 189.6 m AHD without any significant response to the rainfall events. The lack of water level response is possibly due to the depth of the bore and to a possible higher clay content and resulting lower permeability.

3.1.5 PF167Dam

Water levels in the PF167DAM, which was originally excavated to the base of the Maroota Sand within the deep palaeochannel, have been kept above 180 m AHD over the year to June 2010 period by regulating pumpage so as not to exceed this level. Due to the above average rainfall of the last two years there have been long periods when no water was extracted from this site.

The rainfall recorded at the PFF offices for the year to the end of June 2010 has been 797 mm, below the yearly average of 884.8 mm and well below the previous year (1294 mm). In November 2008 the water level in the dam rose to just above 183 m AHD, the highest level recorded at this site since monitoring started in September 1996. Pumping from this source was stopped in February 2010 in order to not exceed the licensed volume. As a result, the water level has peaked to an RL of 183 m AHD, with an average over the period of 182.4 m AHD.

The high level is considered to be the results of the combined effect of the February and May 2010 rainfall, of the reduced pumping from this source and general aquifer recovery and recharge.

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 sand slurring, records show that water levels return rapidly to the average values indicated above, even after higher levels are experienced after heavy rainfall and consequent run-off. Figure 8 shows these combined effects upon the water level in the dam. The records suggest that the Maroota Sand aquifer at the site is capable of sustaining the required pumpage even under the low rainfall recharge conditions and the additional demand posed upon it in the wider Maroota area by the many groundwater users.

3.1.6 Groundwater Quality

As indicated in Section 2.1, water quality in bores PF167MW1 and PF166MW1 has been monitored for pH and EC since monitoring started. Since June 1999 groundwater quality has been analysed for a range of analytical parameters and for Oil and Grease to obtain background data.

Since July 2009, groundwater quality data have become available also from the newly installed monitoring bores, PFP214MW1 and PFL2HitchMW1.

Historical and recent analytical results for the other samples from the monitoring sites are summarised in Tables 3-1 to 3-6, and have been plotted in the graphs presented in Appendix A. The laboratory reports are presented in Appendix B.

Figures 2 and 4 show plots of the EC together with water levels and rainfall for the initial monitoring period, before the installation of the data loggers. The EC plots show a sympathetic variation with rainfall, indicating the effects of dilution generated by recharge (decrease in EC) and by lower water table. In the latter case, the improved EC is interpreted as the effect of aquifer recharge by fresher water.

3 Data Assessment

The plots confirm the dependence of the aquifer upon rainfall to maintain storage and supply. No analysis has been carried out of the water from the dam because extraneous influences, such as direct rainfall and run-off, make the water in the dam not representative of the groundwater at that site.

Groundwater quality has also been monitored at bores PF198PB1 and PF198PB2, the two processing plant water supply bores. The water in these bores is derived from the Hawkesbury Sandstone aquifer. Quality records are summarised in Tables 3-7 and 3-8 and have been plotted in the graphs presented in Appendix B. However, as the pump in bore PF198PB2 was out of service, a water sample could not be obtained during the current monitoring event.

The waters in the Maroota Sand aquifer 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 in bore PF198PB1 in January 2006 (6 mg/L), in bore PF198PB2 in December 2001 (11 mg/L) and in bore PF166MW1 (6 mg/L). These appear to be isolated detections and, as no Oil and Grease has been detected in all other sampling occasions, it is considered that such occurrences do not represent a cause of concern.

The deep Hawkesbury Sandstone pumping bores groundwater display a slightly different character from that in the shallow Maroota Sand aquifer in the Hitchcock Road area and from shallow Hawkesbury Sandstone aquifer in other areas of Maroota. The deeper groundwater has a slightly higher TDS, pH and bicarbonate content (PF198PB2) than the shallower Maroota Sand groundwater; however, its overall low salinity content and sodium-chloride meteoric composition indicate a dynamic groundwater regime with regular and rapid rainfall recharge.

Overall, all the bores in both the Hawkesbury Sandstone and in the Maroota Sand show a marginal decrease in Total Dissolved Solids over time, the deeper bores showing a more constant character.

3.1.7 Quality Control

The laboratory quality control samples (laboratory duplicates, procedure blanks and control spikes) returned results within the required limits and acceptance criteria. The quality control data generated by the laboratory are presented with the laboratory certificates in Appendix B.

Based on the evaluation of the data, it is assessed that the accuracy and precision of the analytical data generated in the sampling round, as reported by the analytical laboratory, are acceptable as a basis for interpretation.

3 Data Assessment

Table 3-1 Bore PF167MW1 Chemical Analyses Summary

ANALYTE	Unit													
Date		2.6.99	8.9.99	21.12.99	9.3.00	28.11.00	21.6.01	19.12.01	26.6.02	23.1.03	9.7.03	30.1.04	29.6.04	15.12.04
pH		4.43	4.49	4.21	4.93	4.28	4.61	4.98	4.52	4.54	5.15	4.31	4.38	4.68
Electrical Conductivity, EC	µS/cm	164	190	201	179	184	170	188	215	199	204	225	221	240
Total Dissolved Solids, TDS	mg/L	118	90	105	115	207	120	108	121	101	116	157	110	143
Calcium, Ca	mg/L	3	3	5	6	3	6	6	5	3	4	4	5	5
Magnesium, Mg	mg/L	5	4	4	4	4	4	5	4	4	3	4	4	4
Sodium, Na	mg/L	16	18	16	15	18	16	18	25	20	19	22	23	26
Potassium, K	mg/L	2	2	3	3	3	5	4	5	2	2	2	3	3
Bicarbonate, HCO ₃	mg/L	<1	<1	<1	<1	<1	<1	<1	<1	<1	1	<1	<1	<1
Sulphate, SO ₄	mg/L	9	11	35	32	16	15	15	14	9	13	12	10	13
Chloride, Cl	mg/L	36	11	35	32	35	36	47	58	4	48	51	53	50
Oil and Grease	mg/L	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5		<5	<5
Date		22.6.05	19.1.06	6.7.06	5.7.07	3.7.08	3.7.09	16.6.10						
pH		5.42	4.32	4.27	4.88	5.29	4.00	4.30						
Electrical Conductivity, EC	µS/cm	215	205	199	188	161	177	190						
Total Dissolved Solids, TDS	mg/L	137	141	119	76	100	104	111						
Calcium, Ca	mg/L	5	4	4	2	6	5	3						
Magnesium, Mg	mg/L	4	4	4	3	5	4	3						
Sodium, Na	mg/L	28	25	23	16	13	14	15						
Potassium, K	mg/L	3	3	3	2	4	4	2						
Bicarbonate, HCO ₃	mg/L	2	1	<1	<1	<1	<1	2						
Sulphate, SO ₄	mg/L	13	10	6	10	30	22.6	17.1						
Chloride, Cl	mg/L	56.6	57.4	53.1	36.1	26.4	34.8	39.9						
Oil and Grease	mg/L	<5	<5	<5	<5	<5	<5	<5						

3 Data Assessment

Table 3-2 Bore PF166MW1 Chemical Analyses Summary

ANALYTE	Unit													
Date		1.6.99	8.9.99	21.12.99	9.3.00	29.11.00	21.6.01	19.12.01	26.6.02	23.1.03	9.7.03	30.1.04	29.6.04	15.12.04
pH		4.18	4.19	4.13	4.14	4.31	4.19	4.63	4.48	4.82	7.86	4.39	4.27	4.06
Electrical Conductivity, EC	µS/cm	222	240	230	214	266	194	228	219	203	221	193	235	203
Total Dissolved Solids, TDS	mg/L	118	108	137	170	460	115	210	280	128	134	204	280	120
Calcium, Ca	mg/L	1	1	1	1	1	1	1	2	1	1	<1	1	1
Magnesium, Mg	mg/L	6	6	6	5	6	5	6	6	5	4	5	5	4
Sodium, Na	mg/L	26	23	23	22	29	21	22	24	19	20	18	19	19
Potassium, K	mg/L	<1	<1	1	1	1	1	2	1	<1	<1	<1	1	1
Bicarbonate, HCO ₃	mg/L	<1	<1	<1	<1	<1	<1	<1	<1	<1	1	<1	<1	<1
Sulphate, SO ₄	mg/L	1	7	1	1	16	2	1	2	<1	<1	2	<1	2
Chloride, Cl	mg/L	58	49	51	52	58	49	58	61	46	50	47	44	36
Oil and Grease	mg/L	<5	<5	<5	<5	<5	<5	<5	<5	6	<5	<5	5	<5
Date		22.6.05	19.1.06	6.7.06	5.7.07	3.7.08	3.7.09	16.6.10						
pH					4.76		3.58	4.06						
Electrical Conductivity, EC	µS/cm	DRY	DRY	DRY	163	NA	240	247						
Total Dissolved Solids, TDS	mg/L				98		140	141						
Calcium, Ca	mg/L						<1	<1						
Magnesium, Mg	mg/L						4	4						
Sodium, Na	mg/L						256	24						
Potassium, K	mg/L						2	2						
Bicarbonate, HCO ₃	mg/L						<1	<1						
Sulphate, SO ₄	mg/L						2.21	1.77						
Chloride, Cl	mg/L						49.1	56.3						
Oil and Grease	mg/L						<5	<5						

3 Data Assessment

Table 3-3 Bore PF166MW1 Chemical Analyses Summary

ANALYTE		Unit	
Date		3.7.2009	16.6.2010
pH		3.96	4.1
Electrical Conductivity, EC	µS/cm	182	154
Total Dissolved Solids, TDS	mg/L	84	88
Calcium, Ca	mg/L	1	<1
Magnesium, Mg	mg/L	2	2
Sodium, Na	mg/L	19	16
Potassium, K	mg/L	2	<1
Bicarbonate, HCO ₃	mg/L	<1	<
Sulphate, SO ₄	mg/L	7.88	4.06
Chloride, Cl	mg/L	40.3	36.9
Oil and Grease	mg/L	<5	<5

3 Data Assessment

Table 3-4 Bore PFP214MW1 Chemical Analyses Summary

ANALYTE	Unit		
Date		3.7.2009	16.6.2010
pH		4.19	4.16
Electrical Conductivity, EC	µS/cm	168	164
Total Dissolved Solids, TDS	mg/L	100	96
Calcium, Ca	mg/L	<1	<1
Magnesium, Mg	mg/L	6	5
Sodium, Na	mg/L	18	15
Potassium, K	mg/L	1	<1
Bicarbonate, HCO ₃	mg/L	<1	<1
Sulphate, SO ₄	mg/L	1.90	<0.5
Chloride, Cl	mg/L	24.3	23.8
Oil and Grease	mg/L	<5	<5

3 Data Assessment

Table 3-5 Bore PF198PB1 Chemical Analyses Summary

ANALYTE	Unit													
Date		1.6.99	8.9.99	21.12.99	9.3.00	28.11.00	21.6.01	19.12.01	26.6.02	23.1.03	9.7.03	30.1.04	29.6.04	15.12.04
pH		5.87	6.24	6.11	4.69	4.49	4.51	5.41	4.73	4.49	5.06	5	4.53	4.28
Electrical Conductivity, EC	µS/cm	161	170	169	141	182	179	204	199	243	199	160	291	197
Total Dissolved Solids, TDS	mg/L	124	116	98	97	107	102	116	112	139	102	116	174	88
Calcium, Ca	mg/L	1	<1	1	1	3	2	2	4	3	2	2	4	1
Magnesium, Mg	mg/L	4	6	5	3	3	4	4	4	4	3	2	5	2
Sodium, Na	mg/L	21	24	22	19	20	21	27	23	31	22	19	40	25
Potassium, K	mg/L	1	<1	1	1	2	5	5	3	3	2	2	3	2
Bicarbonate, HCO ₃	mg/L	13	29	22	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Sulphate, SO ₄	mg/L	4	4	4	2	8	8	3	7	4	8	6	9	8
Chloride, Cl	mg/L	39	35	36	36	40	49	60	58	64	49	43	83	42
Oil and Grease	mg/L	<5	<5	<5	<5	<5	<5	<5	<5	6	<5	<5	<5	<5
Date		22.6.05	19.1.06	6.7.06	5.7.07	3.7.08	3.7.09	16.6.10						
pH		5.22	5.74	5.16	No sample	4.59	3.94	4.43						
Electrical Conductivity, EC	µS/cm	157	158	155		144	174	163						
Total Dissolved Solids, TDS	mg/L	105	115	98		85	83	88						
Calcium, Ca	mg/L	1	2	1		<1	1	<1						
Magnesium, Mg	mg/L	2	4	3		2	2	2						
Sodium, Na	mg/L	23	21	20		18	19	16						
Potassium, K	mg/L	2	2	2		1	2	1						
Bicarbonate, HCO ₃	mg/L	1	12	5		<1	<1	<1						
Sulphate, SO ₄	mg/L	8	6	2		10	9.31	6.89						
Chloride, Cl	mg/L	47.1	43.4	43.8		31.1	38.8	41.1						
Oil and Grease	mg/L	<5	5	<5		<5	<5	<5						

3 Data Assessment

Table 3-6 Bore PF198PB2 Chemical Analyses Summary

ANALYTE	Unit													
Date		1.6.99	8.9.99	21.12.99	9.3.00	29.11.00	21.6.01	19.12.01	26.6.02	23.1.03	9.7.03	30.1.04	29.6.04	15.12.04
pH		5.78	6.61	5.96	NA	4.80	5.24	5.99	6.33	5.96	4.84	5	5.78	5.39
Electrical Conductivity, EC	µS/cm	139	174	146	NA	152	130	141	151	146	162	160	136	156
Total Dissolved Solids, TDS	mg/L	126	102	85	NA	100	87	87	102	84	87	116	79	105
Calcium, Ca	mg/L	1	2	2	NA	<1	<1	<1	1	<1	<1	2	1	1
Magnesium, Mg	mg/L	5	5	5	NA	4	3	4	4	4	2	2	4	2
Sodium, Na	mg/L	18	19	18	NA	19	18	18	21	17	18	19	18	20
Potassium, K	mg/L	2	2	2	NA	1	1	2	2	1	<1	2	1	2
Bicarbonate, HCO ₃	mg/L	23	33	19	NA	4	3	13	8	16	<1	<1	9	2
Sulphate, SO ₄	mg/L	3	3	2	NA	1	1	3	2	<1	<1	6	1	4
Chloride, Cl	mg/L	31	28	31	NA	41	38	33	46	33	40	43	37	35
Oil and Grease	mg/L	<5	<5	<5	NA	<5	<5	11	<5	<5	<5	<5	<5	<5
Date		22.6.05	19.1.06	6.7.06	5.7.07	3.7.08	3.7.09	16.6.10						
pH		6.43	5.3	5.46	4.37	5.25	4.50	NA						
Electrical Conductivity, EC	µS/cm	133	126	122	195	135	130							
Total Dissolved Solids, TDS	mg/L	87	104	79	88	79	79							
Calcium, Ca	mg/L	<1	<1	1	<1	1	<1							
Magnesium, Mg	mg/L	4	3	4	3	5	3							
Sodium, Na	mg/L	17	19	16	21	16	16							
Potassium, K	mg/L	2	1	2	1	2	2							
Bicarbonate, HCO ₃	mg/L	14	7	24	<1	24.4	9.2							
Sulphate, SO ₄	mg/L	4	1	1	4	2	2.78							
Chloride, Cl	mg/L	34.9	38.8	30.2	44.8	31.8	32.2							
Oil and Grease	mg/L	<5	<5	<5	<5	<5	<5							

3 Data Assessment

3.1.8 Portion 167 dam

Records of pump operation have been kept from PF167DAM since January 1997. Figure 9 shows the monthly summary of the pumpage from the dam and Table 3-7 shows the annual totals. Annual pumpage for the current year (56.2 ML) has been marginally above the licensed limit (50 ML/year). This excess is due to the malfunction of the pump in bore PF198PB2 since December 2009, as this required additional pumpage from the dam. However, this marginal excess is largely offset by the significantly lower combined volumes extracted from the two pumping bores, as shown in following Table 3.8, indicating an overall reduced water usage at the site.

Table 3-7 Portion 167 Dam Annual Pumpage Records

YEAR	TOTAL, ML
1997	24.56
1998	24.24
1999 to May	16.84
1 June 1999 – 30 June 2000	66.3
1 July 2000 – 5 September 2000	31.4
5 September 2000 – 25 June 2001	Not used
25 June 2001 – 30 June 2001	1.0
1 July 2001 – 8 February 2002	59.2
8 February 2002 – 30 June 2002	Not used
30 June 2002 – 29 August 2002	Not used
29 August 2002 – 30 June 2003	65.2
1 July 2003 – 29 June 2004	73.1
1 July 2004 – 3 May 2005	57.5
7 October 2005 – 30 June 2006	25.4
1 July 2006 – 30 June 2007	21.3
1 July 2007 - 30 June 2008	21.5
1 July 2008 – 30 June 2009	42.2
1 July 2009 – 30 June 2010	56.2

3 Data Assessment

3.1.9 Water Supply Bores, Portion 198

Pumping records for the two water supply bores in Portion 198 for the year July 2009 to June 2010 are tabulated in Table 3-8 below. The total pumpage of 17.6 ML for the year has been significantly below the combined annual allocation of 60 ML.

Table 3-8 Water Supply Bores Annual Pumpage Records

YEAR	BORE	TOTAL, ML
1 July 1999 – 30 June 2000	Bore PF198PB1	21.1
	Bore PF198PB2	35.6
1 July 2000- 30 June 2001	Bore PF198PB1	20.3
	Bore PF198PB2	29.0
1 July 2001 – 30 June 2002	Bore PF198PB1	25.1
	Bore PF198PB2	36.0
1 July 2002 – 30 June 2003	Bore PF198PB1	24.8
	Bore PF198PB2	47.8
1 July 2003 – 29 June 2004	Bore PF198PB1	22.9
	Bore PF198PB2	49.3
1 July 2004 – 29 June 2005	Bore PF198PB1	4.2
	Bore PF198PB2	18.7
5 July 2005 – 23 June 2006*	Bore PF198PB1	14.8
	Bore PF198PB2	8.9
24 June 2006 – 30 June 2007*	Bore PF198PB1	7.8
	Bore PF198PB2	19.9
1 July 2007 – 30 June 2008*	Bore PF198PB1	1.6
	Bore PF198PB2	22.9
1 July 2008 – 30 June 2009*	Bore PF198PB1	25.6
	Bore PF198PB2	16.0
1 July 2008 – 30 June 2009*	Bore PF198PB1	9.5
	Bore PF198PB2**	8.1

* Due to modifications carried out at the wash plant, these bores are no longer required for continuous supply.

** The pump in bore PF198PB2 has been out of service since December 2009, requiring additional pumpage from the PF167 DAM.

Conclusions

4.1 Conclusions

The assessment of the data collected on the groundwater levels and quality in the Maroota Trig area, some of which represent the oldest data available to the groundwater study carried out by the DLWC (now The Office of Water) in the area, indicate that:

- water levels in the Maroota Sand aquifer respond rapidly to the rainfall pattern;
- since April 2002 the water table in bore PF167MW1 has fallen steadily in response to the lower rainfall, but it rose sharply after the rain events in June 2007 and in June 2008; followed by a characteristic slow decline pattern;
- water quality in the Maroota Sand aquifer varies with rainfall recharge;
- pumpage from the dam in Portion 167 for the year to the end of June 2010 (56.2 ML) has been above the licence limit of 50 ML/year. The pumping exceedance at this site was largely offset by the lower extraction from the two water supply bores; giving an overall reduced water usage at the site;
- during the year 2009 – 2010, the water level in the Portion 167 dam has averaged 182.4 m AHD, a value higher than that of the long term average (181.08 m AHD) since September 1996. This high level is thought to be due to the stop of pumping since February 2010, and to high run off into the dam following high rainfall events in February and June 2010;
- records indicate that the water level in the dam recovers rapidly upon cessation of pumping;
- the groundwater pumpage from the two deep water supply bores in Portion 198 (17.6 ML) has been significantly below the combined licence limit of 60 ML for the year;
- the quality of the groundwater in the deep aquifer of the Hawkesbury Sandstone (water supply bores in Portion 198) has an overall character that indicates that recharge occurs readily;
- the current sand extraction operations in the Hitchcock Road area operate in a manner that does not appear to have a significant impact upon the groundwater sustainability, and in accordance with the DA conditions.

The data collected during the year are available to the NSW Office of Water for their continued study in the area.

Limitations

5.1 Geotechnical & Hydro Geological Report

URS Australia Pty Ltd (URS) has prepared this report in accordance with the usual care and thoroughness of the consulting profession for the use of PF Formation and only those third parties who have been authorised in writing by URS to rely on the report. It is based on generally accepted practices and standards at the time it was prepared. No other warranty, expressed or implied, is made as to the professional advice included in this report. It is prepared in accordance with the scope of work and for the purpose outlined in the Proposal dated 3 June 2010.

The methodology adopted and sources of information used by URS are outlined in this report. URS has made no independent verification of this information beyond the agreed scope of works and URS assumes no responsibility for any inaccuracies or omissions. No indications were found during our investigations that information contained in this report as provided to URS was false.

This report was prepared between 16 and 30 June 2010 and is based on the conditions encountered and information reviewed at the time of preparation. URS disclaims responsibility for any changes that may have occurred after this time.

This report should be read in full. No responsibility is accepted for use of any part of this report in any other context or for any other purpose or by third parties. This report does not purport to give legal advice. Legal advice can only be given by qualified legal practitioners.

This report contains information obtained by inspection, sampling, testing or other means of investigation. This information is directly relevant only to the points in the ground where they were obtained at the time of the assessment. The borehole logs indicate the inferred ground conditions only at the specific locations tested. The precision with which conditions are indicated depends largely on the frequency and method of sampling, and the uniformity of conditions as constrained by the project budget limitations. The behaviour of groundwater and some aspects of contaminants in soil and groundwater are complex. Our conclusions are based upon the analytical data presented in this report and our experience. Future advances in regard to the understanding of chemicals and their behaviour, and changes in regulations affecting their management, could impact on our conclusions and recommendations regarding their potential presence on this site.

Where conditions encountered at the site are subsequently found to differ significantly from those anticipated in this report, URS must be notified of any such findings and be provided with an opportunity to review the recommendations of this report.

Whilst to the best of our knowledge information contained in this report is accurate at the date of issue, subsurface conditions, including groundwater levels can change in a limited time. Therefore this document and the information contained herein should only be regarded as valid at the time of the investigation unless otherwise explicitly stated in this report.



