

PF FORMATION



## HITCHCOCK ROAD SAND EXTRACTION AND REHABILITATION PROJECT, MAROOTA

ANNUAL ENVIRONMENTAL MANAGEMENT REPORT

**2011 - 2012**



# **PF Formation**

**HITCHCOCK ROAD**  
**Sand Extraction and Rehabilitation Project Maroota**

## **ANNUAL ENVIRONMENTAL MANAGEMENT REPORT 2011-2012**

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## Hitchcock Road sand extraction and rehabilitation project

# Annual Environmental Management Report 2011-2012

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Term	Abbreviation
<b>AEMR</b>	Annual Environmental Management Report
<b>AHD</b>	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.
<b>Airshed</b>	Lower atmosphere within a defined geographic area.
<b>Ambient</b>	The background level at a specific location, being a composite of all sources.
<b>Annual Average Daily Traffic</b>	Annual average daily traffic volume representing the total traffic in both directions at a specified location calculated from mechanically obtained axle counts.
<b>Annual Exceedance Probability (AEP)</b>	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.
<b>Aquifer</b>	Geologic formation, group of formations, or part of a formation capable of transmitting and yielding economic quantities of water.
<b>Archaeology</b>	The scientific study of human history, particularly the relics and cultural remains of the distant past.
<b>ARI</b>	Average Recurrence Interval-average or expected period between exceedance of a flood.
<b>Background Noise Level</b>	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.
<b>Batter</b>	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.
<b>Bore</b>	A cylindrical drill hole sunk into the ground from which water is pumped for use or monitoring.
<b>Buffer</b>	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.
<b>Bund Wall</b>	A wall erected to prevent the escape of various emissions into the environment (liquids, noise or views).
<b>Catchment</b>	The area drained by a stream or body of water or the area of land from which water is collected.
<b>Clay</b>	Very fine grained sediment, often defined as having a particle size less than 2 microns (0.002mm) in diameter.
<b>Compaction</b>	The process of compressing individual grains in a soil or sediment in response to pressure.
<b>Conservation</b>	The management of resources in a way that will benefit both present and future generations.

Term	Abbreviation
<b>Contaminant</b>	Any physical, chemical, biological or radiological substance or matter in water or soil that is not of natural origin.
<b>Contamination</b>	The degradation of the natural environment as a result of human activities.
<b>Council</b>	The Hills Shire Council.
<b>Day</b>	The period from 7.00am to 6.00pm on Monday to Saturday and 8.00am to 6.00pm on Sunday and public holidays.
<b>dBA</b>	Decibels using the A-weighted scale measured according to the frequency of the human ear.
<b>DECC</b>	NSW Department of Environment and Climate Change now OEH.
<b>Decibel</b>	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.
<b>Department</b>	NSW Department of Planning.
<b>Director-General</b>	Director-General of the Department of Planning or delegate.
<b>DPI</b>	NSW Department of Primary Industries
<b>DWE</b>	NSW Department of Water
<b>EA</b>	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.
<b>Ecology</b>	The relationship between living things and their environment.
<b>Ecologically Sustainable Development</b>	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.
<b>Ecosystem</b>	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.
<b>Emission</b>	Discharge of a substance to the environment.
<b>Environment</b>	A term for all the conditions (physical, chemical, biological and social) in which an organism or group of organisms, including humans, exists.
<b>Environmental Assessment (EA)</b>	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.

Term	Abbreviation
<b>Environment Protection Licence</b>	
<b>EMP</b>	Environmental Management Plan
<b>EP&amp;A Act</b>	<i>Environmental Planning and Assessment Act 1979.</i>
<b>EP&amp;A Regulation</b>	<i>Environmental Planning and Assessment Regulation 2000.</i>
<b>EPL</b>	Environmental Protection Licence issued under the <i>Protection of the Environment Operations Act 1997.</i>
<b>Equivalent Continuous Sound Level (LAeq)</b>	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.
<b>Erosion</b>	The wearing away of the land surface by the action of water, wind and ice.
<b>Evening</b>	The period from 6.00pm to 10.00pm.
<b>Excavate</b>	Dig into natural material and remove using specialist machinery.
<b>Extraction</b>	A term referring to the removal of material from the earth synonymous with quarrying.
<b>Extraction area</b>	The land described as the extraction area in Appendix 1 of the Project Approval.
<b>Evapotranspiration</b>	Loss of water from a land mass through transpiration from plants and evaporation from the soil.
<b>Fauna</b>	All animals including birds, reptiles, marsupials and fish.
<b>Flora</b>	All plants
<b>Frequency</b>	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.
<b>Friable</b>	Easily crumbled.
<b>Front-end loader</b>	Machine used to lift and place soil, earth, rocks and other materials within an extraction site or to load products into trucks.
<b>Gradient</b>	Rate of change of a given variable with distance, such as temperature or elevation.
<b>g/m<sup>2</sup>/month</b>	grams per square metre per month
<b>Greenhouse effect</b>	Changes in climate that could occur due to increases in atmospheric concentrations of certain gases.
<b>Groundwater</b>	Subsurface water contained within the saturated zone.

Term	Abbreviation
<b>Hawkesbury Sandstone</b>	Prominent cliff-forming sandstone occurring across the Sydney basin.
<b>Head (hydraulic head)</b>	Energy contained in a water mass produced by elevation, pressure or velocity.
<b>Heritage</b>	Things of value which are inherited from the past.
<b>Hydrocarbon</b>	Any organic compound, gaseous, liquid or solid, consisting only of carbon and hydrogen.
<b>Hydrogeology</b>	The study of subsurface water in its geological context.
<b>Impact</b>	The effect of human-induced action on the environment.
<b>Infiltration</b>	The process of surface water soaking into the soil.
<b>Infrastructure</b>	Supporting installations and services supplying the needs of a project.
<b>Introduced species</b>	Plants and animals not native to Australia and known or thought to have been brought here by humans.
<b>Land</b>	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.
<b>Landform</b>	A specific feature of the landscape or the general shape of the land.
<b>µg/m<sup>3</sup></b>	micrograms per cubic metre
<b>µs/cm</b>	microsiemens per centimetre
<b>micron</b>	Unit of measure-one millionth of a metre.
<b>mg/L</b>	milligrams per litre
<b>Mitigation measures</b>	Measures put in place to reduce an impact.
<b>Modelling</b>	Use of mathematical equations to simulate and predict real events and processes.
<b>Monitoring</b>	Regular measurement of components of the environment to understand their condition and establish if necessary standards are being met.
<b>Minister</b>	NSW Minister for Planning or delegate.
<b>Night</b>	The period from 10.00pm to 7.00am on Monday to Saturday and 10.00pm to 8.00am on Sunday and public holidays/
<b>Observation well</b>	A well constructed or utilised for the purpose of observing groundwater parameters such as water levels, pressure changes and water quality.
<b>OEH</b>	Office of Environment and Heritage (formerly DECC)



Term	Abbreviation
<b>Palaeochannel</b>	An ancient river bed, often filled with more recent sediments.
<b>Perched water</b>	Unconfined groundwater separated from an underlying body of groundwater by an unsaturated zone.
<b>pH</b>	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.
<b>Piezometer</b>	A pipe in which the elevation of the water level or potentiometric surface can be determined.
<b>Privately owned land</b>	Land not owned by a public agency or the proponent or its related companies.
<b>Preferred Project Report</b>	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.
<b>Process plant</b>	Equipment used to clean and separate sand into various sizes.
<b>Project</b>	The development as described in the EA.
<b>Proponent</b>	PF Formation or its successors in title.
<b>Recharge</b>	Addition of water to the zone of saturation; also the amount of water added.
<b>Recovery</b>	The difference between the observed water level during the recovery period after cessation of pumping and the water level measured immediately before pumping stopped.
<b>Receptor</b>	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.
<b>Rehabilitation</b>	Preparation of a final landform following extraction and its stabilisation with vegetation.
<b>Remnant vegetation</b>	Native vegetation remaining after widespread clearing has taken place.
<b>Resource</b>	Potentially usable material in a defined area that can be economically extracted.
<b>Response to Submissions</b>	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.
<b>RL</b>	Reduced level, usually in metres to an arbitrary datum.
<b>RTA</b>	NSW Roads and Traffic Authority

Term	Abbreviation
<b>Run-off</b>	The proportion of precipitation discharged through surface water systems.
<b>Sand</b>	Sediment comprising particles ranging between 0.063mm and 2mm.
<b>Sandstone</b>	A fine grained rock of sedimentary origin composed primarily of sand-sized particles (0.06 to 2 mm).
<b>Sedimentation basin</b>	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.
<b>SHTW</b>	Sydney Hinterland Transition Woodland
<b>Silt</b>	Sediment comprising most particles between 0.004mm and 0.063mm.
<b>Species</b>	Taxonomic grouping of organisms that are able to interbreed with each other but not with other species.
<b>Stakeholder</b>	An individual or group with an interest in the proposal.
<b>Statement of Commitments</b>	The proponent's commitments in Appendix 3 of the Project Approval.
<b>Stockpile</b>	Mound used to store material.
<b>Stormwater</b>	Rainwater which runs off catchments following rain events. The untreated water is carried into creeks, rivers and lakes.
<b>Strategy A, Strategy B</b>	The alternative rehabilitation proposals described in the Preferred Project Report.
<b>Terrestrial</b>	Relating to the land as distinct from air or water.
<b>Tertiary</b>	Geologic time at the beginning of the Cainozoic era, 65 to 2 million years ago, after the Cretaceous and before the Quaternary.
<b>Topography</b>	The physical relief and contours of the area.
<b>Topsoil</b>	The surface layer of a soil profile containing most of the organic material and viable life forms and seeds.
<b>Total Dissolved Solids (TDS)</b>	The dissolved mineral content of groundwater, commonly expressed in milligrams/Litre.
<b>Total Suspended Solids</b>	A measure of suspended solids concentrations in a water body and expressed in terms of mass per unit of volume.
<b>Triassic</b>	The earliest of the three periods that constitute the Mesozoic Era. Approximately between 230 and 180 million years before present.
<b>TSC Act</b>	NSW Threatened Species Conservation Act.
<b>Turbidity</b>	A measure of light penetration through a water column containing particles of matter in suspension.

Term	Abbreviation
<b>Underflow</b>	The volume of groundwater that flows through a cross sectional area of an aquifer. It depends on permeability and the prevailing gradient.
<b>Unsaturated zone</b>	That part of an aquifer between the land surface and water table.
<b>Vegetation Offset</b>	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.
<b>VENM</b>	Virgin Excavated Natural Material as defined in the <i>Protection of the Environment Operations Act 1997</i> .
<b>Wash plant</b>	Equipment designed to wash unwanted sized materials from the product.
<b>Water quality</b>	Degree or lack of contamination.
<b>Water table</b>	The surface of saturation in an unconfined aquifer at which the pressure of the water is equal to that of the atmosphere.
<b>Well</b>	A hole sunk into the ground and completed for the abstraction or injection of water or for water observation purposes. Generally synonymous with bore.
<b>1 in 100 Year Flood Level</b>	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 revision of these Plans occurred in 2011 and the Department of Planning (DoP) approved the revised Plans on 15 November 2011.

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 (AEMR). 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).

This AEMR 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 to 30 June
- 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 Approval requires the project to have an Independent Environmental Audit 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.

### **First Independent Environmental Audit**

On the 13 July 2010 the Department of Planning approved Environmental Planning to conduct the first Environmental Audit of the Project. In April 2011 the Independent Environmental Audit Report of the Hitchcock Road Sand Project was received. A copy of the Report is appended in **Attachment 9A** and the Audit Conclusions were:

*Full cooperation was obtained from PF Formation staff during the audit with full access granted to records and copies made of records if requested. No obstacles were encountered during the audit and subsequent queries. Based on the audit findings the audit conclusions are as follows.*

*Based on completion of the environmental audit tasks (section 3), audit evidence and environmental monitoring results (section 4), consultation with agencies (section 5) and assessment of the compliance tables and audit findings (section 6) the environmental performance of the sand project is satisfactory with some non-conformances. The project is generally complying with the relevant standards, performance measures and statutory requirements including project approval conditions, project approval commitments and Environment Protection Licence conditions with some non-conformances that can be rectified. There is a need to improve on some environmental commitments and record keeping.*

*The effects of the Hitchcock Road sand project on the surrounding environment appear to be relatively minor, nevertheless acceptable and manageable with some improvements and corrective actions needed. This assumes that the environmental management measures continue to be implemented by PF Formation.*

*All strategies/plans/programs required under the project approval to date are adequate with some corrective actions proposed.*

## Independent Audit Recommendations

Audit recommendations were outlined in Section 8 of the Audit Report and the PF Formation response to each of the matters raised was reported to the Department of Planning in the letter dated 14 June 2011 as per **Attachment 9B**. All matters referred to in PF Formation 'Comments on Independent Environment Report' dated 14 June 2011 have now been completed.

Points 3, 6, 7, 8, 9, 12, 13, 20 of the Audit Recommendations refer to changes/updates to be made to the Environmental Strategies, Management Plan and Water Table Contours Map and Depth of Mining Contours Map. These Plans have been updated and forwarded to the DoP on 14 September 2011 and were approved by DoP on 15 November 2011.

## *Chapter Two*

# **STATUS OF THE PROJECT**

The site survey plan attached as **Attachment 2A** shows the current status of the development. 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 2012 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 and Planning for Next 12 months***

- Extraction has continued in Lot 214 DP752039 on the southern side of the main clean water dam. The majority of the sand from this site has now been extracted and limited extraction will occur in the next year. Commencement construction of tailing ponds will occur. **(Attachment 2C – Photo 1)**
- Extraction will extend from the southern side of Lot 214 DP752039 along the Hitchcock Road boundary on Lot 167 DP752039.
- Extraction on the south-western side of the slurry plant on Lot 1 DP570966 and will continue as the main extraction area for the next year **(Attachment 2C – Photo 2)**
- Removal of significant overburden heading north through Lot 2 DP1063296 to Lot 2 DP570966 to prepare for long-term extraction of this area. Intermittent extraction will occur in this area. **(Attachment 2C – Photo 3)**
- Capping of Tailings Pond 5 is about one-half complete and will continue. **(Attachment 2C – Photo 4)**
- Tailings Pond 7 is now a disused tailings pond and will be progressively capped. **(Attachment 2C – Photo 5)**
- Previously capped Tailings Ponds 8 has continued to be used as overburden stockpile area.
- Construction of a new tailings pond in the centre of Lot 1 DP1091018 will continue. This pond will be Tailings Pond 11 immediately north of Tailings Ponds 7. **(Attachment 2C – Photo 6)**
- Tailings Ponds 9 and 10 will continue as the main ponds in use in the system. **(Attachment 2C – Photo 7&8)**
- Continued monitoring and supplemental planting of revegetation in the completed areas of Lot 2 DP233818 **(Attachment 2C – Photo 10, 11, 12 &13)**. More than 4 hectares of SHTW has been planted on the site at that stage. No further SHTW will be planted until the remaining SHTW has to be removed for extraction.
- Planting of vegetation will occur along western end of Old Northern Road.

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

There have been no complaints during the year.