Legend

- Site Boundary
- Groundwater Monitoring Site

Client

PF FORMATION

URS

Project

HITCHCOCK ROAD, SAND EXTRACTION
AND REHABILITATION PROJECT

Drawn: AJW

Approved: FC

Date: 13/07/2009

Job No: **43346029**

File No: 43346029-004.wor

Title

**HITCHCOCK ROAD SITE
LOCALITY PLAN**

Figure: **1**



P.F.FORMATION
Bore PF167MW1 Groundwater Monitoring Data

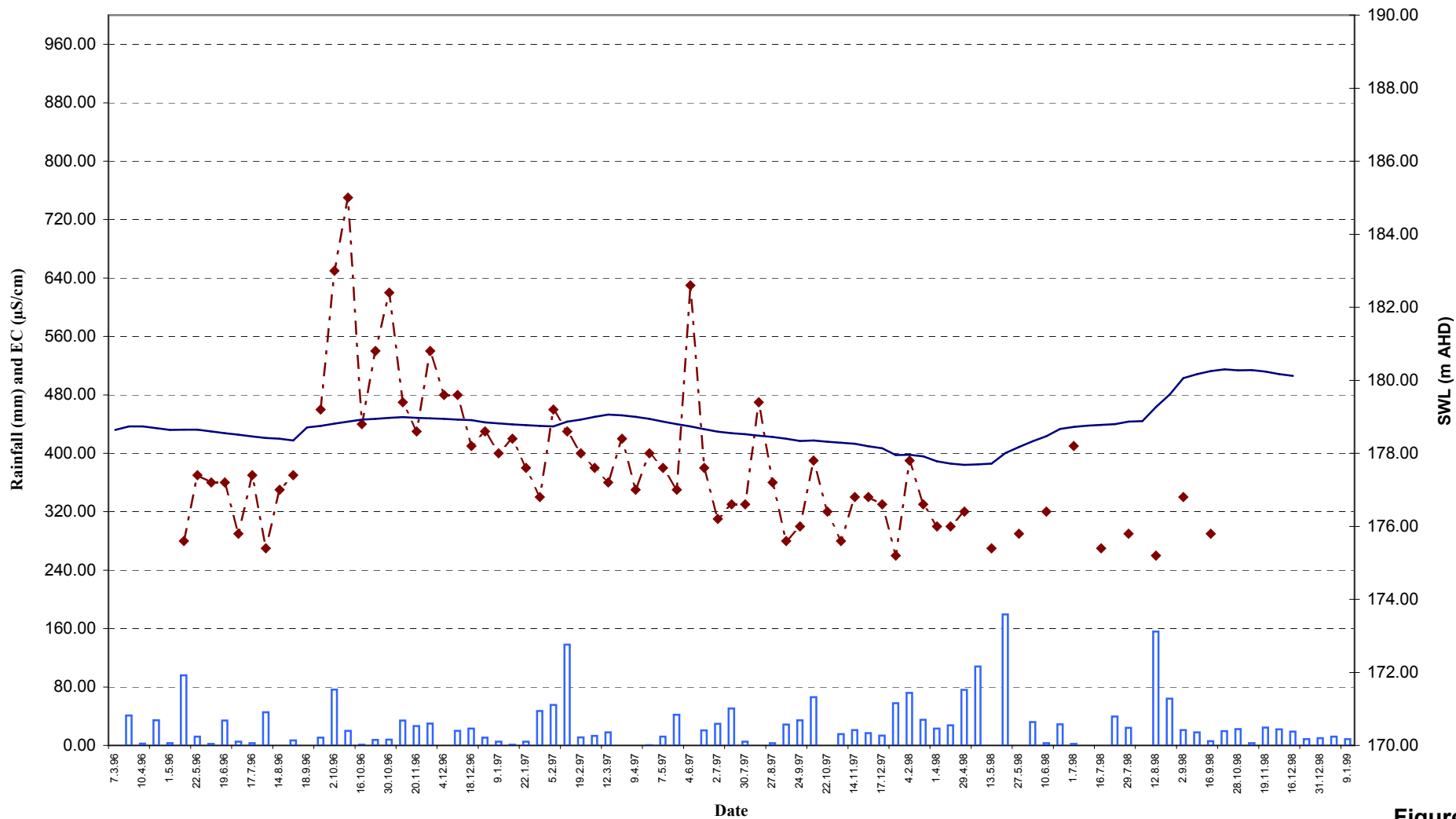
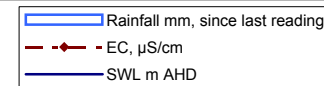


Figure 2



PF FORMATION
Bore PF167MW1 Groundwater Monitoring Data

□ Rainfall, mm
— Water level m AHD

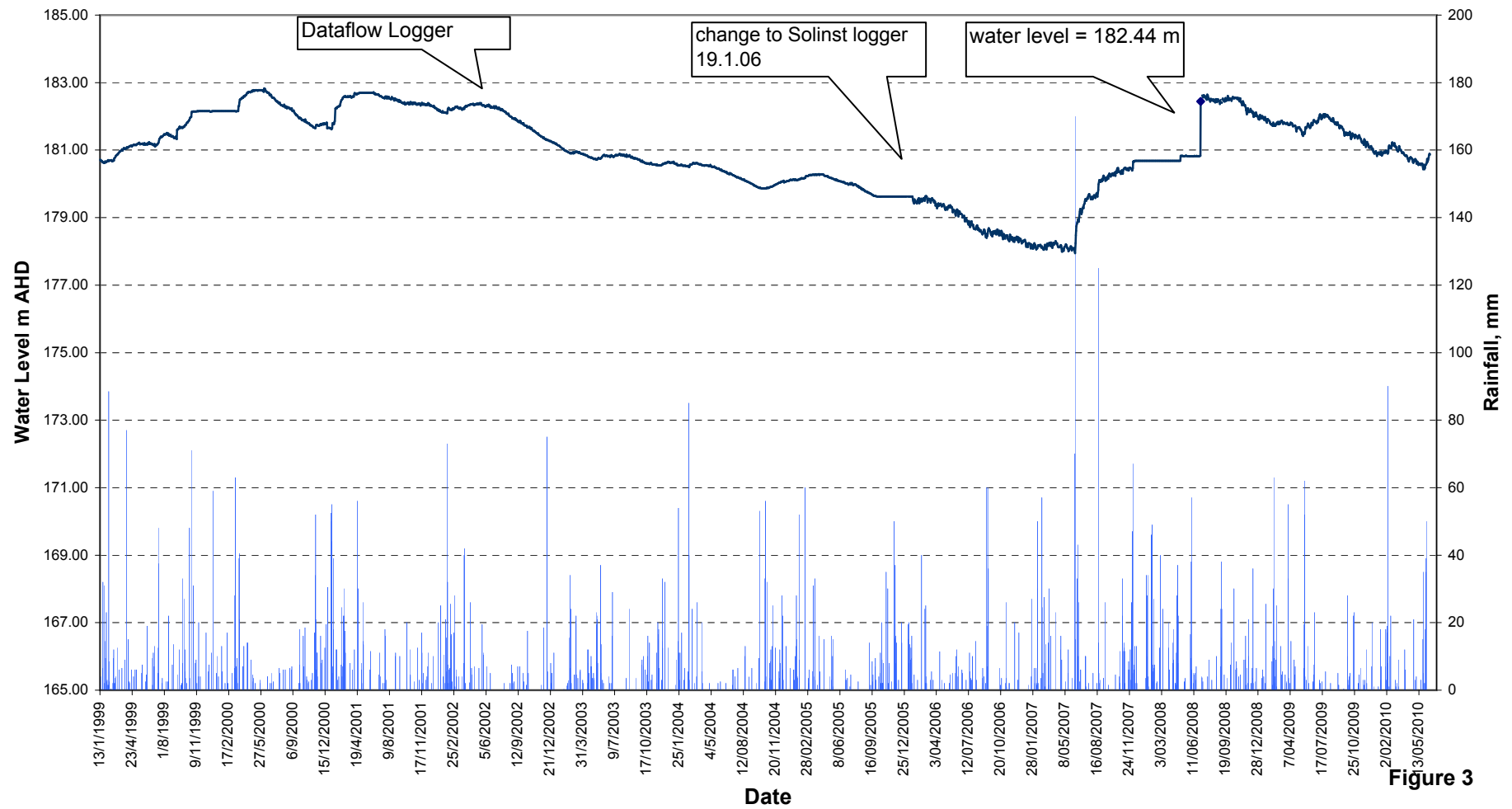


Figure 3



PF FORMATION
PF166MW1 Groundwater Monitoring Data

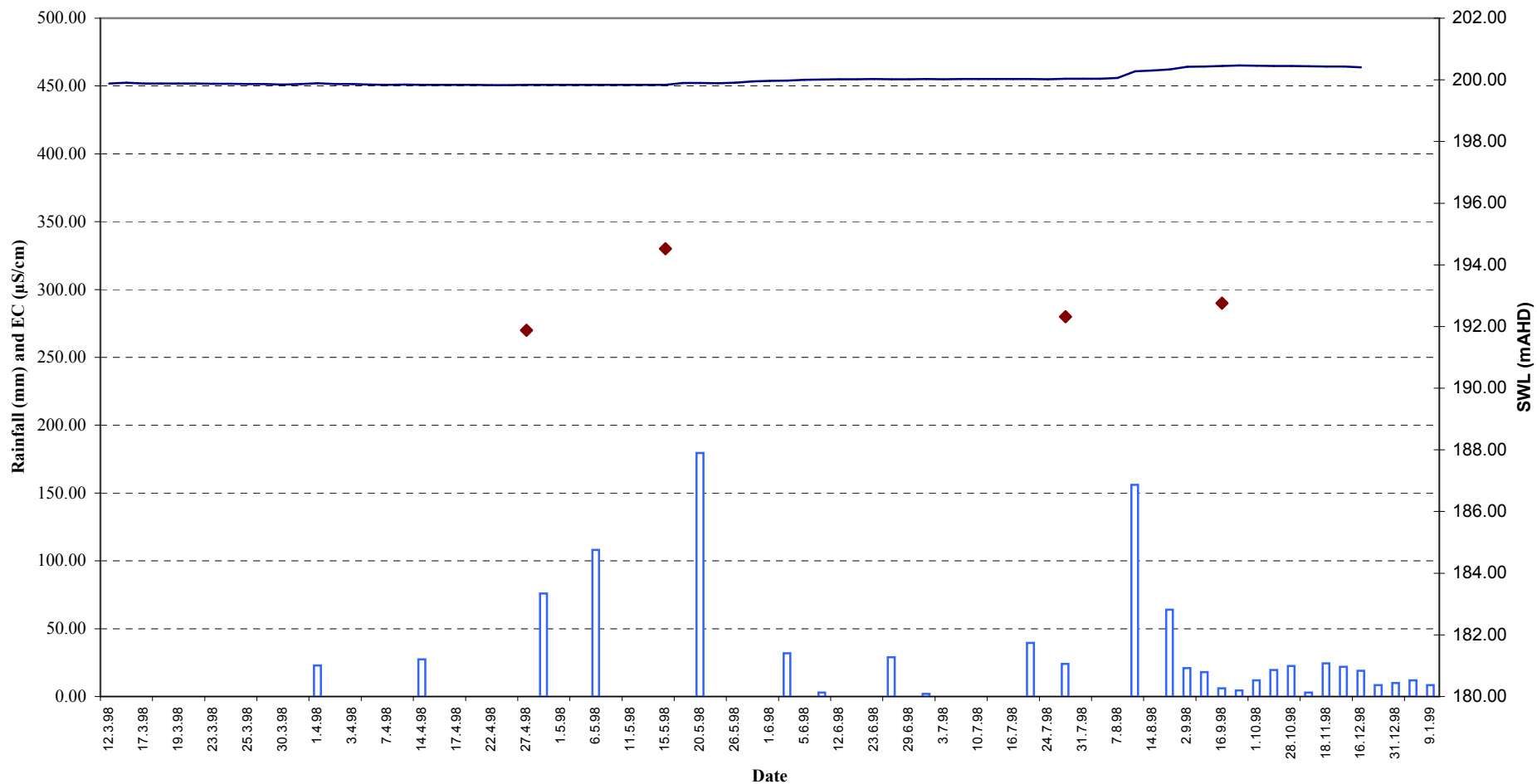
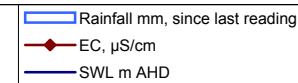


Figure 4



PF FORMATION
Bore PF166MW1 Groundwater Monitoring Data

□ Rainfall, mm
— Water Level m AHD

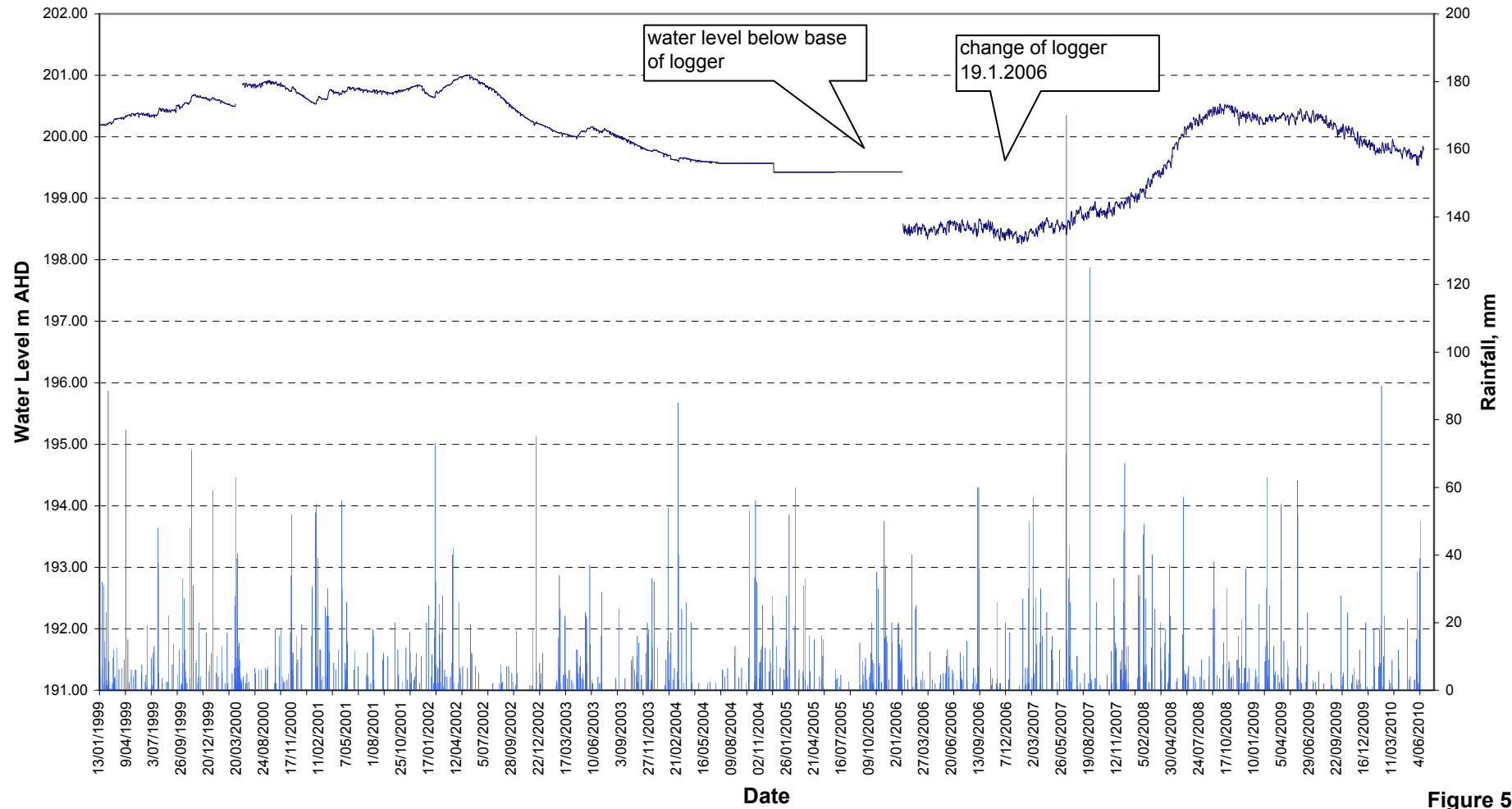


Figure 5



PF FORMATION
Bore PFP214MW1 Groundwater Monitoring Data

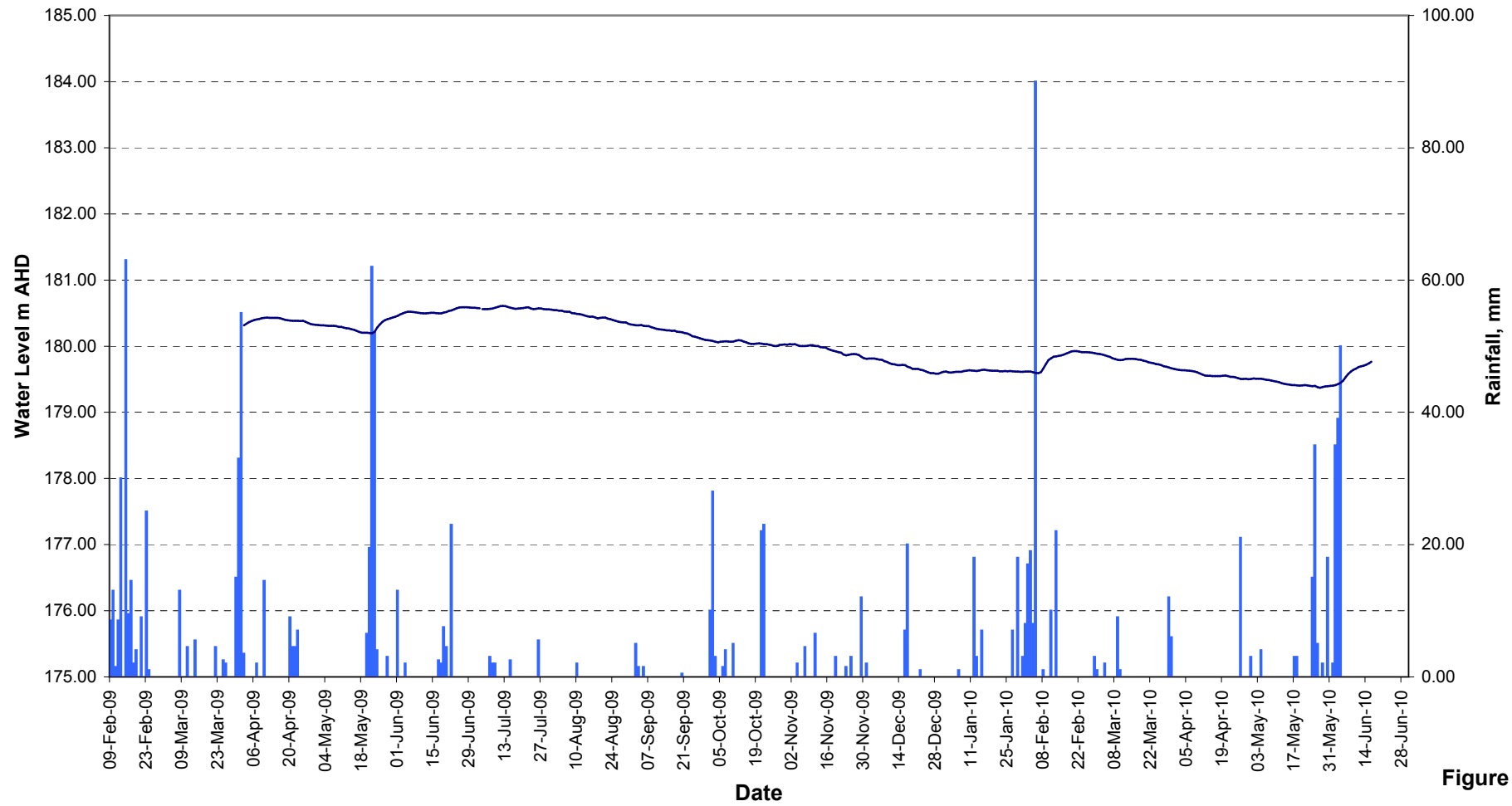
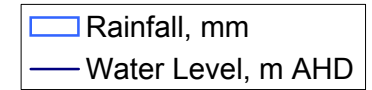


Figure 6



PF FORMATION
Bore PFL2HitchMW1 Groundwater Monitoring Data

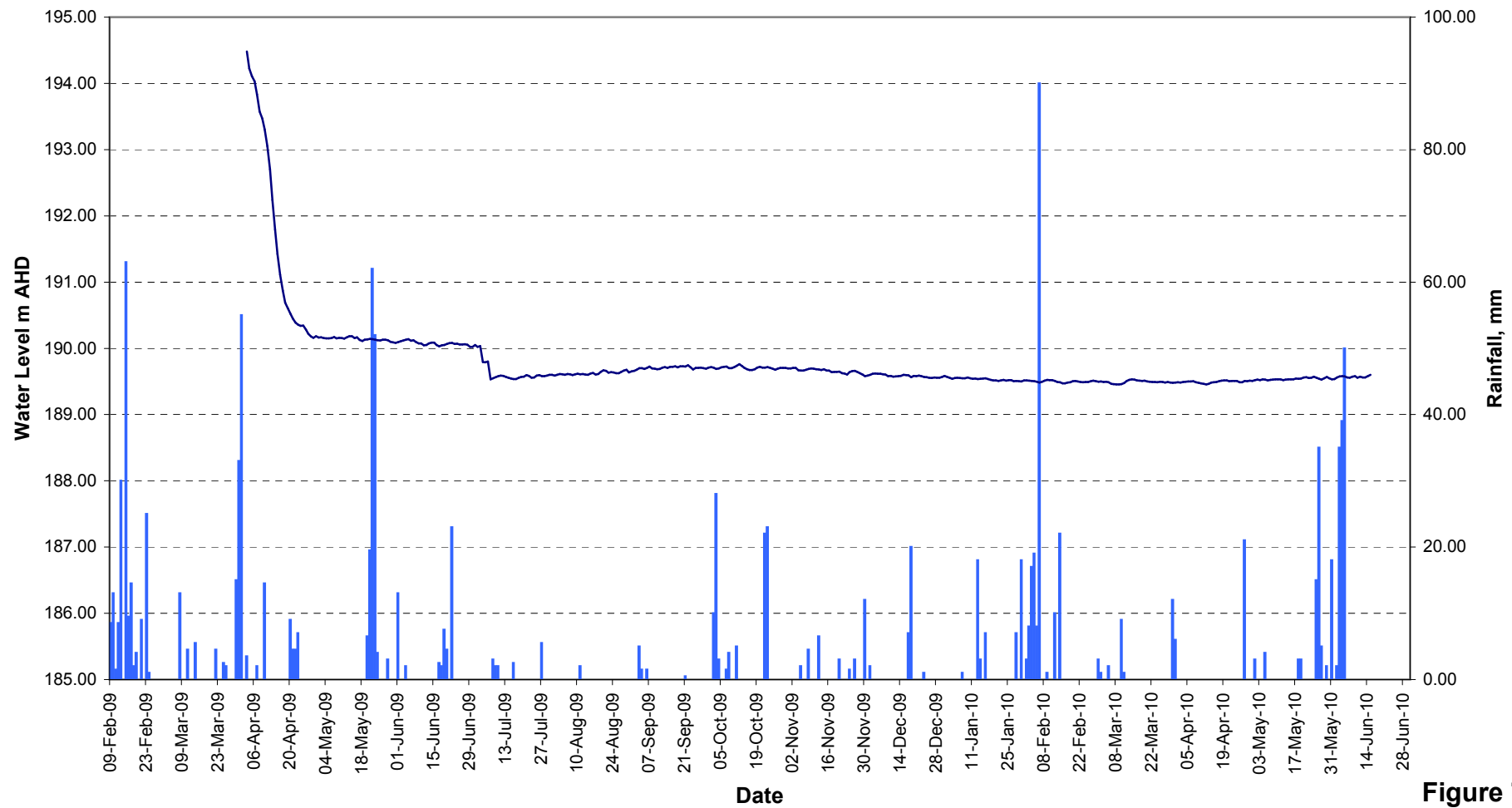
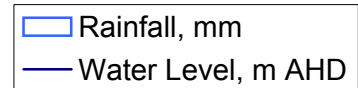


Figure 7



PF FORMATION
PF167DAM, Licence No. 10BL157308, Groundwater Monitoring Data

— Rainfall mm, since last reading
— WL m AHD

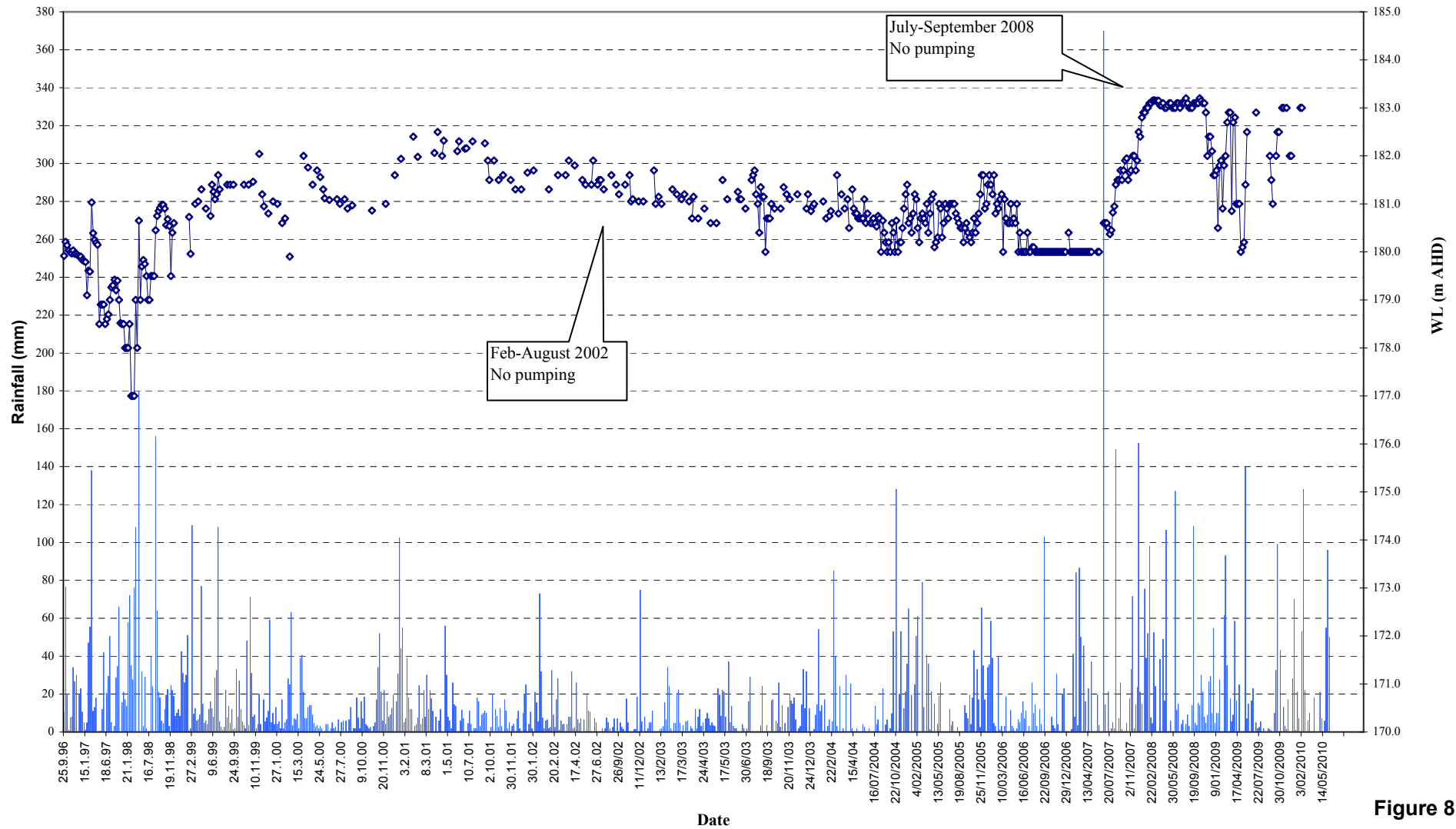


Figure 8



PF FORMATION
PF167DAM Monthly Pumpage Records

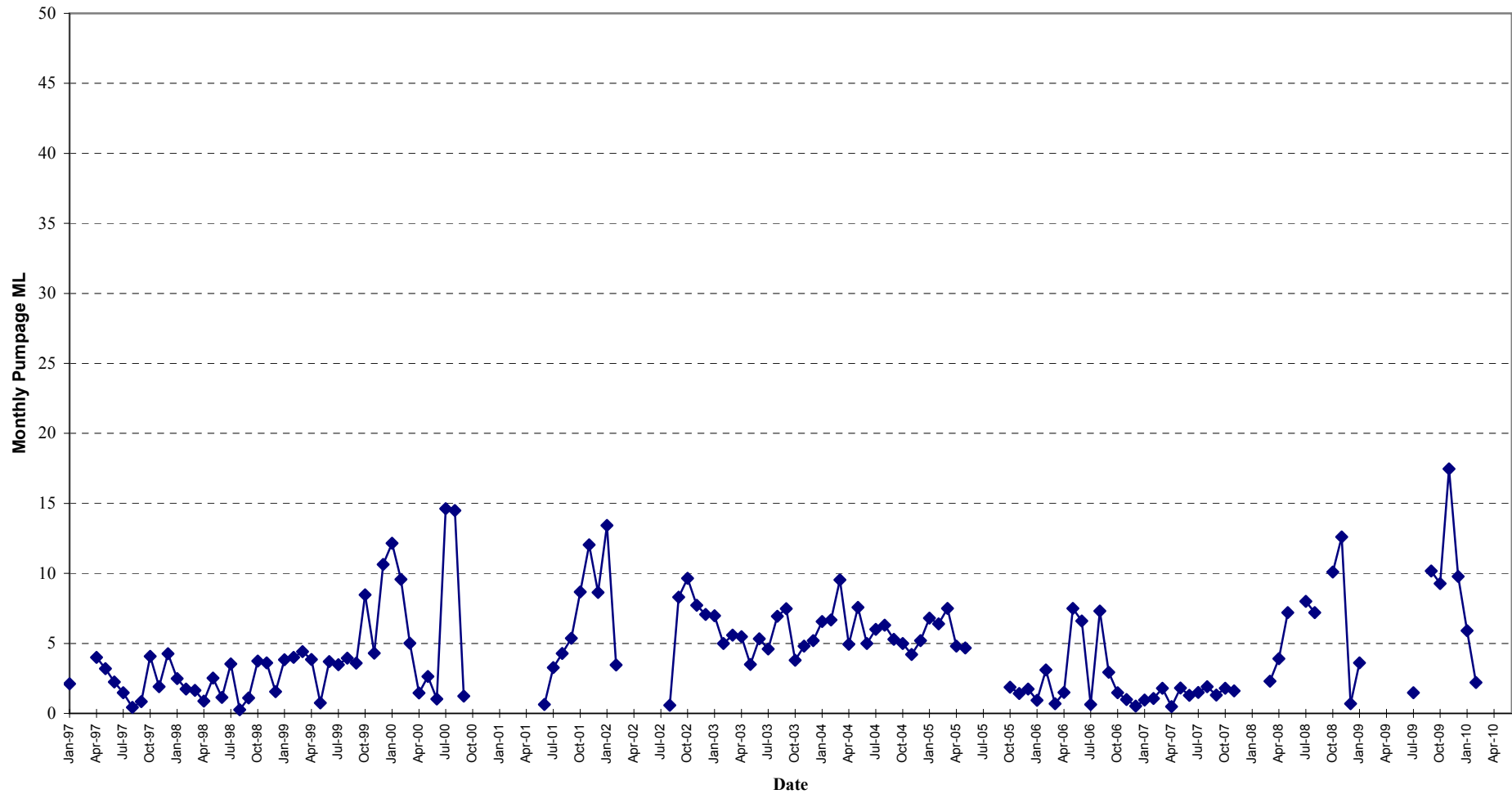


Figure 9

Appendix A Groundwater Water Quality Plots

PF FORMATION - MAROOTA
BORE PF166MW1 GROUNDWATER ANALYTICAL SUMMARY

Analysis	Units	LOR	1.06.99	8.09.99	21.12.99	9.03.00	28.11.00	21.06.01	19.12.01	26.06.02	23.01.03	9.07.03	30.01.04	29.06.04	15.12.04	22.06.05	19.01.06	6.07.06	5.07.07	3.07.08	3.07.09	16.06.10
pH		0.01	4.18	4.19	4.13	4.14	4.31	4.19	4.63	4.48	4.82	7.86	4.39	4.27	4.06	DRY	DRY	DRY	4.76	DRY	3.58	4.06
Electrical Conductivity	µS/cm	1	222	240	230	214	266	194	228	219	203	221	193	235	203				163		240	247
Total Dissolved Solids	mg/L	1	118	108	137	170	460	115	210	280	128	134	204	280	120				98		140	141
Calcium	mg/L	1	1	1	1	1	1	1	1	2	1	1	<1	1	1						1	<1
Magnesium	mg/L	1	6	6	6	5	6	5	6	6	5	4	5	5	4						4	4
Sodium	mg/L	1	26	23	23	22	29	21	22	24	19	20	18	19	19						26	24
Potassium	mg/L	1	<1	<1	1	1	1	1	2	1	<1	<1	<1	1	1						2	2
Bicarbonate	mg/L	1	<1	<1	<1	<1	<1	<1	<1	<1	<1	1	<1	<1	<1						<1	<1
Sulphate	mg/L	1	1	7	1	1	16	2	1	2	<1	<1	2	<1	2						2.21	1.77
Chloride	mg/L	1	58	49	51	52	58	49	58	61	46	50	47	44	36						49.1	56.3
Oil and Grease	mg/L	5	<5	<5	<5	<5	<5	<5	<5	<5	6	<5	<5	5	<5						<5	<5

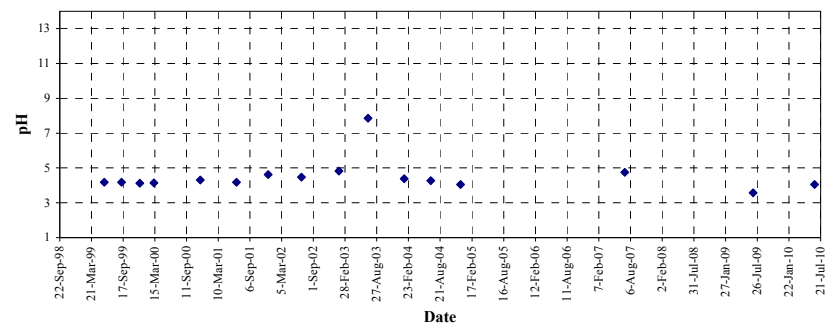
LOR = Limit of Reporting

* field measurements

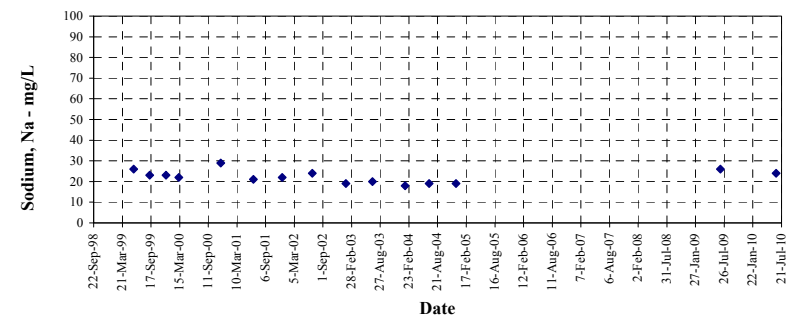
Average EC = 220 µS/cm
Average TDS = 178 mg/L
Average pH = 5

N.B. = TDS value in November 2000 is unusually high because of the presence of particulate matter in the sample.
NA = Not enough water for sample

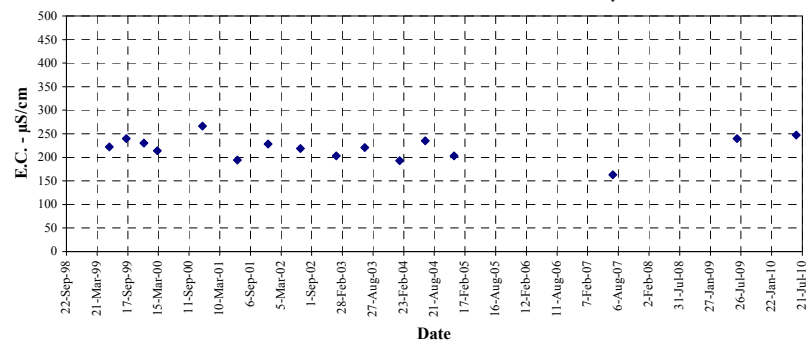
PF FORMATION - Bore PF166MW1 - pH



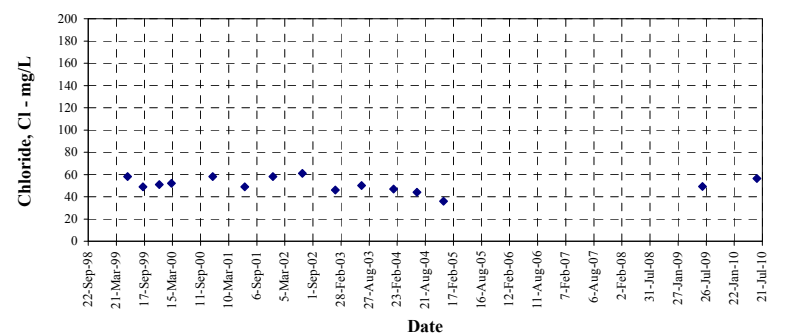
PF FORMATION - Bore PF166MW1 - Sodium



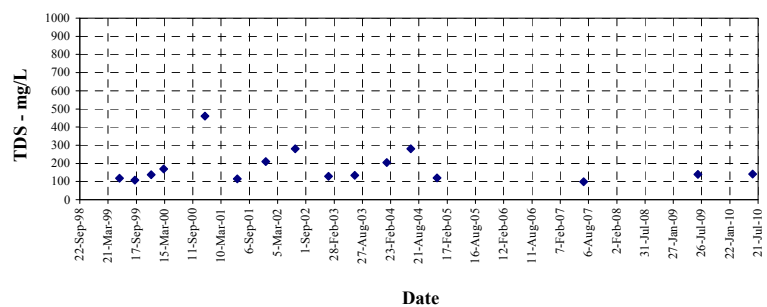
PF FORMATION - Bore PF166MW1 - Electrical Conductivity



PF FORMATION - Bore PF166MW1 - Chloride



PF FORMATION - Bore PF166MW1 - Total Dissolved Solids



PF FORMATION - MAROOTA
BORE PF167MW1 GROUNDWATER ANALYTICAL SUMMARY

Analysis	Units	LOR	1.06.99	8.09.99	21.12.99	9.03.00	28.11.00	21.06.01	19.12.01	26.06.02	23.01.03	9.07.03	30.01.04	29.06.04	15.12.04	22.06.05	19.01.06	6.07.06	5.07.07	3.07.08	3.07.09	16.06.10
pH		0.01	4.43	4.49	4.21	4.93	4.28	4.61	4.98	4.52	4.54	5.15	4.31	4.38	4.68	5.42	4.32	4.27	4.88	5.29	4	4.3
Electrical Conductivity	µS/cm	1	164	190	201	179	184	170	188	215	199	204	225	221	240	215	205	199	188	161	177	190
Total Dissolved Solids	mg/L	1	118	90	105	115	207	120	108	121	101	116	157	110	143	137	141	119	76	100	104	111
Calcium	mg/L	1	3	3	5	6	3	6	6	5	3	4	4	5	5	5	4	4	2	6	5	3
Magnesium	mg/L	1	5	4	4	4	4	4	5	4	4	3	4	4	4	4	4	4	3	5	4	3
Sodium	mg/L	1	16	18	16	15	18	16	18	25	20	19	22	23	26	28	25	23	16	13	14	15
Potassium	mg/L	1	2	2	3	3	3	5	4	5	2	2	2	3	3	3	3	3	2	4	4	2
Bicarbonate	mg/L	1	<1	<1	<1	<1	<1	<1	<1	<1	<1	1	<1	<1	<1	2	1	<1	<1	<1	<1	2.4
Sulphate	mg/L	1	9	<1	13	17	16	15	15	14	9	13	12	10	13	13	10	6	10	30	22.6	17.1
Chloride	mg/L	1	36	11	35	32	35	36	47	58	44	48	51	53	50	56.6	57.4	53.1	36.1	26.4	34.8	39.9
Oil and Grease	mg/L	5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5

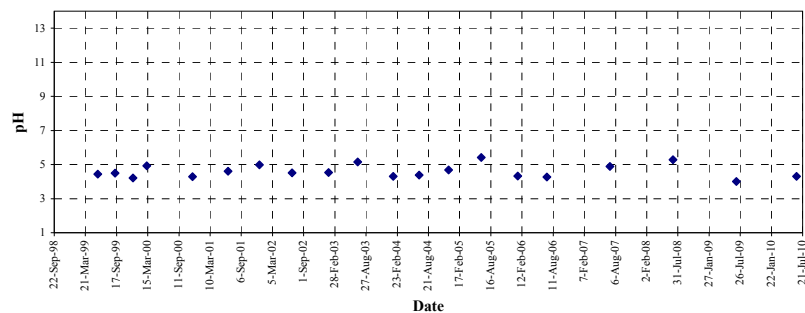
LOR = Limit of Reporting

Average EC = 196 µS/cm
Average TDS = 120 mg/L
Average pH = 5

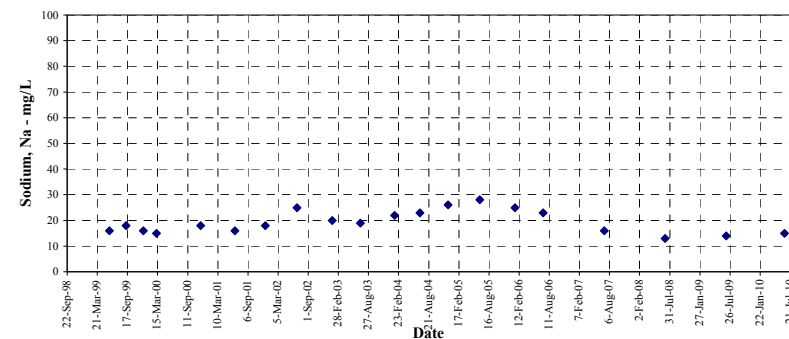
N.B. = TDS value in November 2000 is unusually high because of the presence of particulate matter in the sample.