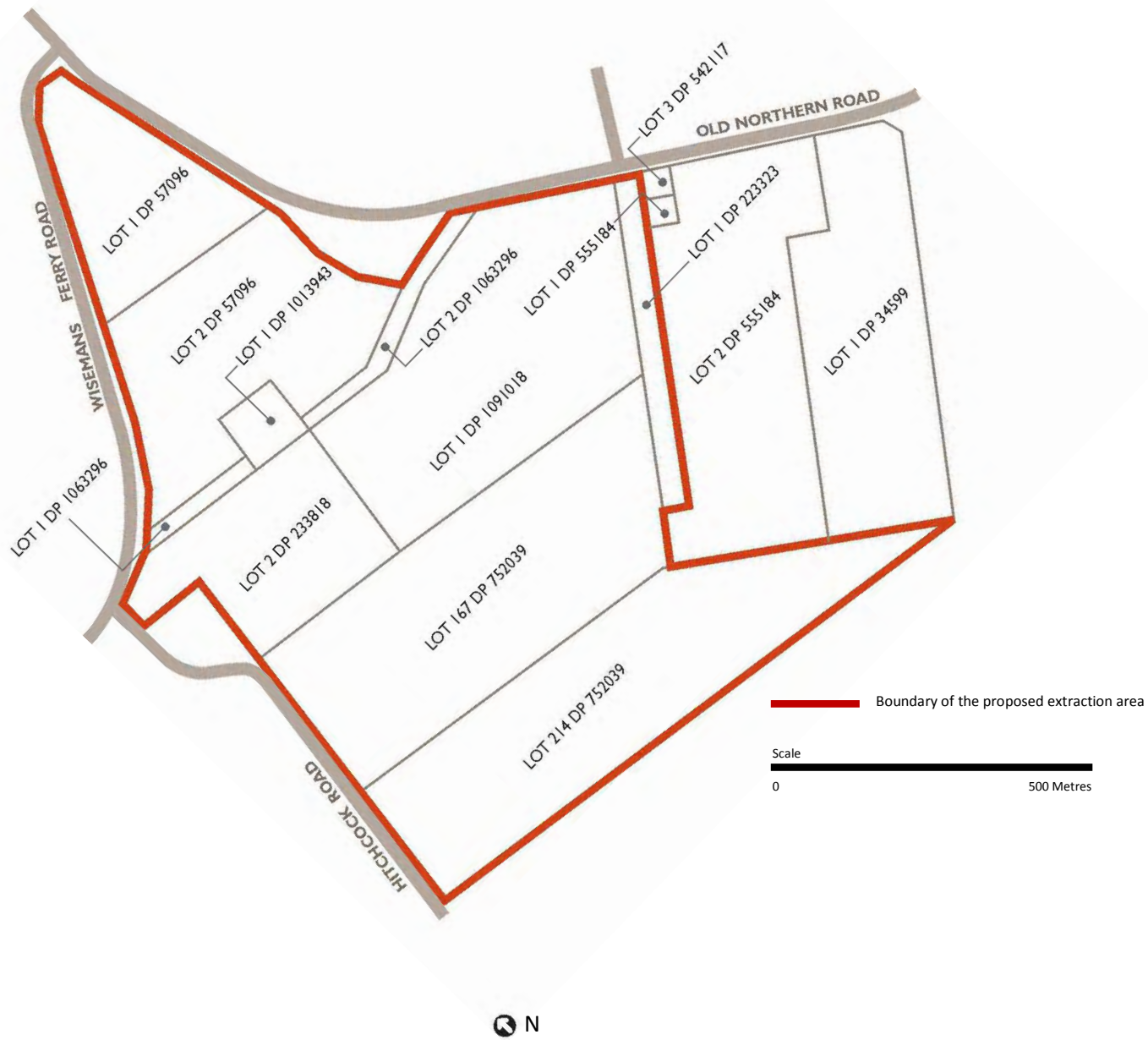
### **Other Matters**

The weighbridge is required to be verified under the Fair Trading Rules every two years. The last verification was done on 11 May 2012 and a copy of the verification is in **Appendix 2D**.

Annual production data is forwarded to the Department of Primary Industries in aggregate for all material produced and sold at Maroota. The figures provided include material from Hornsby Shire Council and Hills Shire Council and from several Approvals/Consents. The information in these forms is commercially sensitive and in any case it does not break down the material from this Approval or others. The throughput for the year from this Approval was less than 400,000 tonnes and detail of this AEMR not available for publication.











**Photo 1:** Extraction area - Lot 214 DP572039



**Photo 2:** Extraction Area - Lot 1 DP570966



**Photo 3:** Overburden to be removed



**Photo 4:** Tailings Pond 5 (being capped)



**Photo 5:** Tailings Pond 7 (disused)



**Photo 6:** New Tailings Pond





**Photo 7:** Tailings Pond 9 (in current use)



**Photo 8:** Tailings Pond 10 (in current use)



**Photo 9:** Clean Water Dam



**Photo 10:** Rehabilitation Area



**Photo 11:** Rehabilitation Area



**Photo 12:** New Planting to Old





**Photo 13:** Rehabilitation Area



**Photo 14:** Lot 198 Dam

## **Attachment 2D**

### Weighbridge Verification



**Test report reference number:** 0003394

**Calibration Sticker Reference:** E12-16576-1

**Date of Test:** 11/05/12

**Verification:** Y

**In-Service Test:**

**For in-service inspection record the verification/certification mark:** E2

**Name of owner/user:** PF FORMATION

**Contact:** DIANNE REA

**Address of owner/user:** 1774 WISEMAN FERRY RD  
MAROOTA

**Phone:**

**Report Emailed from Site?** Y

**DESCRIPTION OF INSTRUMENT:**

**Customer Scale ID:** IN00542/7

**Make / Model:** TOLEDO 7560/5000

**NSC No** 6/10B/46

**Capacity:** 60t

**Min:** 0.4t

**VSI e=d=** 0.02t

**Class** III

DESCRIPTION	Y/N		Y/N
Instrument complies with NMI certificate?	Y	The data plate is fixed on instrument?	Y
Instrument is being used appropriately?	Y	Is the instrument clean?	Y
Is the instrument complete?	Y	Level-ind device fitted & Operates?	NA
Is the Instrument Operational?	Y	Mounted on a firm base?	Y
Is the instrument level?	Y	Mandatory marks are clear & permanent?	Y
Any apparent obstructions to Inst?	N		
Does the operator &/OR customer, have a clear and unobstructed view of the indicator & the weighing operation?			Y
Add indicating devices: Do the repeat the primary indication. Does price computation and/or, ticket/label comply with S1/0/A?			Y
If applicable, does the steelyard, tare bar or proportional weight comply with the mandatory requirements in respect to design and marking?			NA
Is the instrument adequately protected against abnormal dust, air movement, vibrations, atmospheric conditions and any other influence likely to affect its performance?			NA
Suspended weighing instruments: does it hang freely & are all transparent covers in good repair?			NA

Repeatability Test: Pass or Fail? P	Zero Settings Pass or Fail? P	1. 41.80	2. 41.80	3. 41.80
Eccentricity Reading 1 - 12:		Difference: 0.00		

1. 12.16	2. 12.16	3. 12.18	4. 12.18	5. 12.16	6. 12.16	Mass Used:
7.	8.	9.	10.	11.	12.	12.16t

Eccentricity Test Pass or Fail? P

No. of Supports? 6

Comments:

**Weighing performance using substitution load (clause 5.4.2)**

Substitution Load 1:	FORKLIFT
Substitution Load 2:	LOADER
Substitution Load 3:	TRUCK

Method Used: Method A? Y Method B?

MPE change points: 500/2000e

Available weights: 18t

**WEIGHBRIDGE WEIGHT TEST:**

Up:	Load	Make up of load:	MPE:	1:	1/2 e:	DL:	E:	Lsub:	Lsub: (rounded)	P or F?
1.	0.4t	MASS	0.5e	0.40	0.01t					P
2.	10t	MASS	1e	10.00	0.01t					P
3.	18t	MASS	1e	18.00	0.01t					P
4.	41.16t	MASS + SUB1	1.5e	41.16	0.01t	23.16t	-0.004	23.146	23.16	P
5	59.22t	MASS + SUB1,	1.5e	59.22	0.01t	41.22T	-0.010	41.210	41.22	P

Over range blanking Pass or Fail? P

Down:	Load	Make up of load:	MPE:	1:	P or F?
1.	0.4t	MASS	0.5e	0.40	P
2.	10t	MASS	1e	10.00	P
3.	18t	MASS	1e	18.00	P
4.	41.16t	MASS + SUB1,	1.5e	41.16	P
5	59.22t	MASS + SUB1,	1.5e	59.22	P

Discrimination (clause 5.5): NA

Accuracy of tare setting (clause 5.7): NA

Test Required: NA

Weight test Pass or Fail?: P

Sensitivity (clause 5.6): P

Test Required: Y

**OVERALL RESULT? PASS**

**Technicians Name: DAVID**

**ID No: AUS0662**



*Chapter Three*

## **ENVIRONMENTAL MONITORING PROGRAM & RESULTS**

### **Operational Monitoring Program**

Based on all the Management Plans and Environmental Strategy the Environmental Operational Procedures have been determined and 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.

## Summary of Monitoring Results

Noise Monitoring	2012	2011	2010	2009
– Noise from operational activities exceed guidelines	NIL	NIL	NIL	NIL
– Complaints received	NIL	NIL	NIL	NIL
<b>Air Quality</b>				
Monthly dust deposit - average g/m2/month (from all sources)				
– Location 1 - behind Maroota Primary School	1.9	3.22 ③	2.27	4.05 ①
– Location 2 - Hitchcock & Wisemans Ferry Roads	1.66	2.38	2.18	6.04 ① ②
– Location 3 - Jurd's Residence	2.43	2.56	2.55	3.14
① results impacted by back burning in September 2008 (10.66, 12.60 respectively)				
② results impacted by ploughing in July 2008 (21.97)				
③ result impacted by reading of 10.5 in October 2010				
– Complaints received	NIL	NIL	NIL	NIL
– Plant exhaust deficiency when vehicles serviced	NIL	NIL	NIL	NIL
<b>Access &amp; Traffic</b>				
– Traffic movements within limits	YES	YES	YES	YES
<b>Erosion &amp; Sediment Control</b>				
– Sediment leaving site	NIL	1	NIL	NIL
<b>Water Management</b>				
– Evidence of issue with groundwater quality	NIL	NIL	NIL	NIL
<b>Rehabilitation</b>				
– Area vegetated	> 4 hectares	> 4 hectares	2.4 hectares	2.4 hectares
<b>Overall number of complaints received</b>	NIL	1	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