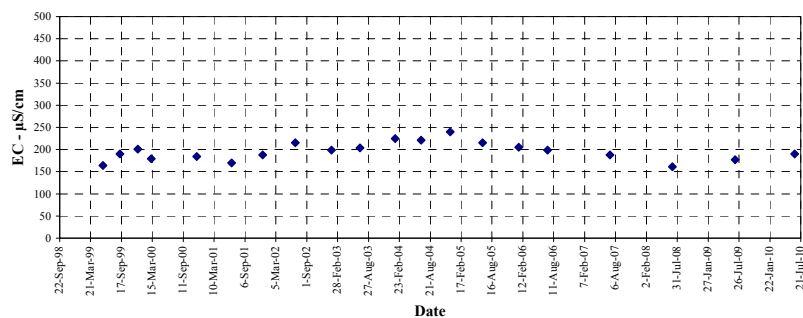
PF FORMATION - Bore PF167MW1 - pH



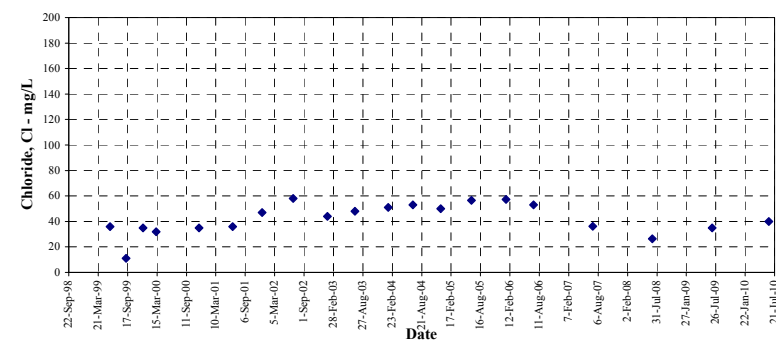
PF FORMATION - Bore PF167MW1 - Sodium



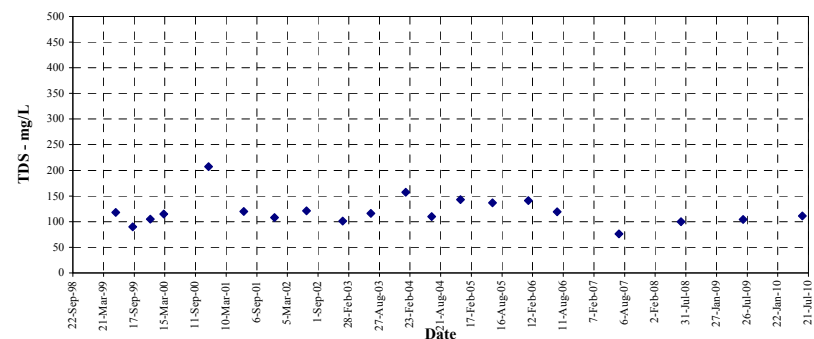
PF FORMATION - Bore PF167MW1 - Electrical Conductivity



PF FORMATION - Bore PF167MW1 - Chloride



PF FORMATION - Bore PF167MW1 - Total Dissolved Solids



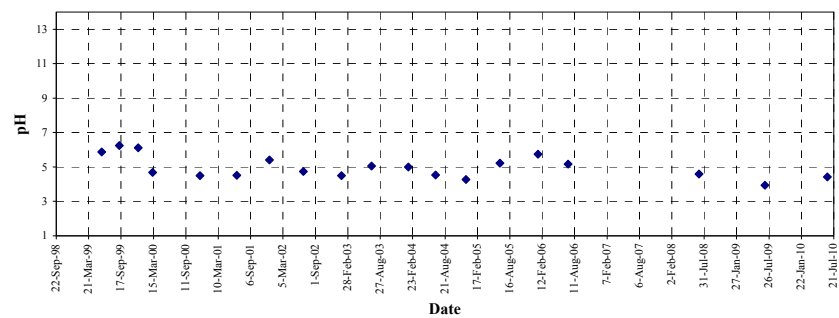
PF FORMATION - MAROOTA
BORE PF198PB1 GROUNDWATER ANALYTICAL SUMMARY

Analysis	Units	LOR	1.06.99	8.09.99	21.12.99	10.03.00	28.11.00	21.06.01	20.12.01	26.06.02	23.01.03	9.07.03	30.01.04	29.06.04	15.12.04	22.06.05	19.01.06	6.07.06	5.07.07	3.07.08	3.07.09	16.06.10
pH		0.01	5.87	6.24	6.11	4.69	4.49	4.51	5.41	4.73	4.49	5.06	5	4.53	4.28	5.22	5.74	5.16	NA	4.59	3.94	4.43
Electrical Conductivity	µS/cm	1	161	170	169	141	182	179	204	199	243	199	160	291	197	157	158	155		144	172	163
Total Dissolved Solids	mg/L	1	124	116	98	97	107	102	116	112	139	102	116	174	88	105	115	98		85	83	88
Calcium	mg/L	1	1	<1	1	1	3	2	2	4	3	2	2	4	1	1	2	1		<1	1	<1
Magnesium	mg/L	1	4	6	5	3	3	4	4	4	4	3	2	5	2	2	4	3		2	2	2
Sodium	mg/L	1	21	24	22	19	20	21	27	23	31	22	19	40	25	23	21	20		18	19	16
Potassium	mg/L	1	1	<1	1	1	2	5	5	3	3	2	2	3	2	2	2	2		1	2	1
Bicarbonate	mg/L	1	13	29	22	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	1	12	5		<1	<1	8.54
Sulphate	mg/L	1	4	4	4	2	8	8	3	7	4	8	6	9	8	8	6	2		10	9.31	6.1
Chloride	mg/L	1	39	35	36	36	40	49	60	58	64	49	43	83	42	47.1	43.4	43.8		34.1	38.8	48.4
Oil and Grease	mg/L	5	<5	<5	<5	<5	<5	<5	<5	<5	6	<5	<5	<5	<5	<5	5	<5		<5	<5	<5

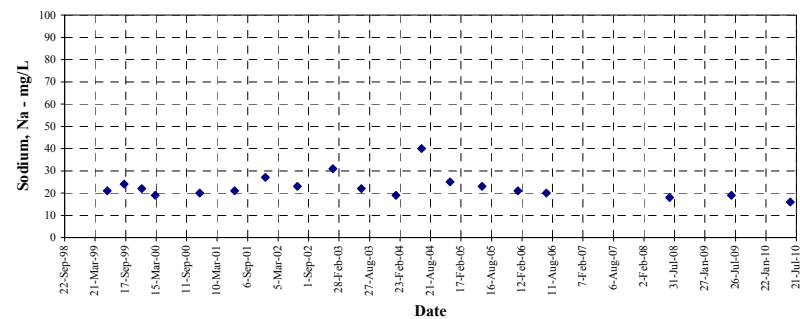
LOR = Limit of Reporting

Average EC = 181 µS/cm
Average TDS = 109 mg/L
Average pH = 5

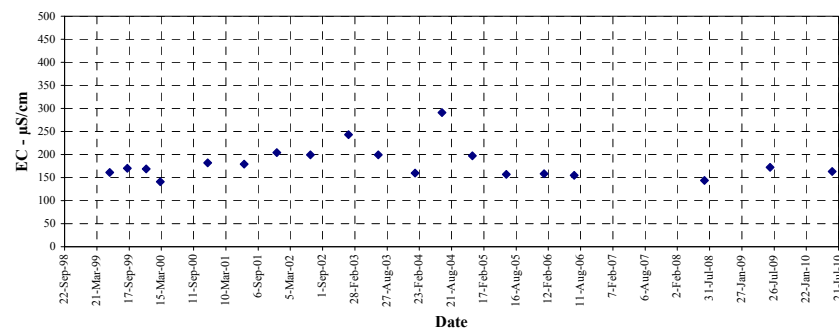
PF FORMATION Bore PF198PB1 - pH



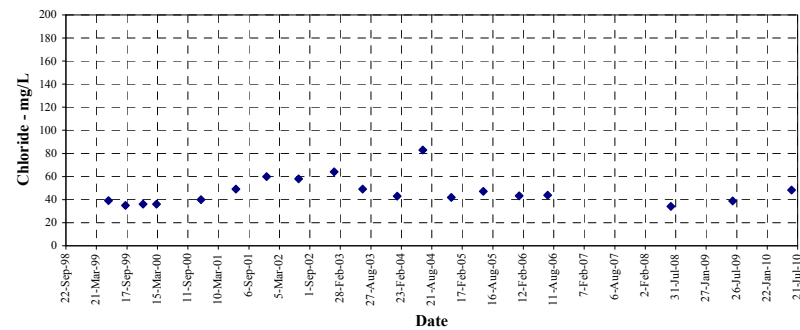
PF FORMATION Bore PF198PB1 - Sodium



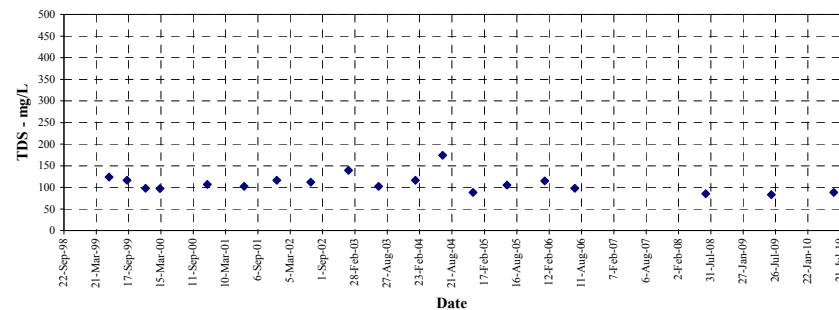
PF FORMATION Bore PF198PB1 - Electrical Conductivity



PF FORMATION Bore PF198PB1 - Chloride



PF FORMATION Bore PF198PB1 - Total Dissolved Solids



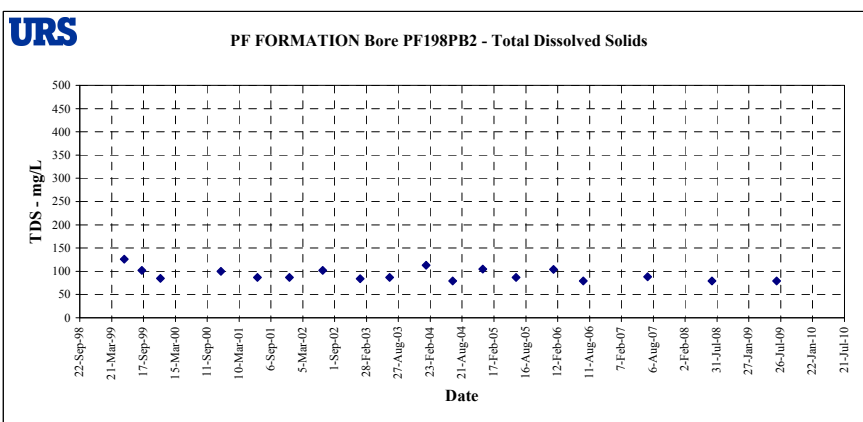
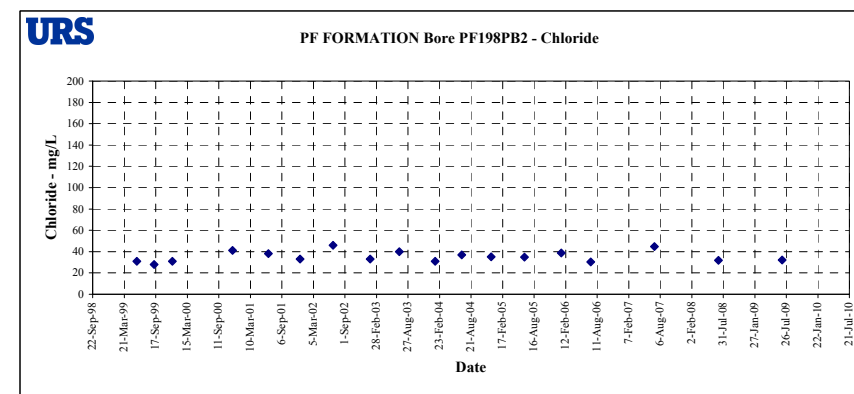
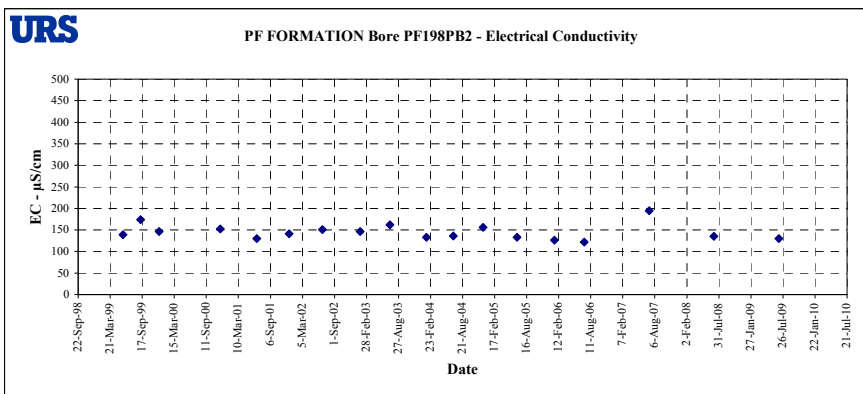
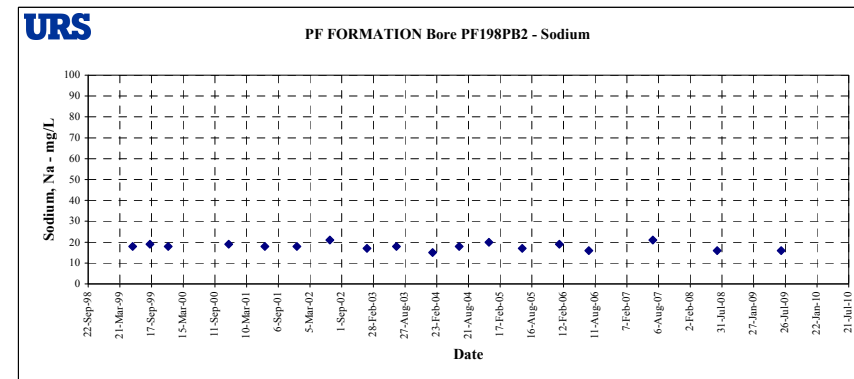
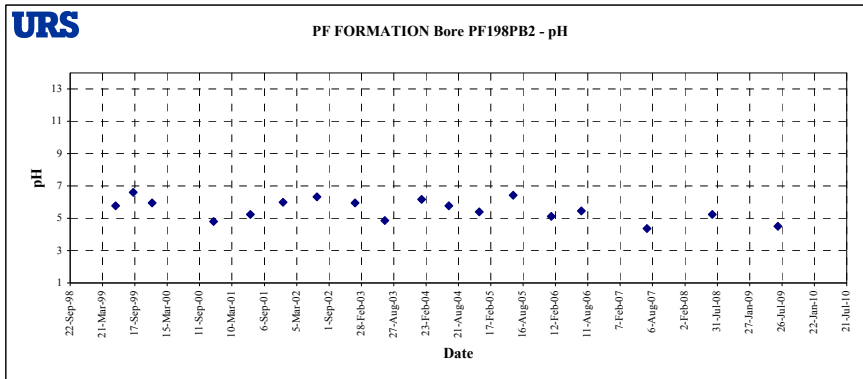
PF FORMATION - MAROOTA
BORE PF198PB2 GROUNDWATER ANALYTICAL SUMMARY

Analysis	Units	LOR	1.06.99	8.09.99	21.12.99	28.11.00	21.06.01	20.12.01	26.06.02	23.01.03	9.07.03	30.01.04	29.06.04	15.12.04	22.06.05	19.01.06	6.07.06	5.07.07	3.07.08	3.07.09	16.06.10
pH		0.01	5.78	6.61	5.96	4.8	5.24	5.99	6.33	5.96	4.87	6.18	5.78	5.39	6.43	5.13	5.46	4.37	5.25	4.5	NA
Electrical Conductivity	µS/cm	1	139	174	146	152	130	141	151	146	162	133	136	156	133	126	122	195	135	130	
Total Dissolved Solids	mg/L	1	126	102	85	100	87	87	102	84	87	113	79	105	87	104	79	88	79	79	
Calcium	mg/L	1	1	2	2	<1	<1	<1	1	<1	<1	<1	1	1	<1	<1	1	0.01	1	<1	
Magnesium	mg/L	1	5	5	5	4	3	4	4	4	2	4	4	2	4	3	4	3	5	3	
Sodium	mg/L	1	18	19	18	19	18	18	21	17	18	15	18	20	17	19	16	21	16	16	
Potassium	mg/L	1	2	2	2	1	1	2	2	1	<1	1	1	2	2	1	2	1	2	2	
Bicarbonate	mg/L	1	23	33	19	4	3	13	8	16	<1	16	9	2	14	7	24	<1	24.4	9.6	
Sulphate	mg/L	1	3	3	2	1	1	3	2	<1	4	2	1	4	4	1	1	4	2	2.78	
Chloride	mg/L	1	31	28	31	41	38	33	46	33	40	31	37	35	34.9	38.8	30.2	44.8	31.8	32.2	
Oil and Grease	mg/L	5	<5	<5	<5	<5	<5	11	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	

LOR = Limit of Reporting

Average EC = 145 µS/cm
Average TDS = 93 mg/L
Average pH = 6

Note: PF198PB2 could not be sampled in March 2000

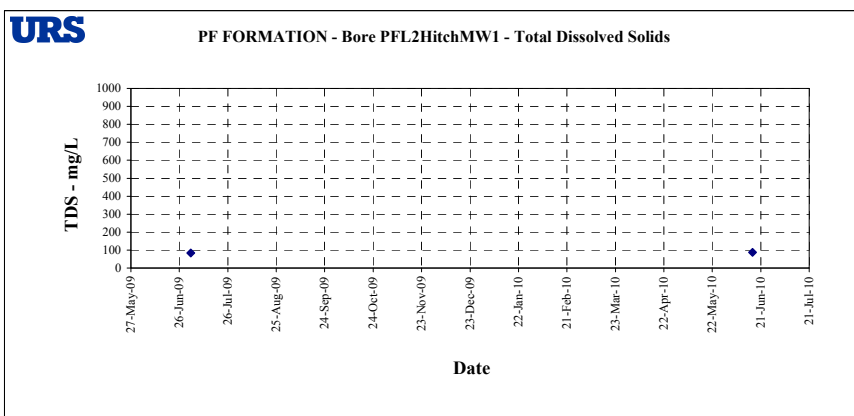
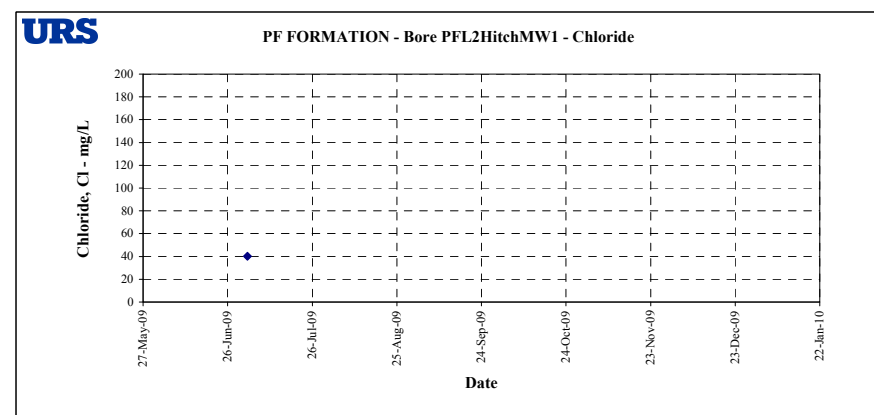
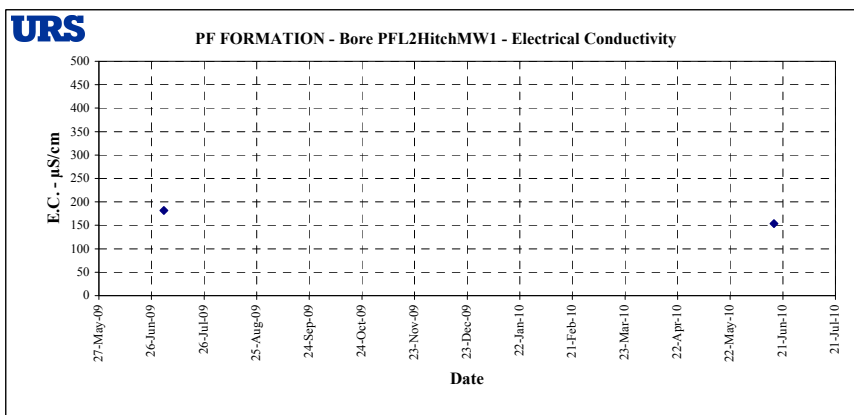
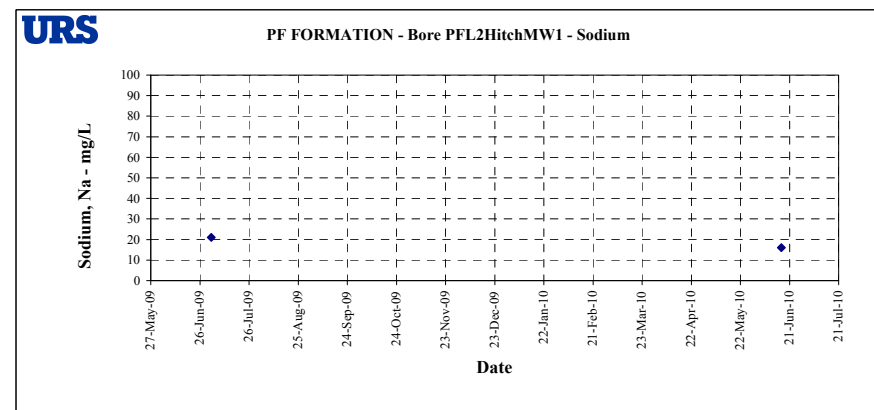
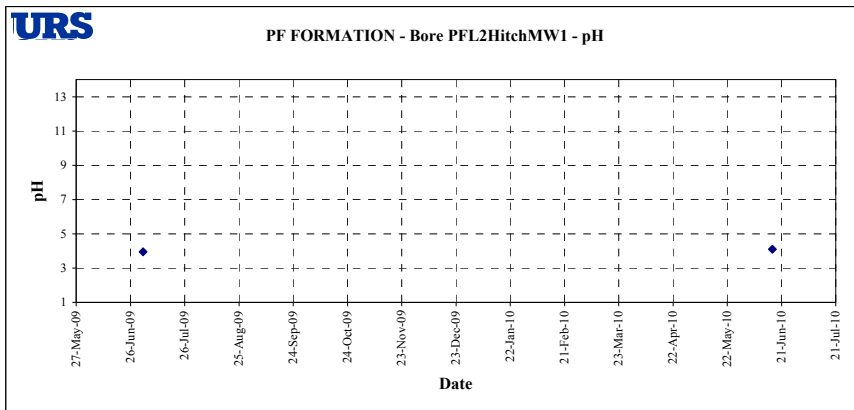


PF FORMATION - MAROOTA
BORE PFL2HitchMW1 GROUNDWATER ANALYTICAL SUMMARY

Analysis	Units	LOR	3.07.09	16.06.10
pH		0.01	3.96	4.1
Electrical Conductivity	µS/cm	1	182	154
Total Dissolved Solids	mg/L	1	84	88
Calcium	mg/L	1	<1	<1
Magnesium	mg/L	1	2	2
Sodium	mg/L	1	21	16
Potassium	mg/L	1	<1	<1
Bicarbonate	mg/L	1	<1	<1
Sulphate	mg/L	1	7.88	7.06
Chloride	mg/L	1	40.3	36.9
Oil and Grease	mg/L	5	<5	<5