July 2011

STRATEGY POINT	PAGE NO	DESCRIPTION	STATUS ✓ or ✗	COMPLAINTS RECEIVED	COMMENTS
A2	A3-A5	Noise	✓	Nil	Noise monitoring was carried out throughout the month. Results from testing to be included in the 2011 – 2012 AEMR.
A3	A6-A10	Air Quality	✓	Nil	Deposited Dust results for the reporting period 2010 – 2011 show levels within the criteria specified in the EPA Licence.
A4	A11-A12	Access and Traffic	✓	Nil	An audit of truck movements was undertaken on 4/07/11. Five trucks were recorded leaving the site between the hours of 6:00 and 7:00 am.
A5	A13-A16	Erosion & Sediment Control	✓	Nil	No water or sediment left the site throughout the month. Water samples were collected downstream from Lot 198 in June 2011 and results from testing will be included in the 2010 – 2011 AEMR.
A6	A17-A20	Water	✓	Nil	
A7	A21-A25	Rehabilitation & Vegetation offset	✓	Nil	
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: 29<sup>th</sup> July 2011



## PF FORMATION

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

*August 2011*


STRATEGY POINT	PAGE NO	DESCRIPTION	STATUS ✓ or ✗	COMPLAINTS RECEIVED	COMMENTS
A2	A3-A5	Noise	✓	Nil	Noise monitoring will next be undertaken in October 2011.
A3	A6-A10	Air Quality	✓	Nil	Deposited Dust Results for July have been received and show low levels at all locations.
A4	A11-A12	Access and Traffic	✓	Nil	An audit of truck movements between the hours of 6:00 and 7:00am was carried out on 12/08/11. It is noted that 7 trucks left the site in this time.
A5	A13-A16	Erosion & Sediment Control	✓	Nil	No water or sediment left the site throughout the month. Downstream water samples are collected quarterly and results included in the AEMR.
A6	A17-A20	Water	✓	Nil	
A7	A21-A25	Rehabilitation & Vegetation offset	✓	Nil	A further 691 plants have been purchased and will be planted in the 2006 site next month. There are a total of 1880 new plants in this site. Weed re growth has occurred and will need to be treated once the new plants are in the ground.
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: 31<sup>st</sup> August 2011

## PF FORMATION

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

*September 2011*

STRATEGY POINT	PAGE NO	DESCRIPTION	STATUS ✓ or ✗	COMPLAINTS RECEIVED	COMMENTS
A2	A3-A5	Noise	✓	Nil	Noise monitoring will next be undertaken in October 2011.
A3	A6-A10	Air Quality	✓	Nil	Deposited Dust results for August 2011 were received and show low levels at all locations.
A4	A11-A12	Access and Traffic	✓	Nil	An audit of early morning truck movements was undertaken on 15 <sup>th</sup> September 2011. Eight trucks were recorded leaving the site between the hours of 6 and 7am.
A5	A13-A16	Erosion & Sediment Control	✓	Nil	No water or sediment left the site throughout the month.
A6	A17-A20	Water	✓	Nil	
A7	A21-A25	Rehabilitation & Vegetation offset	✓	Nil	691 native plants were installed throughout the month in the 2006 rehab site. The new area was prepared for seeding and native seed was broadcasted over the site. The site will be irrigated throughout the hotter months until seedlings are established.
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	
<b>Key:</b> ✓ = Satisfactory				Completed by Environmental Manager (Josh Graham)	



## PF FORMATION

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

October 2011

STRATEGY POINT	PAGE NO	DESCRIPTION	STATUS ✓ or ✗	COMPLAINTS RECEIVED	COMMENTS
A2	A3-A5	Noise	✓	Nil	Noise monitoring was carried out throughout the month. Results from testing were consistent with previous results and will be summarised in the next AEMR.
A3	A6-A10	Air Quality	✓	Nil	Deposited Dust Results for September 2011 were received. Sites 1 and 2 showed low levels and Site 3 was higher than normal. The reason for the high result at Site 3 is unknown.
A4	A11-A12	Access and Traffic	✓	Nil	An audit of early morning truck movements was carried out on 18 <sup>th</sup> October 2011. 15 Trucks were recorded leaving the site between the hours of 6:00 and 7:00am.
A5	A13-A16	Erosion & Sediment Control	✓	Nil	
A6	A17-A20	Water	✓	Nil	
A7	A21-A25	Rehabilitation & Vegetation offset	✓	Nil	
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

Completed by Environmental Manager (Josh Graham)

## PF FORMATION

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

*November 2011*

STRATEGY POINT	PAGE NO	DESCRIPTION	STATUS ✓ or ✗	COMPLAINTS RECEIVED	COMMENTS
A2	A3-A5	Noise	✓	Nil	Noise Monitoring will next be carried out in January 2012.
A3	A6-A10	Air Quality	✓	Nil	Deposited Dust Results for October 2011 were received and show low levels at all locations.
A4	A11-A12	Access and Traffic	✓	Nil	An audit of early morning truck movements was carried out on 29 <sup>th</sup> November 2011. 9 trucks were recorded entering and leaving the site between the hours of 6:00 and 7:00am. No more than 200 trucks movements occurred on any one day.
A5	A13-A16	Erosion & Sediment Control	✓	Nil	No water or sediment left the site. Water samples were collected from the drainage line downstream of Lot 198. Laboratory analysis showed low Total Suspended Solids. (5.6mg/L) Full results from testing will be included in the 2011 – 2012 AEMR.
A6	A17-A20	Water	✓	Nil	
A7	A21-A25	Rehabilitation & Vegetation offset	✓	Nil	At least 3.7 hectares has now been seeded and planted to establish an offset area for future clearing of SHTW on the site.
A8	A26-A27	Social Impact	✓	Nil	The bi annual Community Consultative Committee Meeting was held on 2 <sup>nd</sup> November 2011. The minutes will be posted on the website and included in the 2011 – 2012 AEMR. The Department of Planning has approved the Independent Audit, Response to the Audit, and the revised Plans and Strategies in a letter dated 15 <sup>th</sup> November 2011.
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

Completed by Environmental Manager (Josh Graham)

*(Signature)*



## PF FORMATION

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

*December 2011*

STRATEGY POINT	PAGE NO	DESCRIPTION	STATUS ✓ or ✗	COMPLAINTS RECEIVED	COMMENTS
A2	A3-A5	Noise	✓	Nil	Noise Monitoring will next be carried out in January 2012.
A3	A6-A10	Air Quality	✓	Nil	Deposited Dust Results for November 2011 show low levels at all locations.
A4	A11-A12	Access and Traffic	✓	Nil	An audit of early morning truck movements was carried out on 15/12/11. 10 trucks were recorded entering and leaving the site between the hours of 6:00 and 7:00am.
A5	A13-A16	Erosion & Sediment Control	✓	Nil	No water or sediment left the site throughout the month.
A6	A17-A20	Water	✓	Nil	
A7	A21-A25	Rehabilitation & Vegetation offset	✓	Nil	
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

Completed by Environmental Manager (Josh Graham)

*(Signature)*

## PF FORMATION

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

*January 2012*

STRATEGY POINT	PAGE NO	DESCRIPTION	STATUS ✓ or ✗	COMPLAINTS RECEIVED	COMMENTS
A2	A3-A5	Noise	✓	Nil	Noise Monitoring was carried out throughout the month during DAY and NIGHT hours. Daytime testing showed that quarry noise was mostly inaudible and the noise from cicadas was dominant. Night readings also showed that quarry noise was predominantly inaudible however traffic noise was the dominant noise source.
A3	A6-A10	Air Quality	✓	Nil	Deposited Dust Results for December 2011 showed low levels at all locations.
A4	A11-A12	Access and Traffic	✓	Nil	An audit of daily truck movements was carried out on 10/01/12. Ten trucks were recorded entering and leaving the site between the hours the hours of 6:00 and 7:00am.
A5	A13-A16	Erosion & Sediment Control	✓	Nil	No sediment laden water left the site despite heavy rainfall.
A6	A17-A20	Water	✓	Nil	
A7	A21-A25	Rehabilitation & Vegetation offset	✓	Nil	Further weed control measures were carried out in the 2006 rehabilitation site. This involved hand weeding around the bases of new plants and slashing of tall grass in areas. Spraying will be required as soon as weather will permit.
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

Completed by Environmental Manager (Josh Graham)