LOR = Limit of Reporting

Average EC = 168 µS/cm
Average TDS = 86 mg/L
Average pH = 4

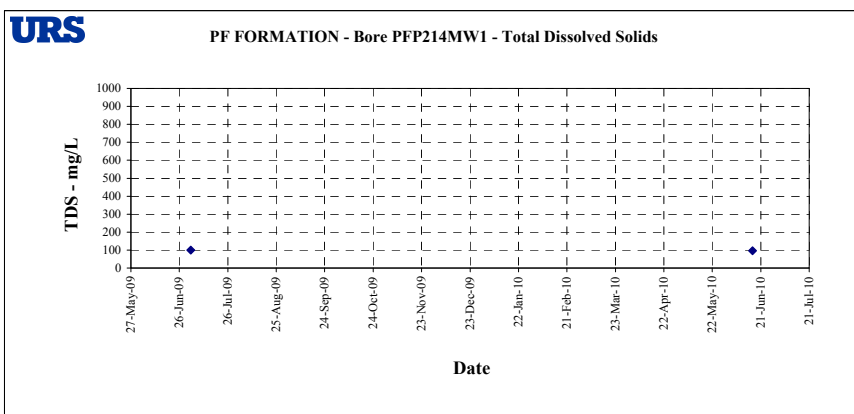
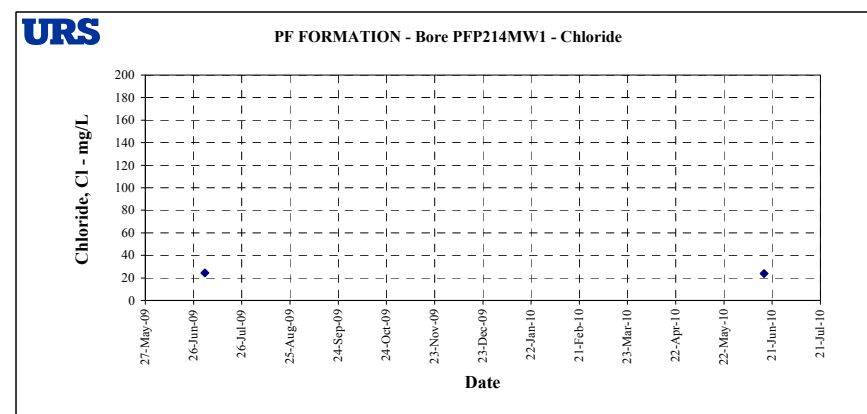
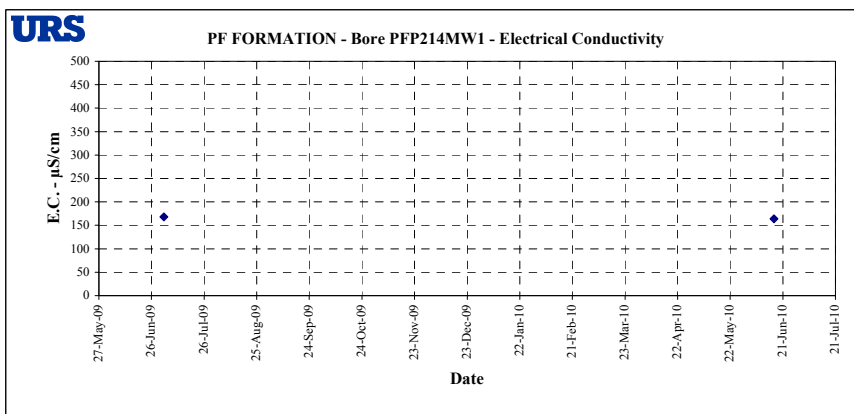
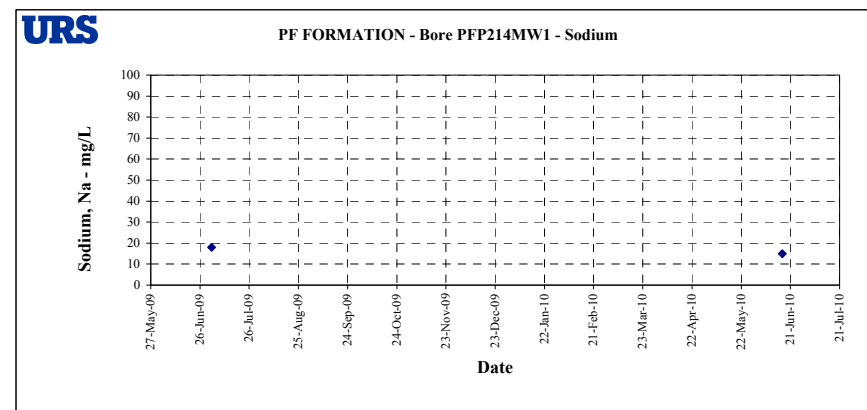
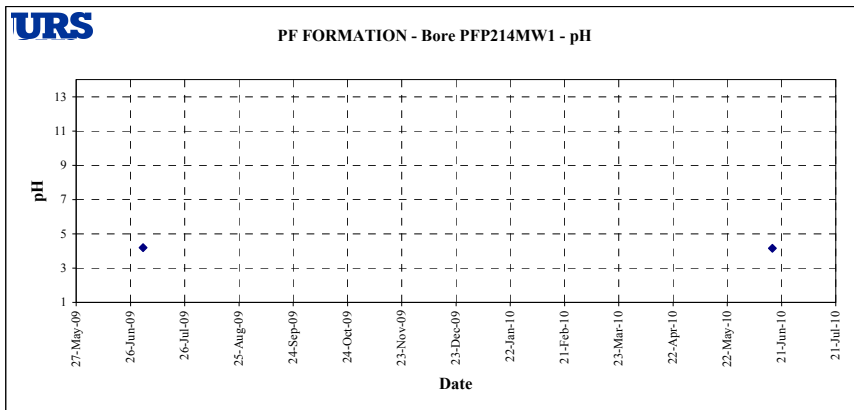


PF FORMATION - MAROOTA
BORE PFP214MW1 GROUNDWATER ANALYTICAL SUMMARY

Analysis	Units	LOR	3.07.09	16.06.10
pH		0.01	4.19	4.16
Electrical Conductivity	µS/cm	1	168	164
Total Dissolved Solids	mg/L	1	100	96
Calcium	mg/L	1	<1	<1
Magnesium	mg/L	1	6	5
Sodium	mg/L	1	18	15
Potassium	mg/L	1	1	<1
Bicarbonate	mg/L	1	<1	<1
Sulphate	mg/L	1	1.9	<0.5
Chloride	mg/L	1	24.3	23.8
Oil and Grease	mg/L	5	<5	<5

LOR = Limit of Reporting

Average EC = 166 µS/cm
Average TDS = 98 mg/L
Average pH = 4



Appendix B Analytical Laboratory Reports



Environmental Division

CERTIFICATE OF ANALYSIS

Work Order	: ES1011690	Page	: 1 of 4
Client	: URS AUSTRALIA (NSW) PTY LTD	Laboratory	: Environmental Division Sydney
Contact	: MR FABIO CAROSONE	Contact	: Charlie Pierce
Address	: LEVEL 4, 407 PACIFIC HIGHWAY ARTARMON NSW, AUSTRALIA 2064	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
E-mail	: fabio_carosone@urscorp.com	E-mail	: sydney.enviro.services@alsglobal.com
Telephone	: +61 89255500	Telephone	: +61-2-8784 8555
Facsimile	: +61 02 89255555	Facsimile	: +61-2-8784 8500
Project	: 43167726	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Order number	: —	Date Samples Received	: 16-JUN-2010
C-O-C number	: —	Issue Date	: 25-JUN-2010
Sampler	: FC	No. of samples received	: 10
Site	: —	No. of samples analysed	: 10
Quote number	: EN/001/10		

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. All pages of this report have been checked and approved for release.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results



NATA Accredited Laboratory 825

This document is issued in
accordance with NATA
accreditation requirements.

Accredited for compliance with
ISO/IEC 17025.

Signatories

This document has been electronically signed by the authorized signatories indicated below. Electronic signing has been carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	Position	Accreditation Category
Ankit Joshi	Inorganic Chemist	Inorganics
Celine Conceicao	Spectroscopist	Inorganics

Environmental Division Sydney
Part of the **ALS Laboratory Group**
277-289 Woodpark Road Smithfield NSW Australia 2164
Tel. +61-2-8784 8555 Fax. +61-2-8784 8500 www.alsglobal.com

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General Comments

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When date(s) and/or time(s) are shown bracketed, these have been assumed by the laboratory for processing purposes. If the sampling time is displayed as 0:00 the information was not provided by client.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.

LOR = Limit of reporting

^ = This result is computed from individual analyte detections at or above the level of reporting



Analytical Results

Sub-Matrix: WATER

Client sample ID

Client sampling date / time

Compound	CAS Number	LOR	Unit
EA005: pH			
pH Value	—	0.01	pH Unit
EA010P: Conductivity by PC Titrator			
Electrical Conductivity @ 25°C	—	1	µS/cm
EA015: Total Dissolved Solids			
^ Total Dissolved Solids @180°C	GIS-210-010	1	mg/L
ED009: Anions			
Chloride	16887-00-6	0.50	mg/L
Sulfate	14808-79-8	0.50	mg/L
ED037P: Alkalinity by PC Titrator			
Hydroxide Alkalinity as CaCO ₃	DMO-210-001	1	mg/L
Carbonate Alkalinity as CaCO ₃	3812-32-6	1	mg/L
Bicarbonate Alkalinity as CaCO ₃	71-52-3	1	mg/L
Total Alkalinity as CaCO ₃	—	1	mg/L
ED093F: Dissolved Major Cations			
Calcium	7440-70-2	1	mg/L
Magnesium	7439-95-4	1	mg/L
Sodium	7440-23-5	1	mg/L
Potassium	7440-09-7	1	mg/L
EN055: Ionic Balance			
^ Total Anions	—	0.01	meq/L
^ Total Cations	—	0.01	meq/L
EP020: Oil and Grease (O&G)			
Oil & Grease	—	5	mg/L

PFL2HITCHMW1 [16-JUN-2010] ES1011690-007	PFP214MW1 [16-JUN-2010] ES1011690-008	PF198PB1 [16-JUN-2010] ES1011690-009
4.10	4.16	4.43
154	164	163
88	96	88
36.9	23.8	41.4
7.06	<0.50	6.89
<1	<1	<1
<1	<1	<1
<1	<1	<1
<1	<1	<1
<1	<1	<1
2	5	2
16	15	16
<1	<1	1
1.19	0.67	1.31
0.83	1.05	0.96
<5	<5	<5



Analytical Results

Sub-Matrix: WATER

Client sample ID

Client sampling date / time

Compound	CAS Number	LOR	Unit	PF167MW1 [16-JUN-2010] ES1011690-005
EA005: pH				
pH Value	—	0.01	pH Unit	4.30
EA010P: Conductivity by PC Titrator				
Electrical Conductivity @ 25°C	—	1	µS/cm	190
EA015: Total Dissolved Solids				
^ Total Dissolved Solids @180°C	GIS-210-010	1	mg/L	111
ED009: Anions				
Chloride	16887-00-6	0.50	mg/L	39.9
Sulfate	14808-79-8	0.50	mg/L	17.1
ED037P: Alkalinity by PC Titrator				
Hydroxide Alkalinity as CaCO ₃	DMO-210-001	1	mg/L	<1
Carbonate Alkalinity as CaCO ₃	3812-32-6	1	mg/L	<1
Bicarbonate Alkalinity as CaCO ₃	71-52-3	1	mg/L	2
Total Alkalinity as CaCO ₃	—	1	mg/L	2
ED093F: Dissolved Major Cations				
Calcium	7440-70-2	1	mg/L	3
Magnesium	7439-95-4	1	mg/L	3
Sodium	7440-23-5	1	mg/L	15
Potassium	7440-09-7	1	mg/L	2
EN055: Ionic Balance				
^ Total Anions	—	0.01	meq/L	1.53
^ Total Cations	—	0.01	meq/L	1.14
EP020: Oil and Grease (O&G)				
Oil & Grease	—	5	mg/L	<5

THIS COLUMN FOR LAB USE ONLY						FROM: URS ACN 000 691 690 407 Pacific Hwy Artamon 2064		Job Code:	
DATE: 16/06/2010 TO: ALS									
Container Size, Type, Preservative and Analysis		Container Identification							
Size	Type*	Label colour	Preservative Code	Number of containers	pH, EC, TDS, Ca, Mg, Na, K, Cl, HCO ₃ , SO ₄	oil and grease	H ₂ SO ₄		
1 L	P	green							
	G	purple							
Ph: 8925 5500 Fax: 8925 5555									
Project No: 43167726		Project Manager: Fabio Carosone		Agreement No:		Released for URS by: Fabio Carosone Date: 5/7/07 Time:			
Due Date:		Sample(s):		Signature(s):		Checked:		Date: 16/6/10 Time: 16:50	
		Fabio Carosone		Received for Laboratory by: [signature] Date: 16/6/10 Time: 16:50					
Lab Identification		Date	Time	Matrix	Sample Number	Comments	Total no	Tick required analytes	
	16/06/2010			Water	PFL3MW1		2	✓	✓
				Water	PIT 4MMW1		2	✓	✓
				Water	PIT4MMW2		2	✓	✓
				Water	PIT4MMW3		2	✓	✓
				Water	PF167MW1		2	✓	✓
				Water	PF166MW1		2	✓	✓
				Water	PFL2HtchMW1		2	✓	✓
				Water	PF198PB1		2	✓	✓
				Water	PF198PB1		2	✓	✓
				Water	PF198PB1		2	✓	✓
Remarks:		TOTAL 20 10 10							
* Container Type and Preservative Codes: P = Neutral Plastic; N = Nitric Acid Preserved; C = Sodium Hydroxide Preserved; J = Solvent Washed Acid Rinsed Jar; S = Solvent Washed Acid Rinsed Glass Bottle; VC = Hydrochloric Acid Preserved Vial; VS = Sulfuric Acid Preserved Vial; BS = Sulfuric Acid Preserved Glass Bottle; Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle									
NOTE: SAMPLES MAY CONTAIN DANGEROUS AND HAZARDOUS SUBSTANCES									
Counter Job No:									



Environmental Division

QUALITY CONTROL REPORT

Work Order	: ES1011690	Page	: 1 of 6
Client	: URS AUSTRALIA (NSW) PTY LTD	Laboratory	: Environmental Division Sydney
Contact	: MR FABIO CAROSONE	Contact	: Charlie Pierce
Address	: LEVEL 4, 407 PACIFIC HIGHWAY ARTARMON NSW, AUSTRALIA 2064	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
E-mail	: fabio_carosone@urscorp.com	E-mail	: sydney.enviro.services@alsglobal.com
Telephone	: +61 89255500	Telephone	: +61-2-8784 8555
Facsimile	: +61 02 89255555	Facsimile	: +61-2-8784 8500
Project	: 43167726	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Site	: ----	Date Samples Received	: 16-JUN-2010
C-O-C number	: ----	Issue Date	: 25-JUN-2010
Sampler	: FC	No. of samples received	: 10
Order number	: ----	No. of samples analysed	: 10
Quote number	: EN/001/10		

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. All pages of this report have been checked and approved for release.

This Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percentage Difference (RPD) and Acceptance Limits
- Method Blank (MB) and Laboratory Control Spike (LCS) Report; Recovery and Acceptance Limits
- Matrix Spike (MS) Report; Recovery and Acceptance Limits



NATA Accredited Laboratory 825

This document is issued in accordance with NATA accreditation requirements.

Accredited for compliance with ISO/IEC 17025.

Signatories

This document has been electronically signed by the authorized signatories indicated below. Electronic signing has been carried out in compliance with procedures specified in 21 CFR Part 11.

<i>Signatories</i>	<i>Position</i>	<i>Accreditation Category</i>
Ankit Joshi	Inorganic Chemist	Inorganics
Celine Conceicao	Spectroscopist	Inorganics

Environmental Division Sydney

Part of the **ALS Laboratory Group**

277-289 Woodpark Road Smithfield NSW Australia 2164

Tel. +61-2-8784 8555 Fax. +61-2-8784 8500 www.alsglobal.com

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Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

Key :
Anonymous = Refers to samples which are not specifically part of this work order but formed part of the QC process lot
CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
RPD = Relative Percentage Difference
= Indicates failed QC



Laboratory Duplicate (DUP) Report

The quality control term Laboratory Duplicate refers to a randomly selected intralaboratory split. Laboratory duplicates provide information regarding method precision and sample heterogeneity. The permitted ranges for the Relative Percent Deviation (RPD) of Laboratory Duplicates are specified in ALS Method QWI-EN/38 and are dependent on the magnitude of results in comparison to the level of reporting: Result < 10 times LOR:- No Limit; Result between 10 and 20 times LOR:- 0% - 50%; Result > 20 times LOR:- 0% - 20%.

Sub-Matrix: **WATER**

Sub-Matrix: WATER				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
EA005: pH (QC Lot: 1383207)									
ES1011678-001	Anonymous	EA005: pH Value	----	0.01	pH Unit	Anonymous	Anonymous	Anonymous	Anonymous
ES1011690-007	PFL2HITCHMW1	EA005: pH Value	----	0.01	pH Unit	4.10		1.0	0% - 20%
EA010P: Conductivity by PC Titrator (QC Lot: 1392281)									
ES1011689-001	Anonymous	EA010-P: Electrical Conductivity @ 25°C	----	1	µS/cm	Anonymous	Anonymous	Anonymous	Anonymous
ES1011690-009	PF198PB1	EA010-P: Electrical Conductivity @ 25°C	----	1	µS/cm	163		0.0	0% - 20%
EA015: Total Dissolved Solids (QC Lot: 1389369)									
ES1011690-001	PFL3MW1	EA015: Total Dissolved Solids @180°C	GIS-210-010	1	mg/L	108		3.6	0% - 20%
ES1011690-010	PFPIT4PBI	EA015: Total Dissolved Solids @180°C	GIS-210-010	1	mg/L	102	100	2.0	0% - 20%
ED009: Anions (QC Lot: 1384981)									
ES1011634-001	Anonymous	ED009: Chloride	16887-00-6	0.50	mg/L	Anonymous	Anonymous	Anonymous	Anonymous
		ED009: Sulfate	14808-79-8	0.50	mg/L	Anonymous	Anonymous	Anonymous	Anonymous
ES1011676-008	Anonymous	ED009: Chloride	16887-00-6	0.50	mg/L	Anonymous	Anonymous	Anonymous	Anonymous
		ED009: Sulfate	14808-79-8	0.50	mg/L	Anonymous	Anonymous	Anonymous	Anonymous
ED009: Anions (QC Lot: 1384982)									
ES1011690-008	PFP214MW1	ED009: Chloride	16887-00-6	0.50	mg/L	23.8	23.9	0.4	0% - 20%
		ED009: Sulfate	14808-79-8	0.50	mg/L	<0.50	<0.50	0.0	No Limit
ES1011716-003	Anonymous	ED009: Chloride	16887-00-6	0.50	mg/L	Anonymous	Anonymous	Anonymous	Anonymous
		ED009: Sulfate	14808-79-8	0.50	mg/L	Anonymous	Anonymous	Anonymous	Anonymous
ED037P: Alkalinity by PC Titrator (QC Lot: 1392282)									
ES1011690-001	PFL3MW1	ED037-P: Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1		0.0	No Limit
		ED037-P: Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1		0.0	No Limit
		ED037-P: Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	6	4	41.6	No Limit
		ED037-P: Total Alkalinity as CaCO3	----	1	mg/L	6	4	41.6	No Limit
ES1011690-009	PF198PB1	ED037-P: Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1		0.0	No Limit
		ED037-P: Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1		0.0	No Limit
		ED037-P: Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	<1		0.0	No Limit
		ED037-P: Total Alkalinity as CaCO3	----	1	mg/L	<1	<1	0.0	No Limit
ED093F: Dissolved Major Cations (QC Lot: 1383147)									
ES1011496-003	Anonymous	ED093F: Calcium	7440-70-2	1	mg/L	Anonymous	Anonymous	Anonymous	Anonymous
		ED093F: Magnesium	7439-95-4	1	mg/L	Anonymous	Anonymous	Anonymous	Anonymous
		ED093F: Sodium	7440-23-5	1	mg/L	Anonymous	Anonymous	Anonymous	Anonymous
		ED093F: Potassium	7440-09-7	1	mg/L	Anonymous	Anonymous	Anonymous	Anonymous
ES1011690-002	PIT4MW1	ED093F: Calcium	7440-70-2	1	mg/L	<1		0.0	No Limit
		ED093F: Magnesium	7439-95-4	1	mg/L	2		0.0	No Limit
		ED093F: Sodium	7440-23-5	1	mg/L	16	16	0.0	0% - 50%

Page : 4 of 6
Work Order : ES1011690
Client : URS AUSTRALIA (NSW) PTY LTD
Project : 43167726



Sub-Matrix: WATER				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
ED093F: Dissolved Major Cations (QC Lot: 1383147) - continued									
ES1011690-002	PIT4MW1	ED093F: Potassium	7440-09-7	1	mg/L	<1		0.0	No Limit



Method Blank (MB) and Laboratory Control Spike (LCS) Report

The quality control term Method / Laboratory Blank refers to an analyte free matrix to which all reagents are added in the same volumes or proportions as used in standard sample preparation. The purpose of this QC parameter is to monitor potential laboratory contamination. The quality control term Laboratory Control Sample (LCS) refers to a certified reference material, or a known interference free matrix spiked with target analytes. The purpose of this QC parameter is to monitor method precision and accuracy independent of sample matrix. Dynamic Recovery Limits are based on statistical evaluation of processed LCS.

Sub-Matrix: **WATER**

Sub-Matrix: WATER				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike Concentration	Spike Recovery (%)	Recovery Limits (%)	
Method: Compound	CAS Number	LOR	Unit	Result		LCS	Low	High
EA010P: Conductivity by PC Titrator (QCLot: 1392281)								
EA010-P: Electrical Conductivity @ 25°C	----	1	µS/cm	<1	2000 µS/cm	99.2	86.3	112
EA015: Total Dissolved Solids (QCLot: 1389369)								
EA015: Total Dissolved Solids @180°C	GIS-210-010	1	mg/L	<1	293 mg/L	101	77.9	122
ED009: Anions (QCLot: 1384981)								
ED009: Chloride	16887-00-6	0.5	mg/L	<0.50	4 mg/L	97.7	70	130
ED009: Sulfate	14808-79-8	0.5	mg/L	<0.50	4 mg/L	80.5	70	130
ED009: Anions (QCLot: 1384982)								
ED009: Chloride	16887-00-6	0.5	mg/L	<0.50	4 mg/L	97.5	70	130
ED009: Sulfate	14808-79-8	0.5	mg/L	<0.50	4 mg/L	119	70	130
ED037P: Alkalinity by PC Titrator (QCLot: 1392282)								
ED037-P: Total Alkalinity as CaCO3	----	1	mg/L	----	200 mg/L	88.0	80.2	108
ED093F: Dissolved Major Cations (QCLot: 1383147)								
ED093F: Calcium	7440-70-2	1	mg/L	<1	50 mg/L	94.6	88	110
ED093F: Magnesium	7439-95-4	1	mg/L	<1	50 mg/L	102	90	110
ED093F: Sodium	7440-23-5	1	mg/L	<1	50 mg/L	88.8	81	107
ED093F: Potassium	7440-09-7	1	mg/L	<1	50 mg/L	92.4	89	109
EP020: Oil and Grease (O&G) (QCLot: 1389786)								
EP020: Oil & Grease	----	5	mg/L	<5	5000 mg/L	82.2	81.6	107
EP020: Oil and Grease (O&G) (QCLot: 1390436)								
EP020: Oil & Grease	----	5	mg/L	<5	5000 mg/L	88.8	81.6	107



Matrix Spike (MS) Report

The quality control term Matrix Spike (MS) refers to an intralaboratory split sample spiked with a representative set of target analytes. The purpose of this QC parameter is to monitor potential matrix effects on analyte recoveries. Static Recovery Limits as per laboratory Data Quality Objectives (DQOs). Ideal recovery ranges stated may be waived in the event of sample matrix interference.

Sub-Matrix: WATER

Sub-Matrix: WATER				Matrix Spike (MS) Report			
				Spike Concentration	Spike Recovery (%)	Recovery Limits (%)	
					MS	Low	High
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number				
ED009: Anions (QCLot: 1384981)							
ES1011634-001	Anonymous	ED009: Chloride	16887-00-6	Anonymous	Anonymous	Anonymous	Anonymous
		ED009: Sulfate	14808-79-8	Anonymous	Anonymous	Anonymous	Anonymous
ED009: Anions (QCLot: 1384982)							
ES1011690-008	PFP214MW1	ED009: Chloride	16887-00-6	4 mg/L	# Not Determined	70	130
		ED009: Sulfate	14808-79-8	4 mg/L	128	70	130



Environmental Division

INTERPRETIVE QUALITY CONTROL REPORT

Work Order	: ES1011690	Page	: 1 of 6
Client	: URS AUSTRALIA (NSW) PTY LTD	Laboratory	: Environmental Division Sydney
Contact	: MR FABIO CAROSONE	Contact	: Charlie Pierce
Address	: LEVEL 4, 407 PACIFIC HIGHWAY ARTARMON NSW, AUSTRALIA 2064	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
E-mail	: fabio_carosone@urscorp.com	E-mail	: charlie.pierce@alsenviro.com
Telephone	: +61 89255500	Telephone	: +61-2-8784 8555
Facsimile	: +61 02 89255555	Facsimile	: +61-2-8784 8500
Project	: 43167726	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Site	: ----		
C-O-C number	: ----	Date Samples Received	: 16-JUN-2010
Sampler	: FC	Issue Date	: 25-JUN-2010
Order number	: ----		
Quote number	: EN/001/10	No. of samples received	: 10
		No. of samples analysed	: 10

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. All pages of this report have been checked and approved for release.

This Interpretive Quality Control Report contains the following information:

- Analysis Holding Time Compliance
- Quality Control Parameter Frequency Compliance
- Brief Method Summaries
- Summary of Outliers

Environmental Division Sydney

Part of the **ALS Laboratory Group**

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A Campbell Brothers Limited Company



Analysis Holding Time Compliance

The following report summarises extraction / preparation and analysis times and compares with recommended holding times. Dates reported represent first date of extraction or analysis and precludes subsequent dilutions and reruns. Information is also provided re the sample container (preservative) from which the analysis aliquot was taken. Elapsed period to analysis represents number of days from sampling where no extraction / digestion is involved or period from extraction / digestion where this is present. For composite samples, sampling date is assumed to be that of the oldest sample contributing to the composite. Sample date for laboratory produced leachates is assumed as the completion date of the leaching process. Outliers for holding time are based on USEPA SW 846, APHA, AS and NEPM (1999). A listing of breaches is provided in the Summary of Outliers.

Holding times for leachate methods (excluding elutriates) vary according to the analytes being determined on the resulting solution. For non-volatile analytes, the holding time compliance assessment compares the leach date with the shortest analyte holding time for the equivalent soil method. These soil holding times are: Organics (14 days); Mercury (28 days) & other metals (180 days). A recorded breach therefore does not guarantee a breach for all non-volatile parameters.

Matrix: **WATER**

Evaluation: * = Holding time breach ; ✓ = Within holding time.

Method	Sample Date	Extraction / Preparation			Analysis			
Container / Client Sample ID(s)		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation	
EA005: pH								
Clear Plastic Bottle - Natural PFL3MW1,								



Matrix: **WATER**

Evaluation: * = Holding time breach ; ✓ = Within holding time.

Method		Sample Date	Extraction / Preparation			Analysis		
Container / Client Sample ID(s)			Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
ED037P: Alkalinity by PC Titrator								
Clear Plastic Bottle - Natural		16-JUN-2010	---	---	----	24-JUN-2010	30-JUN-2010	✓
PFL3MW1,	PIT4MW1,							
PIT4MW2,	PIT4MW3,							
PF167MW1,	PF166MW1,							
PFL2HITCHMW1,	PFP214MW1,							
PF198PB1,	PFPIT4PBI							
ED093F: Dissolved Major Cations								
Clear Plastic Bottle - Natural		16-JUN-2010	---	---	----	16-JUN-2010	23-JUN-2010	✓
PFL3MW1,	PIT4MW1,							
PIT4MW2,	PIT4MW3,							
PF167MW1,	PF166MW1,							
PFL2HITCHMW1,	PFP214MW1,							
PF198PB1,	PFPIT4PBI							
EP020: Oil and Grease (O&G)								
Amber Glass Bottle - Sulphuric Acid		16-JUN-2010	----	----	----	22-JUN-2010	14-JUL-2010	✓
PFL3MW1,	PIT4MW1,							
PIT4MW2,	PIT4MW3							
Amber Glass Bottle - Sulphuric Acid		16-JUN-2010	----	----	----	23-JUN-2010	14-JUL-2010	✓
PF167MW1,	PF166MW1,							
PFL2HITCHMW1,	PFP214MW1,							
PF198PB1,	PFPIT4PBI							



Quality Control Parameter Frequency Compliance

The following report summarises the frequency of laboratory QC samples analysed within the analytical lot(s) in which the submitted sample(s) was(where) processed. Actual rate should be greater than or equal to the expected rate. A listing of breaches is provided in the Summary of Outliers.

Matrix: **WATER** Evaluation: ✖ = Quality Control frequency not within specification ; ✔ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	Method	QC	Regular	Actual	Expected	Evaluation	
Laboratory Duplicates (DUP)							
Alkalinity by PC Titrator	ED037-P	2	11	18.2	10.0	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Conductivity by PC Titrator	EA010-P	2	16	12.5	10.0	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Major Cations - Dissolved	ED093F	2	18	11.1	10.0	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
pH	EA005	2	20	10.0	10.0	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Standard Anions	ED009	4	40	10.0	10.0	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Total Dissolved Solids	EA015	2	20	10.0	10.0	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Laboratory Control Samples (LCS)							
Alkalinity by PC Titrator	ED037-P	1	11	9.1	5.0	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Conductivity by PC Titrator	EA010-P	1	16	6.3	5.0	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Major Cations - Dissolved	ED093F	1	18	5.6	5.0	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Oil and Grease	EP020	2	40	5.0	5.0	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Standard Anions	ED009	2	40	5.0	5.0	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Total Dissolved Solids	EA015	1	20	5.0	5.0	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Method Blanks (MB)							
Conductivity by PC Titrator	EA010-P	1	16	6.3	5.0	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Major Cations - Dissolved	ED093F	1	18	5.6	5.0	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Oil and Grease	EP020	2	40	5.0	5.0	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Standard Anions	ED009	2	40	5.0	5.0	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Total Dissolved Solids	EA015	1	20	5.0	5.0	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Matrix Spikes (MS)							
Standard Anions	ED009	2	40	5.0	5.0	✓	ALS QCS3 requirement



Brief Method Summaries

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the US EPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request. The following report provides brief descriptions of the analytical procedures employed for results reported in the Certificate of Analysis. Sources from which ALS methods have been developed are provided within the Method Descriptions.

Analytical Methods	Method	Matrix	Method Descriptions
pH	EA005	WATER	APHA 21st ed. 4500 H+ B. pH of water samples is determined by ISE either manually or by automated pH meter. This method is compliant with NEPM (1999) Schedule B(3) (Appdx. 2)
Conductivity by PC Titrator	EA010-P	WATER	APHA 21st ed., 2510 B This procedure determines conductivity by automated ISE. This method is compliant with NEPM (1999) Schedule B(3) (Appdx. 2)
Total Dissolved Solids	EA015	WATER	APHA 21st ed., 2540C A gravimetric procedure that determines the amount of 'filterable' residue in an aqueous sample. A well-mixed sample is filtered through a glass fibre filter (1.2um). The filtrate is evaporated to dryness and dried to constant weight at 180+/-5C. This method is compliant with NEPM (1999) Schedule B(3) (Appdx. 2)
Standard Anions	* ED009	WATER	APHA 21st ed., 4110. This method is compliant with NEPM (1999) Schedule B(3) (Appdx. 2)
Alkalinity by PC Titrator	ED037-P	WATER	APHA 21st ed., 2320 B This procedure determines alkalinity by automated measurement (e.g. PC Titrate) using pH 4.5 for indicating the total alkalinity end-point. This method is compliant with NEPM (1999) Schedule B(3) (Appdx. 2)
Major Cations - Dissolved	ED093F	WATER	APHA 21st ed., 3120; USEPA SW 846 - 6010 The ICPAES technique ionises the 0.45um filtered sample atoms emitting a characteristic spectrum. This spectrum is then compared against matrix matched standards for quantification. This method is compliant with NEPM (1999) Schedule B(3) (Appdx. 2)
Ionic Balance by IC PCT and ICPAES	EN055 - IC ED009	WATER	APHA 21st Ed. 1030F. This method is compliant with NEPM (1999) Schedule B(3) (Appdx. 2)
Oil and Grease	EP020	WATER	APHA 21st ed., 5520 B Oil & grease is a gravimetric procedure to determine the amount of oil & grease residue in an aqueous sample. The sample is serially extracted three times n-hexane. The resultant extracts are combined, dehydrated and concentrated prior to gravimetric determination. This method is compliant with NEPM (1999) Schedule B(3) (Appdx. 2)



Summary of Outliers

Outliers : Quality Control Samples

The following report highlights outliers flagged in the Quality Control (QC) Report. Surrogate recovery limits are static and based on USEPA SW846 or ALS-QWI/EN/38 (in the absence of specific USEPA limits). This report displays QC Outliers (breaches) only.

Duplicates, Method Blanks, Laboratory Control Samples and Matrix Spikes

Matrix: **WATER**

Compound Group Name	Laboratory Sample ID	Client Sample ID	Analyte	CAS Number	Data	Limits	Comment
Matrix Spike (MS) Recoveries							
ED009: Anions	ES1011690-008	PFP214MW1	Chloride	16887-00-6	Not Determined	----	MS recovery not determined, background level greater than or equal to 4x spike level.

- For all matrices, no Method Blank value outliers occur.
- For all matrices, no Duplicate outliers occur.
- For all matrices, no Laboratory Control outliers occur.

Regular Sample Surrogates

- For all regular sample matrices, no surrogate recovery outliers occur.

Outliers : Analysis Holding Time Compliance

This report displays Holding Time breaches only. Only the respective Extraction / Preparation and/or Analysis component is/are displayed.

- No Analysis Holding Time Outliers exist.

Outliers : Frequency of Quality Control Samples

The following report highlights breaches in the Frequency of Quality Control Samples.

- No Quality Control Sample Frequency Outliers exist.

Attachment 6B

Quarterly Water Testing Results

TEST REPORT

CLIENT: P.F. FORMATION - MAROOTA

FILE No: 250/09

ADDRESS: 1774 Wisemans Ferry Road Maroota, NSW 2756

PROJECT: Testing of Water Samples from P.F. Formation - Maroota

TEST PROCEDURES:

APHA 4500 H⁺ B 21st Ed. - pH Value

APHA 2540 D 21st Ed. - Total Suspended Solids Dried at 103-105°C

APHA 2130 B 21st Ed. - Turbidity

APHA 2510 B 21st Ed. - Conductivity

APHA 5520 C 21st Ed. - Oil & Grease by Infra Red

Laboratory Sample No: 95984

Date Sampled: 4.09.09

Sample Description: Water -
Downstream Lot 198 -
12:30pm

Field No: 1

TEST RESULTS

pH	4.9
Total Suspended Solids (mg/L)	5.2
Turbidity (NTU)	4.4
Conductivity (µs/cm)	201
Oil & Grease (mg/L) *	<1

Sample analysed as received.

NOTE: * Solvent used in the determination of Solvent Extractable Matter for Oil & Grease analysis: Polychlorotrifluoroethylene (S316)

J.Graham, File

JUSTIN DOWSE

Approved Signatory

Date

9/09/09

Serial No.

80413

MATERIALS TECHNICAL SERVICES
BORAL RESOURCES (NSW) PTY LTD
ABN 51 000 756 507Unit 4, 3-5 Gibbon Road
Baulkham Hills NSW 2153 Australia
PO Box 400, Winston Hills NSW 2153
Telephone 61 2 9624 9900
Facsimile 61 2 9624 9999**Test Report**

CLIENT: P.F. FORMATION - MAROOTA

FILE No.: 250/09

PROJECT: Testing of Water Samples from P.F. Formation - Maroota

REQUEST No.: 36420

TEST PROCEDURE: APHA 4500 H+B – pH Value
APHA 2130 B - Turbidity
APHA 5520 C – Oil & Grease by Infra Red
APHA 4500 D - Total Suspended Solid Dried at 103-105 °C
APHA 2510 B – Conductivity

Laboratory Sample No.: 98680
Date Sampled: 1.12.09
Date Received: 2.12.09
Sample Description: Water -
Downstream -
Lot 198 -
10:00am
Field No.: 1

TEST RESULTS

pH 4.1
Turbidity (NTU) 3.9
Oil & Grease (mg/L) * <1
Total Suspended Solid (mg/L) 2.7
Conductivity (µm/cm) 222

Samples submitted by the Client.

NOTE: * Solvent used in the determination of Solvent Extractable Matter for Oil & Grease analysis:
Polychlorotrifluoroethylene (S316)

J. Graham, File.

Approved Signatory Name of Signatory: Justin Dowse
Date 7/12/09 Serial No. 82525

MATERIALS TECHNICAL SERVICES
BORAL RESOURCES (NSW) PTY LTD
ABN 51 000 756 507Unit 4, 3-5 Gibbon Road
Baulkham Hills NSW 2153 Australia
PO Box 400, Winston Hills NSW 2153
Telephone 61 2 9624 9900
Facsimile 61 2 9624 9999**Test Report**

CLIENT: P.F.FORMATION

FILE No.: 250/10

ADDRESS: 1774 WISEMANN'S FERRY ROAD, MAROOTA, NSW 2756

PROJECT: Testing of Water Samples from P.F. Formation

REQUEST No.: 37086

TEST PROCEDURE: APHA 4500 H⁺B - pH Value
APHA 2130 B - Turbidity
APHA 5520 C - Oil & Grease by Infra Red
APHA 4500 D - Total Suspended Solid Dried at 103-105 °C
APHA 2510 B - Conductivity

Laboratory Sample No.: 100440
Date Sampled: 4.02.10
Date Received: 5.02.10
Sample Description: Water -
Downstream -
Lot 198 -
11:00am
Field No.: 1

TEST RESULTS

pH	4.7
Turbidity (NTU)	95
Oil & Grease (mg/L)	<1
Total Suspended Solid (mg/L)	77.6
Conductivity (µm/cm)	180

Samples submitted by the Client.

NOTE: * Solvent used in the determination of Solvent Extractable Matter for Oil & Grease analysis:
Polychlorotrifluoroethylene (S316)

J. Graham, File.

JUSTIN DOWSE

Approved Signatory

Date

17/02/10

Serial No.

84117

ACCREDITED FOR
TECHNICAL
COMPETENCE

This document is issued in accordance with NATA's accreditation requirements.
Accredited for compliance with ISO/IEC 17025

NATA Accredited Laboratory
Number: 9968

MATERIALS TECHNICAL SERVICES
BORAL RESOURCES (NSW) PTY LTD
ABN 51 000 756 507Unit 4, 3-5 Gibbon Road
Baulkham Hills NSW 2153 Australia
PO Box 400, Winston Hills NSW 2153
Telephone 61 2 9624 9900
Facsimile 61 2 9624 9999**Test Report**

CLIENT: P.F.FORMATION

FILE No.: 250/10

ADDRESS: 1774 WISEMANN'S FERRY ROAD, MAROOTA, NSW 2756

PROJECT: Testing of Water Samples from P.F. Formation

REQUEST No.: 38721

TEST PROCEDURE: APHA 4500 H⁺B - pH Value
APHA 2130 B - Turbidity
APHA 5520 C - Oil & Grease by Infra Red
APHA 4500 D - Total Suspended Solid Dried at 103-105 °C
APHA 2510 B - Conductivity

Laboratory Sample No.: 104747
Date Sampled: 7.06.10
Date Received: 7.06.10
Sample Description: Water -
Downstream -
Lot 198 -
9:00am

Field No.: 1

TEST RESULTS

pH	4.8
Turbidity (NTU)	24
Oil & Grease (mg/L)	<1
Total Suspended Solid (mg/L)	11.0
Conductivity (µm/cm)	196

Samples submitted by the Client.

NOTE: * Solvent used in the determination of Solvent Extractable Matter for Oil & Grease analysis:
Polychlorotrifluoroethylene (S316)

J. Graham, File.

JUSTIN DOWSE

Approved Signatory

Date 21/06/10

Serial No.

87 2 9 5

ACCREDITED FOR
TECHNICAL
COMPETENCE

This document is issued in accordance with NATA's accreditation requirements.
Accredited for compliance with ISO/IEC 17025

NATA Accredited Laboratory
Number: 9968

Attachment 7A

Monitoring of Revegetation

Monitoring of revegetation at Hitchcock Road, Maroota

August 2010

PF Formation



*Parsons Brinckerhoff Australia Pty Limited
ABN 80 078 004 798*

*Level 27, Ernst & Young Centre
680 George Street
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Executive summary

Expansion of PF Formation's existing sand mine at Hitchcock Road required clearing of 3.7 hectares of Sydney Hinterland Transition Woodland. It was proposed to offset this clearing with revegetation and re-creation of this community within a 7.9 hectare area on the western boundary of the site where mining has been completed. To date an area of 3 hectares has been replanted. The objectives of revegetation within the Hitchcock Road site are to:

- rehabilitate and revegetate quarried areas
- revegetate with native vegetation characteristic of the community to be removed from adjacent to the trig reserve, namely Sydney Hinterland Transition Woodland
- re-create the existing characteristics of this community, to provide an area suitable for offsetting the clearing of this community at that time.

The Department of Planning has requested that the success of this revegetation be monitored regularly and assessed against defined criteria (five, ten and fifteen year targets) to provide some certainty that this revegetation will ultimately result in the creation of a naturally regenerating patch of Sydney Hinterland Transition Woodland. Monitoring of the rehabilitation of previously mined areas is required as part of annual environmental reporting.

This report aims to:

- present the results of the monitoring survey
- analyse the results against the criteria for monitoring the success of rehabilitation and progress towards five year targets
- provide recommendations on management actions required to assist in successful re-creation of Sydney Hinterland Transition Woodland within the site and to meet the long-term goals.

A site inspection was undertaken on 5 July 2010. Four fixed quadrats (20 x 20 metres) were set up, one within the 2004 and three within the 2006 revegetation area. Within each quadrat, every species of plant present was recorded and its cover abundance estimated.

In general the revegetation areas appear to be regenerating well:

- the 2004 revegetation area met all targets except that the shrub cover was lower than the target set
- although the results from the 2006 revegetation area were variable, it should be noted that it is not yet five years since this area was revegetated. Results to date indicate that:
 - vegetation height targets were met including canopy and ground cover height and cover targets
 - natural regeneration was observed
 - native species diversity and characteristic species diversity is below target values and shrub cover too sparse and shrub and canopy not present in some areas.

Despite some good regeneration, some measures to improve the revegetation were identified. Recommendations include:

- Review proposed planting list for appropriateness, restricting species to those characteristic to Sydney Hinterland Transition Woodland or occurring within the trig reserve.
- Undertake supplementary planting in the 2006 revegetation area. This should focus on shrub species and *Eucalyptus* spp. where canopy species are absent.
- Ensure that any supplementary planting or new rehabilitation areas are planted haphazardly rather than in rows.
- Consider spraying exotic grasses where they occur densely.
- Implement erosion control measures. This could include additional planting.
- Undertake monitoring of the site in two years time.
- Keep records of all management actions (including revegetation, erosion control, rehabilitation and weeding) undertaken along with any subsequent outcomes observed during monitoring.
- Develop a revegetation plan for future areas to be revegetated. This should take into consideration the successful methods used to date and recommendations for improvement.

1. Introduction

This report presents the findings of monitoring of a rehabilitation area within the sandmining operations at Hitchcock Road, Maroota.

1.1 Background

Expansion of an existing PF Formation sand mine at Hitchcock Road required clearing of 3.7 hectares of Sydney Hinterland Transition Woodland. It was proposed to offset this clearing with revegetation and re-creation of this community within a 7.9 hectare area on the western boundary of the site where quarrying has been completed. To date an area of 3 hectares has been replanted (approximately 1 hectares in 2004 and 2 hectares in 2006) with the aim to recreate the vegetation to be removed near the former trig reserve (see Appendix A for more detail).

The Department of Planning has requested that the success of this revegetation be monitored regularly and assessed against defined criteria to provide some certainty that this revegetation will ultimately result in the creation of a naturally regenerating patch of Sydney Hinterland Transition Woodland.

Monitoring of the rehabilitation of previously mined areas is required as part of annual environmental reporting. This monitoring needs to be undertaken annually by independent consultants (not those undertaking the revegetation works), including assessment against the success criteria developed for rehabilitation within the site, as included in the consent conditions for the project.

1.2 Objectives of revegetation

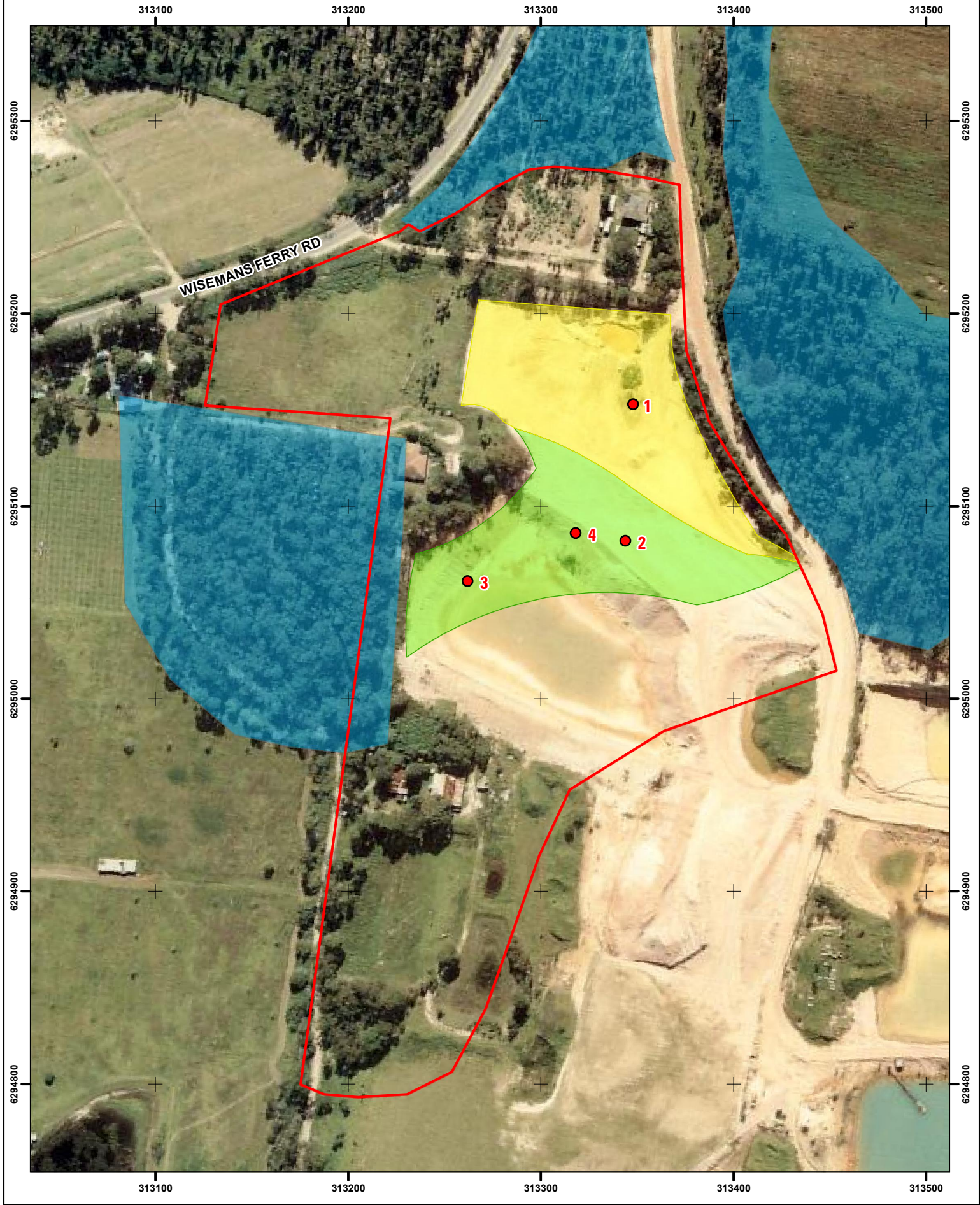
The objectives of revegetation within the Hitchcock Road site are to:

- rehabilitate and revegetate quarried areas
- revegetate with native vegetation characteristic of the community to be removed from adjacent to the trig reserve, namely Sydney Hinterland Transition Woodland
- re-create the existing characteristics of this community, to provide an area suitable for offsetting the clearing of this community at that time.