*201*



## PF FORMATION

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

*February 2012*

STRATEGY POINT	PAGE NO	DESCRIPTION	STATUS ✓ or ✗	COMPLAINTS RECEIVED	COMMENTS
A2	A3-A5	Noise	✓	Nil	Noise Monitoring will next be undertaken in April 2012 unless any complaints are received. No complaints were received throughout the month.
A3	A6-A10	Air Quality	✓	Nil	Deposited Dust Results for January 2012 show low levels at all locations.
A4	A11-A12	Access and Traffic	✓	Nil	An audit of early morning truck movements was undertaken on 27/02/12. A total of 12 truck movements were recorded between the hours of 6:00 and 7:00am. On the 15/02/12 a sand pipe exploded near Old Northern Rd resulting in sand slurry spilling onto the road. The material was swept off the road using a mechanical broom.
A5	A13-A16	Erosion & Sediment Control	✓	Nil	Water Samples were collected from the drainage line downstream from Lot 198. Total Suspended Solids were 3.3 mg/L. Full testing results will be included in the next AEMR.
A6	A17-A20	Water	✓	Nil	
A7	A21-A25	Rehabilitation & Vegetation offset	✓	Nil	Weed spraying was carried out in certain areas of the 2006 rehabilitation site. An area adjacent Old Northern Rd was also sprayed and will be slashed down to prepare the ground for planting natives. It is expected that ongoing weed control will be required to ensure the success of the natives in this area.
A8	A26-A27	Social Impact	✓	Nil	
A9	A28-A29	Heritage	✓	Nil	
A10	A30-A32	Visual Amenity	✓	Nil	The eastern setback areas along Old Northern Rd are being prepared for planting in Spring.
A11	A33-A35	Waste Management	✓	Nil	
A12	A36-A37	Emergency Response	✓	Nil	
A13	A38-A41	Hazard, Risk and Safety	✓	Nil	

**Key:**

✓ = Satisfactory

Completed by Environmental Manager (Josh Graham)



# PF FORMATION

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

March 2012

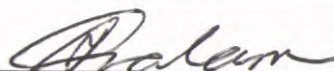
STRATEGY POINT	PAGE NO	DESCRIPTION	STATUS ✓ or ✗	COMPLAINTS RECEIVED	COMMENTS
A2	A3-A5	Noise	✓	Nil	Noise Monitoring to be carried out next month.
A3	A6-A10	Air Quality	✓	Nil	Deposited Dust Results for February 2012 show low levels at all locations.
A4	A11-A12	Access and Traffic	✓	Nil	An audit of early morning truck movements was carried out on 7/03/12. A total of 9 truck movements were recorded between the hours of 6:00 and 7:00am.
A5	A13-A16	Erosion & Sediment Control	✓	Nil	
A6	A17-A20	Water	✓	Nil	
A7	A21-A25	Rehabilitation & Vegetation offset	✓	Nil	
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: 30<sup>th</sup> March 2012



## PF FORMATION

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

April 2012

STRATEGY POINT	PAGE NO	DESCRIPTION	STATUS ✓ or ✗	COMPLAINTS RECEIVED	COMMENTS
A2	A3-A5	Noise	✓	Nil	Noise monitoring was carried out at four locations throughout the month. Results from monitoring showed that Quarry Noise was either in audible or audible but not measurable at all four locations. Results will be summarised by a noise consultant and full report attached to AEMR.
A3	A6-A10	Air Quality	✓	Nil	Deposited dust results for March 2012 show low levels at all locations.
A4	A11-A12	Access and Traffic	✓	Nil	An audit of early morning truck movements was carried out on 27/04/12. A total of 12 truck movements were recorded between the hours of 6:00 and 7:00 am.
A5	A13-A16	Erosion & Sediment Control	✓	Nil	
A6	A17-A20	Water	✓	Nil	
A7	A21-A25	Rehabilitation & Vegetation offset	✓	Nil	600 native plants were planted along the eastern setback areas of the site. Further planting in this area will recommence in Spring.
A8	A26-A27	Social Impact	✓	Nil	
A9	A28-A29	Heritage	✓	Nil	
A10	A30-A32	Visual Amenity	✓	Nil	Planting of set - back areas along the eastern boundary will improve visual screening of the trig site.
A11	A33-A35	Waste Management	✓	Nil	
A12	A36-A37	Emergency Response	✓	Nil	Pollution Incident Management and Response Plan has been prepared in order to comply with the new requirements of the POEO Act.
A13	A38-A41	Hazard, Risk and Safety	✓	Nil	

**Key:**

✓ = Satisfactory  
✗ = Unsatisfactory

Completed by Environmental Manager (Josh Graham)

Signed:



Date: 30<sup>th</sup> April 2012

# PF FORMATION

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

May 2012

STRATEGY POINT	PAGE NO	DESCRIPTION	STATUS ✓ or ✗	COMPLAINTS RECEIVED	COMMENTS
A2	A3-A5	Noise	✓	Nil	Noise monitoring will next be carried out in July 2012.
A3	A6-A10	Air Quality	✓	Nil	Deposited dust results for April 2012 showed low levels at Site 2 and 3 and a small spike at Site 1 where the insoluble solids were 4.6. The annual average for the reporting period remains below the EPA Criterion of 4.
A4	A11-A12	Access and Traffic	✓	Nil	An audit of early morning truck movements was carried out on 14/05/12. A total of 4 truck movements were recorded between the hours of 6:00 and 7:00am. (Average of 8 per day for the month.)
A5	A13-A16	Erosion & Sediment Control	✓	Nil	
A6	A17-A20	Water	✓	Nil	
A7	A21-A25	Rehabilitation & Vegetation offset	✓	Nil	
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: 31<sup>st</sup> May 2012



# PF FORMATION

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

June 2012

STRATEGY POINT	PAGE NO	DESCRIPTION	STATUS ✓ or ✗	COMPLAINTS RECEIVED	COMMENTS
A2	A3-A5	Noise	✓	Nil	Noise monitoring will next be carried out in July 2012. Results from testing carried out throughout the reporting period have been forwarded to Koikas Acoustics for analysis. A full noise report will be prepared to be included in the 2011 – 2012 AEMR.
A3	A6-A10	Air Quality	✓	Nil	Deposited dust results for May 2012 showed low levels at all locations.
A4	A11-A12	Access and Traffic	✓	Nil	An audit of early morning truck movements was carried out on 25/06/12. A total of 6 truck movements were recorded between the hours of 6:00 and 7:00am.
A5	A13-A16	Erosion & Sediment Control	✓	Nil	Downstream water quality testing results for the reporting period will be included in the 2011 – 2012 AEMR.
A6	A17-A20	Water	✓	Nil	Fabio from URS has visited the site to collect groundwater samples and download information from the data loggers. A Groundwater Management Report will be prepared and included in the 2011 – 2012 AEMR.
A7	A21-A25	Rehabilitation & Vegetation offset	✓	Nil	
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:











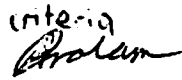

Date: 29<sup>th</sup> June 2012

## **Attachment 3C**

### Annual Environmental Operations Procedures Checklist

**A2.3 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
2.1.1 Manage site activities so that any necessary high noise and vibration levels occur at times of least impact.	Quarry Manager 
2.1.2 Advise neighbouring properties at least 24 hours in advance of the extent and expected duration of especially noisy activities.	Quarry Manager/ Environmental Manager 
2.1.3 Undertake all site activities incorporating noise attenuation measures such as restricting working hours for certain works required close to sensitive receptors	Quarry Manager 
2.1.4 Ensure that panels and covers of silenced plant are kept shut and plant and equipment switched off when not in use.	Quarry Manager 
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.	Quarry Manager 
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.	Quarry Manager 
2.1.7 Arrange for all plant and equipment to be inspected regularly to ensure that it is well maintained to minimise noise emissions.	Quarry Manager 
2.1.8 Conduct compliance monitoring of noise levels at the defined locations and keep records of measurements.	Environmental Manager 
<b>Performance indicator</b>	<p>Noise from operational activities does not exceed the guideline limits. Site complies with nominated noise criteria </p> <p>Number of complaints received Nil </p>

### A3.3 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 site as required. This is to be regularly inspected and maintained in good working order at all times.	Quarry Manager/ Environmental Manager 
3.1.3 Define haul road areas to prevent unnecessary vehicle movement into others	Quarry 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.	Quarry Manager Environmental Manager 
3.1.5 Apply speed controls to all unsealed areas (maximum speed of 20 km/h) and signpost accordingly.	Quarry Manager 
3.1.6 Vegetate all semi-permanent stockpiles with suitable groundcover and water where necessary until the vegetation is well established.	Quarry 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.	Quarry 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.	Quarry Manager 
3.1.9 Construct dust screens such as earth bunds and vegetated barriers.	Quarry 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.	Quarry Manager 
3.1.11 No fires to be permitted on-site.	Quarry Manager 

<b>Performance indicator</b>	Ambient air quality data compiled. AEMR <i>Pradeep</i>  Dust generated from site activities to comply at all times with OEH specified air quality criteria.
<b>Monitoring</b>	Dust monitoring at identified locations.  Compilation of a complaints register.
<b>Reporting</b>	Annual reporting in the AEMR. Monitoring results will be suitably summarised for posting on the PF Formation website.





**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.	Quarry Manager <i>R</i>
3.2.2	Regularly service all vehicles to ensure that exhaust emissions comply with the regulations. Maintain appropriate service records.	Quarry Manager <i>R</i>
3.2.3	Identify any opportunities to minimise machinery use and ensure that all equipment used on the site is energy efficient.	Quarry Manager <i>R</i>
<b>Performance Indicator</b>	Vehicle and plant emissions comply with the regulations. <i>OK</i>	
<b>Monitoring</b>	Regular vehicle and plant inspections.	
<b>Reporting</b>	Annual reporting of inspection results in the AEMR.	

### A4.3 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 The Hills Shire.	Quarry Manager/ Environmental Manager 
4.1.2 Undertake operations involving the transportation of material on the site only between 6.00am and 6.00pm, Monday to Saturday.	Quarry Manager/ Environmental Manager 
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.	Quarry Manager/ Environmental Manager 
4.1.4 Ensure that all vehicle loads leaving the site are suitably covered.	Quarry Manager/ Environmental Manager 

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

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

**Reporting** Annual report on complaints received.





### A4.4 Monitoring and reporting

The Environmental 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.

### A5.3 Management controls

#### 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.	Quarry Manager/ Environmental Manager 
5.1.2 Erect silt traps and erosion control fencing as appropriate along extraction area boundaries and drainage lines.	Quarry Manager/ Environmental Manager 
5.1.3 Design sediment basins with a minimum storage capacity of 400 m <sup>3</sup> per hectare of catchment. Spillway capacity and stability will be designed as follows: <ul style="list-style-type: none"> <li>• life of less than 5 years, adopt the 20 year t<sub>c</sub> event</li> <li>• life between 5 and 10 years, adopt the 50 year t<sub>c</sub> event</li> <li>• life greater than 10 years, adopt the 100 year t<sub>c</sub> event.</li> </ul>	Quarry Manager 
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.	Quarry Manager/ Environmental Manager 
<b>Performance indicator</b>	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.
<b>Monitoring</b>	Review effectiveness of the stormwater basins and treatment methods during and following major rainfall events.
<b>Reporting</b>	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	Quarry Manager/ Environmental Manager
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	Quarry Manager/ Environmental Manager
<b>Performance indicator</b>	Soil erosion control measures are incorporated in the operational activities on the site and are effective in reducing soil erosion.
<b>Monitoring</b>	Monitor suspended solid concentrations in stormwater runoff from the undisturbed parts of the site.
<b>Reporting</b>	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.	Quarry Manager
5.3.2 Where practicable, provide silt fences to minimise erosion and sedimentation from exposed areas.	Quarry Manager/ Environmental Manager
5.3.3 Stabilise exposed areas that are not in use with an appropriate cover crop and water until well established.	Quarry Manager/ Environmental Manager
5.3.4 Construct sediment retention basins with a capacity of at least 300m <sup>3</sup> per hectare of catchment, which will necessitate regular cleaning out, and a minimum freeboard of one metre.	Quarry Manager



5.3.5	Monitor erosion and sediment controls regularly and immediately following a rainfall event. 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.	Quarry Manager/ Environmental Manager <i>Adam</i>
5.3.6	Undertake maintenance of erosion and sediment controls when any deterioration is identified or when replacement is necessary.	Quarry Manager/ Environmental Manager <i>Adam</i>
5.3.7	Reuse stored stormwater for dust control and the watering of site vegetation.	Quarry Manager/ Environmental Manager <i>Adam</i>
5.3.8	Seed material stockpiles where these are to remain unused for a period in excess of four weeks. Water the area when required until the vegetation is well established.	Quarry Manager/ Environmental Manager <i>Adam</i>
5.3.9	Control vehicle movement on the site by the identification of the haul road and current working areas.	Quarry Manager <i>Adam</i>
<hr/>		
<b>Performance indicator</b>	Acceptable control of sedimentation and erosion is achieved so that suspended solids levels in any stormwater leaving the site does not exceed ANZECC guidelines or other regulatory requirements.	
<hr/>		
<b>Monitoring</b>	Monitor suspended solids levels in stormwater following rainfall events. Compare results with other appropriate locations. <i>Samples collected quarterly Adam.</i>	
<hr/>		
<b>Reporting</b>	Report on suspended solid levels and performance of erosion and sedimentation control measures for inclusion in the relevant AEMR.	





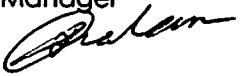

#### A5.4 Monitoring and reporting

The Environmental Manager will be responsible for the monitoring of the effectiveness of the sediment and soil erosion control measures installed on-site, suspended solids levels in stormwater runoff and any off-site discharges. An annual report will be included in the AEMR.

### A6.3 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.	Quarry 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 the Department of Planning consulted to determine the basis on which extraction may recommence.	Quarry Manager 
6.1.3 The sediment retention basins are to accommodate the 100-year $t_c$ event with the minimum basin capacities as follows: <ul style="list-style-type: none"> <li>• Southern catchment (Basin 1) 19,400 m<sup>3</sup></li> <li>• Northern catchment (Basin 2) 7,800 m<sup>3</sup></li> </ul> The volume of these basins can be varied depending on the extent of the area exposed for extraction within each catchment.	Quarry Manager 
6.1.4 Arrange for regular inspection of the capacity and stability of all retention basins and report on their effectiveness.	Quarry Manager/ Environmental Manager 
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 the Department of Planning.	Quarry Manager/ Environmental Manager 
<b>Performance indicator</b>	Maintenance of groundwater quality. Existing water levels and groundwater quality will be determined from data derived from the bores on the site.
<b>Monitoring</b>	Regular monitoring of water levels and water quality data from the on-site bores. URS Reports 

### A7.3 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.	Quarry Manager/ Environmental Manager 
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 
7.1.3 Prepare an assessment of the species mix of the Sydney Hinterland Transition Woodland and arrange for purchase or collection of seeds. 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 
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.	Quarry Manager/ Environmental Manager 
7.1.6 Separate topsoil for use in rehabilitation works.	Quarry Manager/ Environmental Manager 
7.1.7 Incorporate flora and fauna issues (to the extent it is relevant) in the education program so that the site operatives are aware of the requirements of this EMP.	Environmental Manager 
7.1.8 Once each extraction phase is complete, initiate the rehabilitation and revegetation program as set out in the Landscape management Plan.	Quarry Manager/ Environmental Manager 

**Performance indicator** All areas of significant flora and fauna habitat are protected prior to the start of extraction.

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<b>Monitoring</b>	Ensure that all the above are implemented prior to the commencement of extraction activities in the area.
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Monitor condition of flora and fauna habitats on a regular basis.

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<b>Reporting</b>	A report with appropriate maps identifying the areas under rehabilitation and extraction activity is to be prepared.
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Prepare an annual report on the status of the flora of the site for inclusion in the AEMR.



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

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Actions		Responsibility
7.2.1	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 
7.2.2	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.	Quarry Manager/ Environmental Manager 
7.2.3	Sow all stockpiles and exposed areas where no activity is to take place for more than four weeks with an appropriate vegetation cover.	Quarry Manager/ Environmental Manager 

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7.2.4	Undertake revegetation of the site on the following basis:	Environmental Manager 
	<ul style="list-style-type: none"> <li>re-establish the Sydney Hinterland Transition Woodland using seed and mulch collected from the area</li> <li>rehabilitate other areas to native species with a light sowing of cereal and allowing natural regeneration</li> <li>lime, fertilise and sow areas where improved grass cover is required</li> <li>suitably turf surfaces expected to experience high surface flows leaving the site</li> </ul>	
7.2.5	Establish a maintenance program aimed at promoting and protecting the growth of the rehabilitated areas.	Quarry Manager/ Environmental Manager 

<b>Performance Indicator</b>	Completion of site rehabilitation in conformity with the approved Landscape Management Plan.
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<b>Monitoring</b>	<p>Regular site inspections to ensure that the following is achieved:</p> <ul style="list-style-type: none"> <li>rate of rehabilitation is in conformity with the staging program</li> <li>conservation zones and rehabilitated areas are being appropriately maintained</li> <li>vegetative covers are being established</li> <li>site works such as bunding and the establishment of re-vegetated areas are progressing in accordance with the Landscape Management Plan</li> <li>all sensitive flora and fauna habitat is being adequately protected from damage</li> </ul>
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<b>Reporting</b>	Reports of site inspections and annual reviews in the AEMR.
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#### A7.4 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. Annual reports will be prepared by the Environmental Manager for inclusion in the AEMR.