1.3 Aims of report

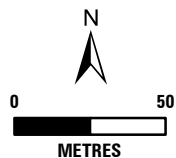
The aims of this report are to:

- present the results of the monitoring survey
- analyse the results against the criteria for monitoring the success of rehabilitation and progress towards five year target (Table 2-2)
- provide recommendations on management actions required to assist in successful re-creation of Sydney Hinterland Transition Woodland within the site and to meet the long-term goals.



- Quadrats
- ▭ Future proposed revegetation area
- ▭ 2004 revegetation area
- ▭ 2006 revegetation area
- ▭ Sydney Hinterland Transition Woodland

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Title: Revegetation areas & survey sites	
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Client:	PF Formation
Proj. No.	2162329A
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2. Methodology

2.1 Nomenclature

Names of plants used in this document follow Harden (Harden 1992, 1993, 2000, 2002) with updates from PlantNet (Royal Botanic Gardens 2010) and the Australian Plant Census (Council of Heads of Australasian Herbaria 2010). Scientific names are used in this report for species of plant. Scientific and common names (where available) are provided in plant lists in Appendices A and B. Introduced species are identified within the text with an asterisk following the name, for example *Lantana camara**

2.2 Field survey

A site inspection was undertaken on 5 July 2010. Fixed quadrats (20 x 20 m) were set up with edges running in a north-south, east west direction. Quadrats were marked with stakes at the north western and south western corners of the quadrat.

Within each quadrat, every species of plant present was recorded and its cover abundance estimated using a modified braun blanquet scale:

1. <5%- rare or few individuals
2. <5% common
3. 5-25%
4. 25-50%
5. 50-75%
6. 75-100%

Additional information recorded at each quadrat site included:

- centre and south western corner of quadrat using GPS
- slope and aspect,
- landform
- soil type
- evidence of disturbance, condition
- evidence of canopy recruitment, natural regeneration
- fauna habitat values
- photographs from the south western corner of the quadrat (to the north, north east, east, south and west).

The location of quadrats is summarised in Table 2-1.

Table 2-1 Quadrat survey locations

Stratification	Quadrat identifier	Centre of site ¹		South West corner ²	
		Easting	Northing	Easting	Northing
2004 rehabilitation area	1	313348	6295163	313335	6295148
2006 rehabilitation area	2	313343	6295082	313333	6295087
	3	313262	6295061	313253	6295059
	4	313318	6295086	313306	6295077

Notes:

1) UTM, WGS 84

2) Location of photopoint and stake marking the south western corner of quadrat

2.3 Criteria to assess rehabilitation success

Field surveys were undertaken in 2008 of the vegetation to be cleared to provide data on the typical characteristics of the community provide baseline information against which the revegetation program can be assessed (Parsons Brinckerhoff 2008).

The criteria for assessment and the target values for these goals are provided in Table 2-2 on the following page.

Table 2-2 Criteria to monitor success of revegetation

Category	Criteria	Target			Condition of vegetation to be removed
		5 years	10 years	15 years	
Native species	Native species diversity (average number per 400 m ² quadrat)	20	35	40	46
	Average number of characteristic species for the site occurring within 400 m ²	15	20	27	34.5 (+/- 1.5)
	Native species cover (% of species in 400 m ² quadrat)	>50	>85	>95	99
Weeds	Weed abundance (% of vegetation cover in 400 m ² quadrat)	<50	<15	<5	<1
	Invasive or Noxious weed species (e.g. Lantana, Blackberry, exotic vines)	Controlled	Controlled	Controlled	Restricted
Vegetation structure	Vegetation structure	Canopy, shrublayer and groundcover species present. However, structure limited, generally consisting of low canopy and ground cover.	Canopy, shrublayer and groundcover species present. Structure beginning to develop.	Well structured and includes canopy, mid-storey and ground cover units	Well structured and includes canopy, mid-storey and ground cover units
Canopy ^a	Average canopy height (m)	4	8	12	12-16
	Native canopy cover (minimum % cover) [modified braun blanquet scale] ^b	5 [3]	5 [3]	5 [3]	5 [3]
Shrub layer ^a	Native shrub cover (minimum % cover) [modified braun blanquet scale] ^b	10 [3]	15 [3]	25 [4]	32.5 (+/-7.5) [4]
	Average shrub layer height (m)	0.5	1	1	1.25
Ground cover	Native ground cover (minimum % cover) [modified braun blanquet scale] ^b	5 [3]	10 [3]	10 [3]	15 (+/-5) [3]

Category	Criteria	Target			Condition of vegetation to be removed
		5 years	10 years	15 years	
Ecosystem function	Habitat values	Vegetation structure beginning to develop.	Woodland birds recorded. Habitat structure beginning to develop, including groundcover such as leaf litter and fallen timber.	Woodland birds recorded. Habitat structure beginning to develop, including groundcover such as leaf litter and fallen timber.	Provides minimal habitat for fauna, however, many woodland birds present. Well structured habitat, includes moderate levels of leaf litter and fallen timber.
	Natural regeneration indicating dispersal of seed into site and/or presence of soil seed bank	Yes	Yes	Yes	Yes
Native species	Native species diversity (average number per 400m ² quadrat)	20	35	40	46
	Average number of characteristic species for the site occurring within 400m ²	15	20	27	34.5 (+/- 1.5)
	Native species cover (% of species in 400m ² quadrat)	>50	>85	>95	99
Weeds	Weed abundance (% of vegetation cover in 400m ² quadrat)	<50	<15	<5	<1
	Invasive or Noxious weed species (e.g. Lantana, Blackberry, exotic vines)	Controlled	Controlled	Controlled	Restricted
Vegetation structure	Vegetation structure	Canopy, shrublayer and groundcover species present. However, structure limited, generally consisting of low canopy and ground cover.	Canopy, shrublayer and groundcover species present. Structure beginning to develop.	Well structured and includes canopy, mid-storey and ground cover units	Well structured and includes canopy, mid-storey and ground cover units
Canopy ^a	Average canopy height (m)	4	8	12	12-16
	Native canopy cover (minimum % cover) [modified braun blanquet scale] ^b	5 [3]	5 [3]	5 [3]	5 [3]

Category	Criteria	Target			Condition of vegetation to be removed
		5 years	10 years	15 years	
Shrub layer ^a	Native shrub cover (minimum % cover)	10	15	25	32.5 (+/-7.5)
	[modified braun blanquet scale] ^b	[3]	[3]	[4]	[4]
	Average shrub layer height (m)	0.5	1	1	1.25
Ground cover	Native ground cover (minimum % cover)	5	10	10	15 (+/-5)
	[modified braun blanquet scale] ^b	[3]	[3]	[3]	[3]
Ecosystem function	Habitat values	Vegetation structure beginning to develop.	Woodland birds recorded. Habitat structure beginning to develop, including groundcover such as leaf litter and fallen timber.	Woodland birds recorded. Habitat structure beginning to develop, including groundcover such as leaf litter and fallen timber.	Provides minimal habitat for fauna, however, many woodland birds present. Well structured habitat, includes moderate levels of leaf litter and fallen timber.
	Natural regeneration indicating dispersal of seed into site and/or presence of soil seed bank	Yes	Yes	Yes	Yes

Notes:

a) cover of canopy species and shrubs may be higher initially due to successional changes with dense growth potentially occurring initially particularly due to the presence of colonising species.
Natural thinning is expected as colonising species senesce and canopy species mature, however, some thinning of vegetation may be required after 10 years if too dense.

b) Modified braun blanquet scale:

1. <5%- rare or few individuals
2. <5% common
3. 6-25%
4. 26-50%
5. 51-75%
6. 76-100%

3. Results

Photos of the vegetation within the former trig reserve and the rehabilitation area quadrat sites are provided in Appendix B. Species recorded, vegetation structure and other environmental characteristics of the quadrat sites are summarised in Appendix C.

3.1 Species of plant

A total of 74 species of plant was recorded within the site of which 60 (81%) are native. A full list of species recorded within each quadrat and the vegetation structure and is provided in Appendix C.

Fourteen introduced species were recorded within the rehabilitation area. One of these is listed as noxious under the *Noxious Weeds Act 1993* within the Hawkesbury River County Council noxious weed control area (includes Baulkham Hills Local Government Area): *Ageratina adenophora** (Crofton Weed) has a noxious weed rating of 4 meaning that the growth and spread of the plant must be controlled according to the measures specified in a management plan published by the local control authority. These are:

- Mechanical control: small areas can be dug out by hand; crowns must be removed to prevent re-growth. Heavy infestations can be controlled by regular slashing to prevent the plant from flowering.
- Chemical control- herbicide applications are most effective during late summer and autumn. Roundup®, Brushoff®, Tordon 75-D® and Banvel M® are registered for the control of crofton weed. Directions provided on herbicide label (Hawkesbury River County Council undated).

No Weed of National Significance was recorded.

3.2 Assessment against criteria

The results of the field survey were assessed against the criteria for successful revegetation, using the five year target (Table 3-1).

Generally, the targets were met for the 2004 revegetation area, except that the shrub cover was too sparse.

The results for the 2006 revegetation area were variable. Although vegetation height targets were met and canopy and ground cover targets were met and natural regeneration observed, native species diversity and characteristic species diversity is below target values and shrub cover too sparse and shrub and canopy not present in some areas.

Table 3-1 Criteria to monitor success of revegetation

Category	Criteria	Five year target	2004 revegetation area	2006 revegetation area
Native species	Native species diversity (average number per 400 m ² quadrat)	20	28	17
	Average number of characteristic species for the site occurring within 400 m ²	15	17	13
	Native species cover (% of species in quadrat that are native)	>50	88%	73%
Weeds	Weed abundance (% of vegetation cover in 400m ² quadrat)	<50	10	Variable (5-72%) Generally low, however high in patches.
	Invasive or Noxious weed species (e.g. Lantana, Blackberry, exotic vines)	Controlled	Controlled	Controlled
Vegetation structure	Vegetation structure	Canopy, shrublayer and groundcover species present. However, structure limited, generally consisting of low canopy and ground cover.	Yes	Generally true, however, some patches lack a canopy, shrub layer sparse to absent in patches
Canopy ^a	Average canopy height (m)	4	8	4.5
	Native canopy cover (minimum % cover) [modified braun blanquet scale] ^a	5 [3]	30 [4]	7 [3]
Shrub layer ^a	Native shrub cover (minimum % cover) [modified braun blanquet scale] ^a	10 [3]	2 [2]	3 [2]
	Average shrub layer height (m)	0.5	1.5m	1.6
Ground cover	Native ground cover (minimum % cover) [modified braun blanquet scale] ^a	5 [3]	23 [4]	39 [4]
	Natural regeneration indicating dispersal of seed into site and/or presence of soil seed bank	Yes	Yes	Yes (except in small localised areas)

Notes: green font indicates that target has been met or exceeded; red font indicates target hasn't been met.

4. Discussion and recommendations

In general the rehabilitation areas appear to be regenerating well:

- the 2004 revegetation area met all targets except that the shrub cover was lower than the target set
- although the results for the 2006 revegetation area were variable, it should be noted that it is not yet five years since this area was revegetated. To date indicate that:
 - vegetation height targets were met including canopy and ground cover height and cover targets
 - natural regeneration observed
 - native species diversity and characteristic species diversity is below target values and shrub cover too sparse and shrub and canopy not present in some areas.

Despite some good regeneration, some areas for improvement were identified and are summarised in **Error! Reference source not found.**

Table 4-1 Observations of the rehabilitation and recommendations to improve success

Observation	Recommendation
Native species- composition and diversity	
A number of species planted within the site have not been previously recorded within the Trig reserve or within Sydney Hinterland Transition Woodland.	Review proposed planting list for appropriateness, restricting species to those characteristic to Sydney Hinterland Transition Woodland or occurring within the trig reserve.
Native species diversity and number of characteristic species within 2006 revegetation area was below target	Supplementary planting should be undertaken in a haphazard pattern. This should focus on shrub species and <i>Eucalyptus</i> spp. where canopy species are absent. Plantings should be of species characteristic of Sydney Hinterland Transition Woodland. See Appendix C for suitable species.
<i>Natural regeneration</i> - was observed to be occurring within the site, both as seed dispersed into the site or from a seed bank as well as recruitment from the seed of plantings	None.
Weeds	
Weed abundance was generally low and restricted to the groundcover. Exotic grasses were dominant in patches.	Consider spraying exotic grasses where they occur densely.

Observation	Recommendation
Vegetation structure- Canopy, shrub layer and groundcover	
Plantings were generally done in rows, with a single or limited number of species planted for a section of the row or grid. Although some natural regeneration was noted outside the planted grid pattern, this method of planting has resulted in an artificial structure and patchy distribution of species.	Ensure that any supplementary planting or new rehabilitation areas are planted haphazardly rather than in rows.
<i>Canopy</i> growth was generally good with height and cover targets met overall. However, due to planting of single or limited number of species in an area, some areas lacked canopy species.	Supplementary planting should be undertaken in a haphazard pattern in areas lacking canopy species (i.e. lacking <i>Eucalyptus</i> spp., or <i>Syncarpia glomulifera</i>).
<i>Shrub layer</i> - Although the shrublayer height met the target, the shrublayer was sparse and did not meet the five year target for cover (% foliage cover).	Undertake supplementary planting of suitable shrub species, in a haphazard pattern.
<i>Groundcover</i> : generally good native cover.	Consider spraying exotic grasses where they occur densely.
Erosion	
Some erosion was observed within the 2006 revegetation area	Implement erosion control measures. This could include additional planting.
Monitoring and record keeping	
Monitoring has not been undertaken annually as recommended. However, based on the limited work undertaken and natural regeneration of the area, this has been appropriate.	Given that additional management of the site is unlikely to occur until next autumn and the rehabilitation is generally on target, monitoring next year is not considered necessary. Monitoring in two years time would be sufficient.
<i>Record keeping</i> of works done to date has been neglected.	Records of all management actions (including revegetation, erosion control, rehabilitation and weeding) undertaken are kept along with any subsequent outcomes observed during monitoring. This should include: <ul style="list-style-type: none"> • details of the area worked • the type of work carried out • any problems encountered • recommendations for changes in management.

Observation	Recommendation
Revegetation planning	
Revegetation has been undertaken with little documented planning	<p>A revegetation plan is developed for future areas to be revegetated. This should take into consideration the successful methods used to date and recommendations for improvement. The plan should outline the revegetation strategy for the site, including:</p> <ul style="list-style-type: none"> • identification of areas to be revegetated • topsoil storage requirements and methods of use • site preparation methods • techniques for planting including timing, use of mulch and watering • species to be used in future planting to ensure that ground cover and shrub layer species are represented • weed control methods • erosion control methods.

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Appendix A

Revegetation works to date

Revegetation works to date

To date an area of 3 hectares has been replanted with the aim to recreate the vegetation to be removed near the former trig reserve. The revegetation area is on the western boundary of the site (Figure 1-1) and further revegetation scheduled to the south as quarrying is completed. The revegetation area occurs adjacent to remnant vegetation, both within and adjacent to the site. This adjacent vegetation provides a potential seed source for natural seed dispersal into the revegetation area.

Greening Australia were commissioned to propagate tubestock from cuttings and seed from collected vegetation within the former trig reserve of the quarry to enable the revegetation of quarried areas. The first collection period occurred from late 2000 to February 2002.

Rehabilitation and revegetation has commenced with further revegetation scheduled to the south as quarrying is completed. In 2004 over one hectare of the quarry that had been previously extracted and used as a silt pond was reshaped and prepared for rehabilitation by PF Formation staff. The top soil had been stored from an adjacent area with Sydney Hinterland Transition Woodland and was spread over the site. Further seed collected over the previous 4 years was broadcast over the site in June 2004 to augment the natural soil borne native seed bank.

In 2006 an additional area of approximately two hectares that had been previously mined was prepared for revegetation. The stored top soil was distributed over the site. Greening Australia then provided over 10,000 seedlings and supervised the planting in September to November 2006 (Photo 1). An irrigation system was installed to water the plantings over that summer.

Following planting of the site, regular visual assessments of the site have been undertaken but manual weed removal has been minimal and no poisoning has been used. Observations of the establishment of revegetation within the site, suggest that weeds initially took over the site, providing soil stability but within 12 months native plants stabilized. The native plants start growing rapidly 1 to 2 years following planting and the weeds begin to die off (pers comm. P Cummins, PF Formation).

Top soil including seed bank has been stored for the next revegetation area, adjoining existing vegetated areas and the 2006 revegetated areas.



Photo 1 Revegetation works in 2006 showing planting into topsoil. Foreground area was planted in 2004

Appendix B

Photos

Vegetation within former trig site (2008)



Quadrat 1- 2004 rehabilitation area

North



East



North East- into centre of quadrat



South



West



Quadrat 2- 2006 rehabilitation

North



East



North East- into quadrat



South



West



Quadrat 3 - 2006 rehabilitation

North



East



North East- into quadrat



South



West



Quadrat 4 - 2006 rehabilitation

North



East



North East- into quadrat



South



West



Appendix C

Quadrat results

Table C. 1 **Vegetation structure**

Vegetation layer	Height: range (median) m	% foliage cover	Dominant species
Quadrat 1			
T1	4-10 (8)	30	<i>Acacia parramattensis</i> , <i>Allocasuarina littoralis</i> , <i>Eucalyptus oblonga</i> , <i>Angophora costata</i> , <i>Eucalyptus ?saligna</i>
S1	0.8-2 (1.5)	10	<i>Daviesia?</i> , <i>Acacia parramattensis</i> , <i>Allocasuarina littoralis</i> , <i>Eucalyptus spp.</i>
G1	0-0.6 (0.3)	30	<i>Entolasia stricta</i> , <i>Hypochaeris radicata</i> , <i>Paspalum dilatatum</i> , <i>Lomandra longifolia</i>
Notes:	Few weeds, good regeneration. Thin layer of leaf litter and some dead grass; No weedy shrubs, weeds present only in groundcover layer; good soil health- lots of mushrooms, soil lichens and moss; fauna habitat poor- no hollows or timber, limited groundcover, leaf litter developing; lots of birds present.		
Quadrat 2			
T1	4-8 (5)	10	<i>Acacia parramattensis</i> , <i>Angophora costata</i>
S1	1-3 (2)	10	<i>Syncarpia glomulifera</i> , <i>Hakea dactyloides</i> , <i>Hakea sericea</i>
G1	0-0.8 (0.3)	90	<i>Kikuyu</i> , <i>Senecio madagascariensis</i> , <i>Themeda australis</i> , <i>Andropogon virginicus</i> , <i>Paspalum dilatatum</i>
Notes:	Weeds dominating the groundcover; lots of native seedlings, especially of <i>Hakea sericea</i> , Poor soil health- no cryptograms or fungi; <i>Themeda australis</i> dominant in patches; poor fauna habitat - no hollows or timber, grass is dense		
Quadrat 3			
T1	2.5-5 (4)	10	<i>Acacia linifolia</i> , <i>Eucalyptus eugenioides</i> , <i>Allocasuarina littoralis</i>
S1	1-1.5 (1.2)	20	<i>Leptospermum trinervium</i> , <i>Eucalyptus eugenioides</i> , <i>Allocasuarina littoralis</i> , <i>Acacia brownii</i>
G1	0-0.8 (0.5)	80	<i>Eragrostis brownii</i> , <i>Entolasia stricta</i> , <i>Themeda australis</i> , <i>Andropogon virginicus</i> , <i>Lomandra longifolia</i>
Notes:	Few weeds, only occasional introduced grass; good regeneration of natives including seedlings from seedbank and mature plantings; good soil health- soil lichens and moss common; fauna habitat poor- no hollows or timber, sparse understory, limited leaf litter.		
Quadrat 4			
T1	-	-	-
S1	1-3 (1.6)	8	<i>Banksia ericifolia</i> , <i>Acacia spp.</i> , <i>Leptospermum trinervium</i>
G1	0-0.8 (0.2)	60	<i>Kikuyu</i> , <i>Themeda australis</i> , <i>Hypochaeris radicata</i> , <i>Andropogon virginicus</i>
Notes:	Some erosion evident; no eucalypts present; single species planted in rows; poor recruitment; fauna habitat poor- no hollows or timber, limited groundcover and leaf litter		

Notes: T1= Tree layer; S1= Shrub layer; G1=Groundcover

Table C. 2

Groundcover, vegetation cover, slope and aspect

Characteristic	Quadrat			
	1	2	3	4
Ground cover (% cover)				
Bare soil	5	6	13	33
Litter	57	2	5	0
Timber	1	0	0	0
Rock	5	2	1	5
Cryptogram	2	0	1	2
Vegetation	30	90	80	60
Ground cover vegetation (% cover)				
Native ground cover- grasses	20	15	70	25
Native ground cover- shrubs	2	2	5	2
Native ground cover- other	1	1	0	2
Exotic	7	72	5	30
Vegetation cover (% cover)				
Total native groundcover	23	18	75	24
Native overstorey	30	10	10	0
Native midstorey	10	10	20	8
Exotic cover (all layers)	10	72	5	30
Slope (degrees)	3	6	8	6
Aspect	S	S	SE	SE

Table C. 3 Species recorded

Scientific name	Common name	Exotic	Recorded within trig reserve	Species of Sydney Hinterland transition woodland	Quadrat			
					1	2	3	4
<i>Acacia brownii</i>	Heath Wattle			Y			2	2
<i>Acacia decurrens</i>	Black Wattle							
<i>Acacia falcata</i>				Y	1			
<i>Acacia fimbriata</i>	Fringed Wattle						3	1
<i>Acacia hispidula</i>				Y				
<i>Acacia linifolia</i>	Flax-leaved Wattle		Y	Y	1		1	
<i>Acacia longifolia</i>				Y				
<i>Acacia myrtifolia</i>	Red-stemmed Wattle		Y	Y	1			
<i>Acacia parramattensis</i>	Parramatta Wattle		Y	Y	4	3		
<i>Acacia parvipinnula</i>				Y				
<i>Acacia saligna</i>	Golden Wreath Wattle	*						
<i>Acacia suaveolens</i>	Sweet Wattle		Y	Y				1
<i>Acacia terminalis</i>	Sunshine Wattle		Y	Y	1	1	1	1
<i>Acacia trinervata</i>				Y				
<i>Acacia ulicifolia</i>	Heath Wattle		Y	Y			2	
<i>Acianthus fornicatus</i>	Pixie Caps		Y	Y				
<i>Actinotus helianthi</i>				Y				
<i>Ageratina adenophora</i>	Crofton Weed	*	Y					
<i>Allocasuarina littoralis</i>	Black Sheoak		Y	Y	4		3	2
<i>Allocasuarina torulosa</i>								
<i>Andropogon virginicus</i>	Whisky Grass	*				2	2	2
<i>Angophora bakeri</i>	Narrow-leaved Apple		Y	Y				
<i>Angophora costata</i>	Sydney Red Gum		Y	Y	2	3	2	
<i>Anisopogon avenaceus</i>				Y				
<i>Araujia sericifera</i>	Moth Vine	*	Y					

Scientific name	Common name	Exotic	Recorded within trig reserve	Species of Sydney Hinterland transition woodland	Quadrat			
					1	2	3	4
<i>Aristida benthamii</i>				Y				
<i>Aristida vagans</i>	Threeawn Speargrass		Y	Y				
<i>Aristida warburgii</i>				Y				
<i>Astroloma humifusum</i>				Y				
<i>Astroloma pinifolium</i>				Y				
<i>Austrodanthonia fulva</i>				Y				
<i>Austrodanthonia tenuior</i>				Y				
<i>Austrostipa pubescens</i>			Y	Y				
<i>Banksia ericifolia</i>	Heath Banksia							2
<i>Banksia integrifolia</i>								2
<i>Banksia oblongifolia</i>						2		1
<i>Banksia spinulosa</i> var. <i>spinulosa</i>				Y				
<i>Billardiera scandens</i>	Appleberry		Y	Y				
<i>Boronia polygalifolia</i>			Y					
<i>Bossiaea lenticularis</i>			Y	Y				
<i>Bossiaea lenticularis</i>					1			
<i>Bossiaea obcordata</i>			Y	Y				
<i>Bossiaea rhombifolia</i> subsp. <i>rhombifolia</i>				Y				
<i>Breynia oblongifolia</i>	Coffee Bush		Y					
<i>Brunoniella pumilio</i>	Dwarf Blue Trumpet		Y	Y	1			
<i>Bursaria spinosa</i>	Native Blackthorn							
<i>Caesia parviflora</i>				Y				
<i>Callistemon linearis</i>				Y				
<i>Callistemon rigidus</i>				Y				
<i>Cassytha glabella</i>				Y				

Scientific name	Common name	Exotic	Recorded within trig reserve	Species of Sydney Hinterland transition woodland	Quadrat			
					1	2	3	4
<i>Cassytha pubescens</i>				Y				
<i>Caustis flexuosa</i>				Y				
<i>Ceratopetalum apetalum</i>	Coachwood		Y					
<i>Cheilanthes sieberi</i>				Y				
<i>Clematis aristata</i>			Y					
<i>Comesperma ericinum</i>	Pyramid flower		Y					
<i>Conyza bonariensis</i>	Flaxleaf Fleabane	*	Y					
<i>Corymbia eximia</i>				Y				
<i>Corymbia gummifera</i>	Red Bloodwood		Y	Y				
<i>Cyathochaeta diandra</i>				Y				
<i>Cynodon dactylon</i>	Common Couch					3		4
<i>Daviesia acicularis</i>				Y				
<i>Daviesia corymbosa</i>				Y	2			
<i>Daviesia genistifolia</i>	Broom Bitter Pea			Y			1	
<i>Daviesia squarrosa</i>				Y				
<i>Dianella caerulea</i>			Y	Y				
<i>Dianella prunina</i>			Y	Y		1		1
<i>Dianella revoluta</i> var. <i>revoluta</i>				Y				
<i>Dillwynia acicularis</i>				Y				
<i>Dillwynia parvifolia</i>				Y				
<i>Dillwynia retorta</i>				Y			1	
<i>Dodonaea pinnata</i>				Y				
<i>Dodonaea triquetra</i>				Y				
<i>Drosera auriculata</i>				Y				
<i>Echinopogon caespitosus</i> var. <i>caespitosus</i>				Y				

Scientific name	Common name	Exotic	Recorded within trig reserve	Species of Sydney Hinterland transition woodland	Quadrat			
					1	2	3	4
<i>Einadia hastata</i>	Berry Saltbush		Y					
<i>Entolasia stricta</i>	Wiry Panic		Y	Y	4		3	
<i>Entolasia whiteana</i>				Y				
<i>Epacris pulchella</i>	NSW Coral Heath			Y				
<i>Epacris purpurascens</i> var. <i>purpurascens</i>				Y				
<i>Eragrostis benthamii</i>				Y				
<i>Eragrostis brownii</i>	Brown's Lovegrass			Y	2		3	
<i>Eriostemon australasius</i>				Y				
<i>Eucalyptus beyeriana</i>				Y				
<i>Eucalyptus crebra</i>				Y				
<i>Eucalyptus eugenioides</i>	Thin-leaved Stringybark		Y	Y			3	
<i>Eucalyptus notabilis</i>				Y				
<i>Eucalyptus oblonga</i>	Stringybark			Y	1			
<i>Eucalyptus pilularis</i>				Y				
<i>Eucalyptus punctata</i>	Grey Gum		Y	Y	1			
<i>Eucalyptus resinifera</i> subsp. <i>resinifera</i>				Y				
<i>Eucalyptus ?saligna</i>					2			
<i>Eucalyptus scias</i> subsp. <i>scias</i>				Y				
<i>Eucalyptus sclerophylla</i>			Y	Y				
<i>Eucalyptus sparsifolia</i>	Narrow-leaved Stringybark		Y	Y				
<i>Eucalyptus squamosa</i>				Y				

Scientific name	Common name	Exotic	Recorded within trig reserve	Species of Sydney Hinterland transition woodland	Quadrat			
					1	2	3	4
<i>Exocarpos cupressiformis</i>	Native Cherry				1			
<i>Exocarpos strictus</i>	Dwarf Cherry		Y	Y				
<i>Glycine clandestina</i>			Y	Y	2			
<i>Glycine tabacina</i>			Y	Y	1			
<i>Gnaphalium</i> sp.						1		1
<i>Gompholobium glabratum</i>	Dainty Wedge Pea		Y	Y				
<i>Gompholobium grandiflorum</i>				Y				
<i>Gompholobium inconspicuum</i>				Y				
<i>Gompholobium minus</i>				Y				
<i>Gompholobium pinnatum</i>				Y				
<i>Gompholobium uncinatum</i>				Y				
<i>Gonocarpus tetragynus</i>				Y				
<i>Gonocarpus teucrioides</i>							1	
<i>Goodenia bellidifolia</i> subsp. <i>bellidifolia</i>			Y	Y				
<i>Goodenia hederacea</i> subsp. <i>hederacea</i>				Y				
<i>Goodenia heterophylla</i>			Y	Y				
<i>Grevillea buxifolia</i> subsp. <i>buxifolia</i>	Grey Spider Flower		Y	Y				
<i>Grevillea diffusa</i>				Y				
<i>Grevillea longifolia</i>				Y				
<i>Grevillea mucronulata</i>				Y				

Scientific name	Common name	Exotic	Recorded within trig reserve	Species of Sydney Hinterland transition woodland	Quadrat			
					1	2	3	4
<i>Grevillea parviflora</i> subsp. <i>parviflora</i>				Y				
<i>Grevillea phyllicoides</i>				Y				
<i>Grevillea sericea</i>				Y				
<i>Grevillea sphacelata</i>				Y				
<i>Haemodorum planifolium</i>				Y				
<i>Hakea dactyloides</i>	Broad-leaved Hakea			Y		2	2	1
<i>Hakea sericea</i>			Y	Y		2	2	2
<i>Hardenbergia violacea</i>	False Sarsaparilla		Y	Y	1			
<i>Hibbertia aspera</i> subsp. <i>aspera</i>				Y				
<i>Hibbertia circumdans</i>					2	1		
<i>Hibbertia bracteata</i>				Y				
<i>Hibbertia diffusa</i>				Y				
<i>Hibbertia serpyllifolia</i>				Y				
<i>Hibbertia</i> sp.							1	
<i>Hovea linearis</i>			Y	Y				
<i>Hybanthus monopetalus</i>				Y				
<i>Hypochaeris radicata</i>	Catsear	*			2	3	2	2
<i>Imperata cylindrica</i> var. <i>major</i>	Bladey Grass		Y	Y			2	
<i>Isopogon anemonifolius</i>				Y				
<i>Jacksonia scoparia</i>				Y				
<i>Juncus</i> sp.			Y					
<i>Kunzea ambigua</i>	Tick Bush			Y			1	

Scientific name	Common name	Exotic	Recorded within trig reserve	Species of Sydney Hinterland transition woodland	Quadrat			
					1	2	3	4
<i>Lagenifera gracilis</i>				Y				
<i>Lambertia formosa</i>	Mountain Devil			Y				
<i>Lasiopetalum ferrugineum</i>				Y				
<i>Lasiopetalum rufum</i>				Y				
<i>Laxmannia gracilis</i>				Y				
<i>Lepidosperma latens</i>				Y				
<i>Lepidosperma laterale</i>			Y	Y	1			
<i>Leptomeria acida</i>				Y				
<i>Leptospermum parvifolium</i>				Y				
<i>Leptospermum trinervium</i>				Y	3			2
<i>Leucopogon juniperinus</i>			Y				2	
<i>Leucopogon lanceolatus</i>	Lance Beard Heath		Y					
<i>Leucopogon muticus</i>				Y				
<i>Leucopogon virgatus</i>				Y				
<i>Lindsaea microphylla</i>				Y				
<i>Lissanthe sapida</i>				Y				
<i>Lissanthe strigosa</i>				Y				
<i>Lobelia gracilis</i>				Y				
<i>Logania pusilla</i>				Y				
<i>Lomandra confertifolia</i> subsp. <i>rubiginosa</i>				Y				
<i>Lomandra cylindrica</i>				Y				

Scientific name	Common name	Exotic	Recorded within trig reserve	Species of Sydney Hinterland transition woodland	Quadrat			
					1	2	3	4
<i>Lomandra filiformis</i> subsp. <i>coriacea</i>				Y				
<i>Lomandra filiformis</i> subsp. <i>filiformis</i>				Y				
<i>Lomandra glauca</i>				Y				
<i>Lomandra gracilis</i>			Y	Y				
<i>Lomandra longifolia</i>	Spiny-headed Mat-rush		Y		2		2	1
<i>Lomandra multiflora</i> subsp. <i>multiflora</i>			Y	Y				
<i>Lomandra obliqua</i>			Y	Y				
<i>Lomatia silaifolia</i>	Crinkle Bush		Y	Y				
<i>Macrozamia spiralis</i>			Y	Y				
<i>Melaleuca nodosa</i>				Y				
<i>Micrantheum ericoides</i>				Y				
<i>Mirbelia rubiifolia</i>				Y				
<i>Monotoca scoparia</i>				Y				
<i>Myrsiphyllum asparagoides</i>	Florist's Smilax	*	Y					
<i>Olearia microphylla</i>				Y				
<i>Opercularia diphylla</i>				Y				
<i>Opercularia varia</i>				Y				
<i>Oxalis perennans</i>					1			
<i>Oxylobium ilicifolium</i>	Prickly Shaggy Pea		Y		1			
<i>Ozothamnus diosmifolius</i>	White Dogwood		Y	Y	1			
<i>Pandorea pandorana</i>	Wonga Vine		Y					

Scientific name	Common name	Exotic	Recorded within trig reserve	Species of Sydney Hinterland transition woodland	Quadrat			
					1	2	3	4
<i>Panicum simile</i>	Two-colour Panic		Y	Y	2			
<i>Paspalum dilatatum</i>	Paspalum	*			2	2		2
<i>Passiflora sp.</i>	Passionfruit		Y					
<i>Patersonia glabrata</i>				Y				
<i>Patersonia longifolia</i>				Y				
<i>Patersonia sericea</i>				Y				
<i>Pennisetum clandestinum</i>	Kikuyu	*			2		2	
<i>Persoonia hirsuta</i>	Hairy Geebung			Y				
<i>Persoonia lanceolata</i>				Y				
<i>Persoonia laurina</i>				Y				
<i>Persoonia levis</i>	Broad-leaved Geebung			Y	1			
<i>Persoonia linearis</i>	Narrow-leaved Geebung		Y	Y				
<i>Persoonia oblongata</i>				Y				
<i>Persoonia pinifolia</i>				Y				
<i>Petrophile pulchella</i>				Y				
<i>Petrophile sessilis</i>				Y				
<i>Philothea hispidula</i>				Y				
<i>Phyllanthus hirtellus</i>				Y				
<i>Pimelea curviflora</i> var. <i>curviflora</i>				Y				
<i>Pimelea linifolia</i> subsp. <i>linifolia</i>				Y				
<i>Pittosporum undulatum</i>	Sweet Pittosporum		Y					
<i>Plantago lanceolata</i>	Lamb's Tongues	*				1	1	

Scientific name	Common name	Exotic	Recorded within trig reserve	Species of Sydney Hinterland transition woodland	Quadrat			
					1	2	3	4
<i>Platysace ericoides</i>				Y				
<i>Platysace lanceolata</i>			Y					
<i>Platysace linearifolia</i>				Y				
<i>Poa labillardierei</i> var. <i>labillardierei</i>			Y					
<i>Podolobium scandens</i>				Y				
<i>Polyscias sambucifolia</i>	Elderberry Panax		Y					
<i>Pomax umbellata</i>			Y	Y				
<i>Poranthera microphylla</i>			Y					
<i>Pratia purpurascens</i>	Whiteroot		Y	Y				
<i>Prostanthera howelliae</i>				Y				
<i>Pteridium esculentum</i>	Bracken		Y					
<i>Pteridium esculentum</i>	Bracken							
<i>Pterostylis acuminata</i>				Y				
<i>Pterostylis longifolia</i>				Y				
<i>Pultenaea ferruginea</i>				Y				
<i>Pultenaea microphylla</i>			Y					
<i>Pultenaea polifolia</i>				Y				
<i>Pultenaea scabra</i>			Y	Y				
<i>Pultenaea tuberculata</i>				Y				
<i>Pultenaea villosa</i>				Y				
<i>Scaevola ramosissima</i>			Y	Y				
<i>Schizaea bifida</i>				Y				

Scientific name	Common name	Exotic	Recorded within trig reserve	Species of Sydney Hinterland transition woodland	Quadrat			
					1	2	3	4
<i>Schoenus imberbis</i>				Y				
<i>Senecio madagascariensis</i>	Fireweed	*				2		2
<i>Setaria gracilis</i>	Slender Pigeon Grass	*						
<i>Sida rhombifolia</i>	Paddy's Lucerne	*	Y		1	1		1
<i>Solanum mauritianum</i>	Wild Tobacco Bush	*	Y					
<i>Solanum nigrum</i>	Black-berry Nightshade	*	Y					
<i>Sonchus oleraceus</i>	Common Sowthistle	*	Y					
<i>Stylidium</i> sp.							1	
<i>Styphelia laeta</i> subsp. <i>laeta</i>				Y				
<i>Syncarpia glomulifera</i> subsp. <i>glomulifera</i>	Turpentine		Y	Y		2	2	1
<i>Thelymitra pauciflora</i>				Y				
<i>Themeda australis</i>	Kangaroo Grass		Y	Y		3	3	3
<i>Thysanotus tuberosus</i> subsp. <i>tuberosus</i>				Y				
<i>Trachymene incisa</i> subsp. <i>incisa</i>				Y				
<i>Tricoryne simplex</i>				Y				
<i>Trifolium</i> sp.		*				2		
<i>Verbena bonariensis</i>	Purpletop	*				1		
<i>Veronica plebeia</i>	Trailing Speedwell		Y					
<i>Vicia sativa</i>		*				2		1
<i>Wahlenbergia stricta</i>	Tall Bluebell							
<i>Xanthorrhoea concava</i>				Y				

Scientific name	Common name	Exotic	Recorded within trig reserve	Species of Sydney Hinterland transition woodland	Quadrat			
					1	2	3	4
<i>Xanthorrhoea media</i>				Y				
<i>Xanthorrhoea minor subsp. minor</i>				Y				
<i>Xanthorrhoea resinifera</i>				Y				
<i>Xanthorrhoea sp.</i>	Grass tree		Y					
<i>Xanthosia pilosa</i>				Y				
<i>Xanthosia tridentata</i>				Y				
<i>Xylomelum pyriforme</i>	Woody Pear		Y	Y				
?Unknown native (rosette)						1		

Notes:

Cover abundance scores:

1. 5%- rare or few individuals
2. <5% common
3. 5-25%
4. 25-50%
5. 50-75%
6. 75-100%

**Community Consultative Committee
Hitchcock Road and Lot 198 Maroota
Sand Extraction and Rehabilitation Projects**

**Minutes
6 November 2009**

Attendance

Kristine McKenzie – Baulkham Hills Shire Council (BHSC) - Chairperson
Robert Buckham – Baulkham Hills Shire Council (BHSC)
Daniel Giffney – Baulkham Hills Shire Council (BHSC)
Marianne Sheumack – Resident
Shaunagh Hitchcock – Resident
David Fingland – DFA Consultants
John Graham – PF Formation
Peter Cummins – PF Formation

Apology

Liz McAuley – Resident
Kane Winwood – Planning NSW
Joshua Graham – PF Formation

Minutes of Previous Meeting

- Accepted

Report on Current Status of Operations by John Graham

- No complaints received in the previous six months
- Operations have continued in a stable manner
- The main extraction area is on the eastern side of the site.
- New steel rubber-lined pipeline is on site and will be installed by Christmas
- The Lot 198 sediment dam will be drained and cleaned out over the Christmas period to increase the storage capacity

Reporting

- The Noise Management Plan, Air Quality Monitoring Program, Water Management Plan and Environmental Strategy incorporating the above have been approved by the Department of Planning and are available for viewing on the website.
- A Landscape Management Plan including a Rehabilitation and Offset Management Plan and Quarry Closure Plan has been drafted and is awaiting approval by PB (PF Formation specialist consultants) and then the Department of Planning. Upon approval it will be placed on the website.
- An Annual Environment Management Report based on the year ending 30 June 2009 and covering both the old and new consent has been submitted and approved by the Department of Planning NSW. This report will be put up on the website in the next couple of weeks. A printed copy was given to Marianne Sheumack to be kept at the Maroota Resource Centre
- An Independent Environment Audit will be undertaken during this year and every three years after that.

Environmental Review

- Results for the dust deposit gauges were reviewed. The low results for September 2009 were surprising given the massive dust storm around the 23 September 2009.
- PM10 results at the school TEOM for the 12 month period to 1 March 2009 were discussed. The results were well within the DECCW goals for PM10 monitoring.
- The approach to noise monitoring has changed as the PF Formation monitoring equipment is broken and is getting repaired. Consultants will conduct testing within the reporting year to assess the noise and recommend future testing methods.

Site Visit

- A full site inspection was conducted.

Next Meeting

- Friday 10.00 am Friday 7 May 2010

**Community Consultative Committee
Hitchcock Road and Lot 198 Maroota
Sand Extraction and Rehabilitation Projects**

**Minutes
17 May 2010**

Attendance

Kristine McKenzie – Baulkham Hills Shire Council (BHSC) - Chairperson
Robert Buckham – Baulkham Hills Shire Council (BHSC)
Daniel Giffney – Baulkham Hills Shire Council (BHSC)
David Gathercole – Department of Environment, Climate Change & Water
Marianne Sheumack – Resident
Shaunagh Hitchcock – Resident
David Fingland – DFA Consultants
John Graham – PF Formation
Peter Cummins – PF Formation
Joshua Graham – PF Formation

Minutes of Previous Meeting

- Accepted

Report on Current Status of Operations by John Graham

- No complaints received in the previous six months
- Operations have continued in a routine manner
- The main project during the period was the de-silting of the main dam on Lot 198. The sediment out of the sand and surface run-off drains through a pre-sediment trap and into the dam below the production area. Capacity was reduced and in January the dam was emptied and cleaned out. A new submersible pump has been installed and is working well to prevent the silt entering the dam.
- The new steel rubber-lined pipeline has been installed.
- Greening Australia were commissioned over two months ago to prepare a plan to rehabilitate a further 1.5 hectares and supplement the area already planted. They are to advise on seeds in stock and recommendations as to how much further seed will have to be collected. Given the delays encountered the planting will probably now occur in autumn 2011.
- Quarterly Safety and Environmental meetings with staff have continued to encourage all staff to take responsibility for environment and rehabilitation matters.

Reporting

- The Noise Management Plan, Air Quality Monitoring Program, Water Management Plan and Environmental Strategy incorporating the above have been approved by the Department of Planning and are available for viewing on the website.
- The third draft of the Landscape Management Plan including a Rehabilitation and Offset Management Plan and Quarry Closure Plan has been sent to the Department of Planning. Upon approval it will be placed on the website.

- An Annual Environment Management Report based on the year ending 30 June 2009 and covering both the old and new consent has been submitted and approved by the Department of Planning NSW. This report is available on the website.
- An Independent Environment Audit will be undertaken during this year and every three years after that. We are awaiting approval from the Department of Planning of the nominated auditor. On receipt of this approval the audit will commence
- The 2010 Annual Environmental Management Report will be prepared during June and July.

Environmental Review

- Results for the dust deposit gauges were reviewed.
- Other environmental reporting was discussed

Other Matters

- Lot 1 DP 595538 (Accursos) has received approval from Hills Shire Council for this small development. The site has been cleared and all extraction should be completed within two years.
- Old Telegraph Road development was acquired in 2009 and the Annual Management Plan is currently being prepared. In conjunction with the annual reporting PF Formation is liaising with Hornsby Shire Council with regard to all the consent conditions.

Site Visit

- A full site inspection including the Lot 1 DP595538 Old Northern Road Maroota site was conducted.

Next Meeting

- Friday 10.00 am Friday 5 November 2010