### A8.3 Management controls

#### OPERATIONAL PHASE

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

Actions		Responsibility
8.1.1	Maintain an <b>open door policy</b> . Widely publish contact phone number and provide an early response to all queries, comments and requests for information.	Quarry Manager/ Environmental Manager
8.1.2	Provide access to all relevant environmental management documentation and monitoring results on the PF Formation web site.	Environmental Manager
8.1.3	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
8.1.4	Establish a complaints register incorporating date and time, type of communication, contact details of the complainant, nature of the complaint and response taken.	Quarry Manager/ Environmental Manager
<b>Performance indicator</b>		Minimal complaints from the community.
<b>Monitoring</b>		Number and type of responses and complaints raised by the community and improved performance.
<b>Reporting</b>		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.


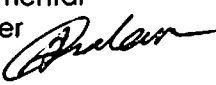
### A8.4 Monitoring and reporting

The Environmental Manager will be responsible for the monitoring of the effectiveness of the measures included in response to community concerns. Annual reports will be prepared by the Environmental Manager for the AEMR.

### A9.3 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 the Hills Shire Council to ensure compliance with the conditions of approval.	Quarry Manager/ Environmental Manager 
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 the Hills Shire Council to ensure compliance with the conditions of the approval.	Environmental Manager 
<b>Performance Indicator</b>	Any item of heritage significance is protected during site operations.
<b>Monitoring</b>	The protection of any heritage items identified during site operations is to be monitored.
<b>Reporting</b>	Any heritage item identified during site operations is to be documented.














### A9.4 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.

### A10.3 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.	Quarry Manager/ Environmental Manager 
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	Quarry Manager/ Environmental Manager 
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 
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 
10.1.5 Re-establish the landform of the extraction areas to that shown in the Landscape Management Plan.	Quarry Manager 
10.1.6 Complete the rehabilitation of the site in conformity with the proposals set out in the Landscape Management Plan.	Quarry Manager 
10.1.7 Remove all temporary fencing when no longer required.	Quarry Manager 
10.1.8 Re-establish vegetation in areas suitable for agricultural/horticultural uses.	Quarry Manager 
10.1.9 Remove all site infrastructure including the slurry plant and its associated pipelines. Restore those areas affected by the plant and rehabilitate.	Quarry Manager 
10.1.10 Remove all waste materials and dispose of in an appropriate manner.	Quarry Manager 
10.1.11 Review Quarry Closure Plan and prepare proposals for future use of the area.	Quarry Manager 

### A11.3 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.	Quarry Manager 
11.1.2 Define specific areas for the collection of materials for reuse and recycling and clearly label.	Quarry Manager 
11.1.3 Process cleared vegetation on site for use as mulch within the landscape program.	Environmental Manager 
11.1.4 Store all topsoil in stockpiles for later use in site rehabilitation.	Environmental Manager 
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.	Quarry Manager 
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.	Quarry Manager 
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.	Quarry Manager 
11.1.8 Retain copies of current licences of all waste removal contractors on site.	Quarry 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.	Quarry 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.	Quarry Manager 

- 
- |         |  |   |
|---------|--|---|
| 11.1.11 | Review all waste licences and monitor terms and conditions for compliance.   | Environmental 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. | Environmental Manager  |
- 

<b>Performance Indicator</b>	Effective use of waste recycling area and maximisation of material reuse.
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Appropriate removal of all waste from the site on completion.

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<b>Monitoring</b>	Regular review of recycling opportunities, quantities and cost savings.
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<b>Reporting</b>	Annual report on waste management, reuse and recycling on the site.
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#### A11.4 Monitoring and reporting

The Quarry Manager will be responsible for conducting regular waste audits, monitoring the currency of any waste disposal contracts and documentation relating to transport and disposal of wastes. The Quarry Manager will also monitor the quantities and costs/savings associated with the effective management of waste materials.













### A12.3 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.	Quarry Manager 
12.1.2 Develop and put in place emergency response procedures. Appoint appropriate individuals as emergency services liaison officers.	Quarry Manager 
12.1.3 Establish an emergency response table listing contact details of all relevant parties required in an environmental emergency.	Quarry Manager 
12.1.4 Establish a Register of Environmentally Hazardous Materials to be stored and used on site.	Quarry Manager 
12.1.5 Ensure that appropriate safety and spill response equipment has been made available.	Quarry Manager 
12.1.6 Clearly label all materials to be used and stored on site.	Quarry Manager 
12.1.7 Review and update emergency response procedures bi-annually.	Quarry Manager 
12.1.8 Ensure that appropriate safety and response equipment is available at all times.	Quarry Manager 
<b>Performance indicator</b>	Emergency response procedures, controls and training adequate for potential emergencies.
<b>Monitoring</b>	Regular monitoring of response procedures and equipment.
<b>Reporting</b>	Annual report on incidents.

### A12.4 Monitoring and reporting

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

### A13.3 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	Quarry Manager <i>None</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.	Quarry Manager/ Environmental Manager <i>Pratham</i>
13.1.3 Obtain Material Safety Data Sheets for all hazardous materials stored on site.	Quarry Manager/ Environmental Manager <i>Pratham</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 permanently stored within the area. Temporary facilities should have drip trays.	Quarry Manager <i>R</i>
13.1.5 Appoint a Safety Officer for the development.	Quarry Manager <i>R</i>
13.1.6 Locate all flammable material storage areas at least ten metres from possible ignition sources.	Quarry Manager/ Environmental Manager <i>Pratham</i>
14.1.7 Clearly label the contents of all above ground storage areas.	Quarry Manager/ Environmental Manager <i>Pratham</i>
13.1.8 Secure all hazardous and dangerous goods storage areas and display appropriate signage. Segregate all incompatible material.	Quarry Manager/ Environmental Manager <i>Pratham</i>
13.1.9 Train all personnel in the handling and safety procedures required for the hazardous materials stored and used on site during Staff Safety Meetings.	Quarry Manager/ Environmental Manager <i>Pratham</i>
<b>Performance Indicator</b>	Storage and handling of hazardous materials complies with legislative requirements and demonstrates due diligence.

<b>Monitoring</b>	Regular review of compliance with legislative requirements for the storage and handling of hazardous materials.
<b>Reporting</b>	AEMR.

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

<b>Actions</b>	<b>Responsibility</b>
13.2.1 Emergency Response Plan in place (see <b>Chapter 12</b> ).	Quarry Manager
13.2.2 Provide a mobile spill control kit containing appropriate absorbent materials, neutralising chemicals and other spill containment equipment.	Quarry Manager
13.2.3 Provide personal protective equipment and instruct personnel on its use.	Quarry Manager
13.2.4 Clean up any spills beyond the bunded area immediately and dispose of the contaminated material in an appropriate manner.	Quarry 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.	Quarry 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.	Quarry Manager

<b>Performance Indicator</b>	All pollution incidents contained and cleaned up without impact on the environment or injury to personnel. All incidents recorded.
<b>Monitoring</b>	Stormwater and soil contamination monitoring undertaken following any spill and subsequent clean up.
<b>Reporting</b>	Report on all pollution events and the results of any clean up.

## 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 2012
- 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 <sup>1</sup>	
		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.

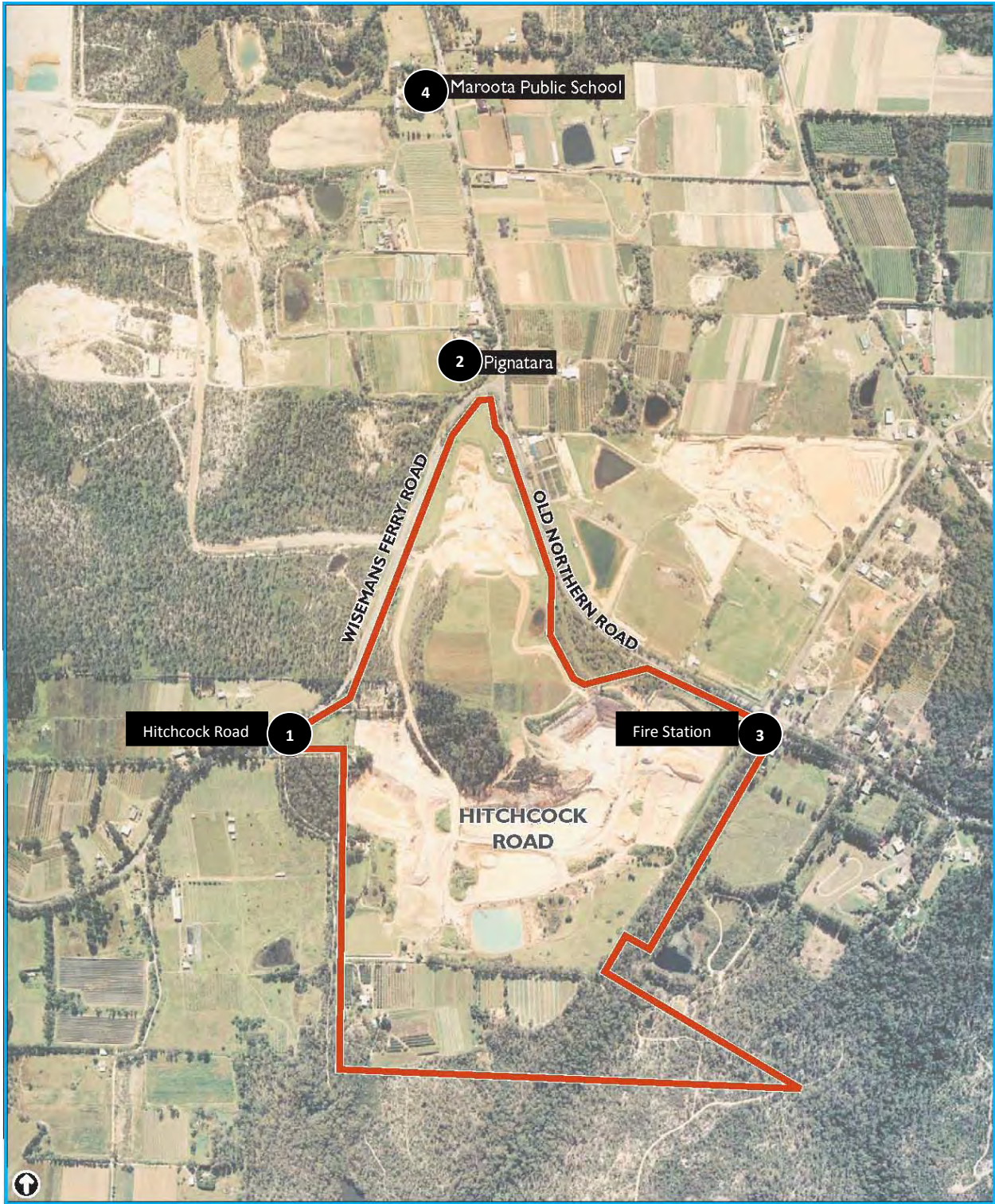
## **Operator-attended noise survey results**

In accordance with the Noise Management Plan PF Formation conducted its quarterly operator attended daytime noise surveys at each of the four test locations. Testing is done in the months of July, October, January and April. An external Noise Consultant was employed to prepare a report to assess and review the results against the noise criteria. The report prepared by Koikas Acoustics Pty Ltd is attached as **Attachment 4B**.

The locations used by Koikas Acoustics correspond to the locations in **Attachment 4A**.

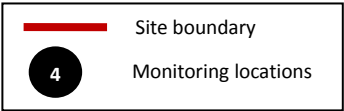
## **Conclusion**

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



Scale  
0 500 Metres

NOISE IMPACT ASSESSMENT MONITORING LOCATIONS





## **Attachment 4B**

### Noise Survey Results

## 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. 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;
- 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.

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

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

PF Formation maintained a program of continuous monthly dust deposition monitoring. This is in compliance with the requirements of the Air Quality Monitoring Program. 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 Sands 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.

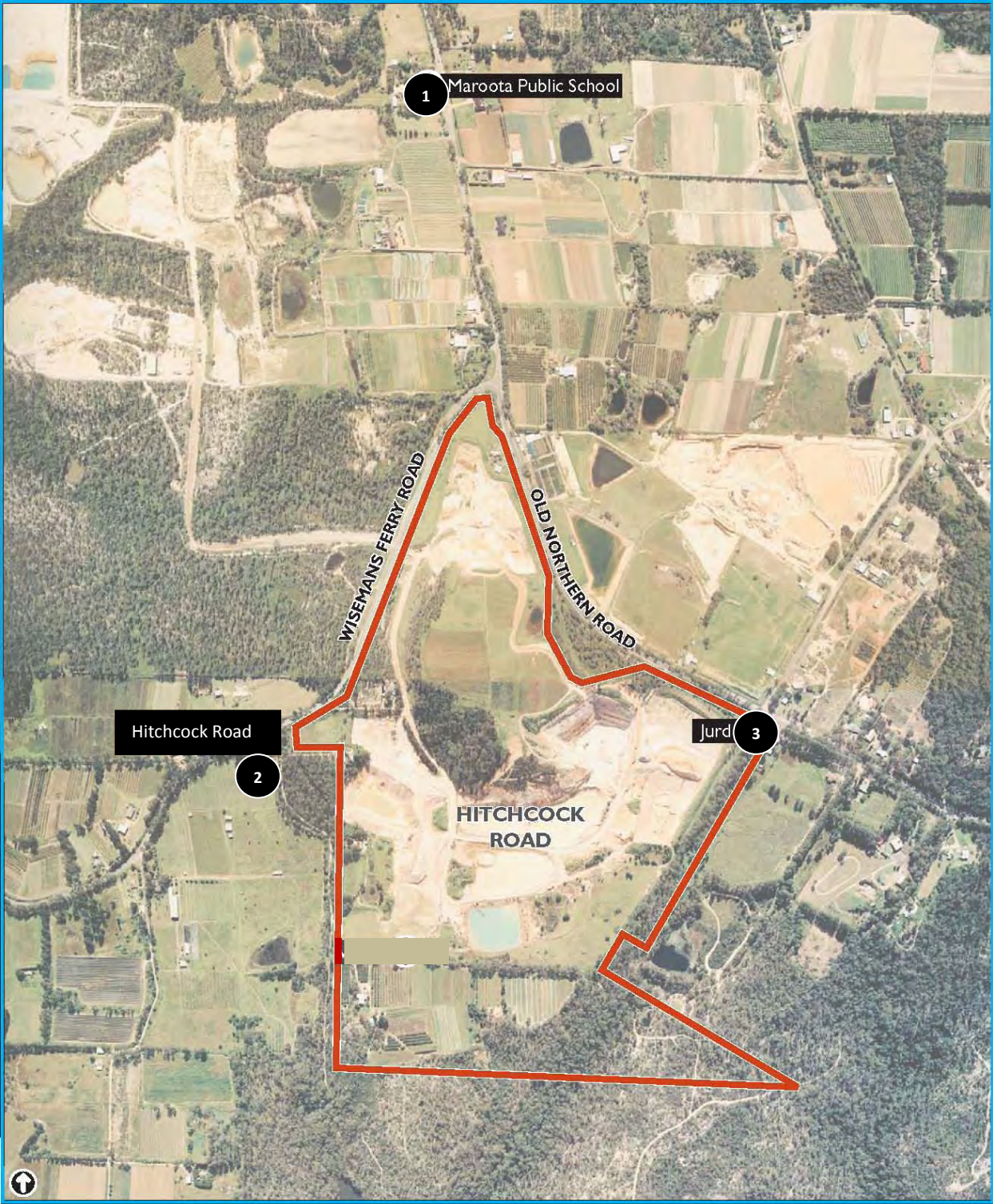
- The insoluble solids portion of deposited dust is expected to be mineral matter with the ash content indicating the level of solid dust particles of inorganic origin such as soil/dust that could be derived from a source such as sand extraction and processing operations.
- The monitoring results are 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/m<sup>2</sup>/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 1.9 g/m<sup>2</sup>/month. This is less than the dust nuisance criterion of 4 g/m<sup>2</sup>/month. This site often gets impacted by external factors such as horticultural activities adjoining the school but the results for 2012 were exceptionally low. The higher than average rainfall during the year would have assisted in keeping the dust levels lower than usual.

- 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 1.66 g/m<sup>2</sup>/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 2.43 g/m<sup>2</sup>/month which is below the dust nuisance criterion defined by the DECC. The September 2011 result was high but is unexplained.
- 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 PM<sub>10</sub> average recorded by the TEOM reaches 42.5 µg/m<sup>3</sup>, 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 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
2011	July	1.34	0.91	2.18	1.64	1.07	2.96	0.78	0.65	1.07
	August	1.65	1.13	3.96	0.72	0.69	1.56	1.07	0.81	2.05
	September	1.25	0.82	1.6	1.5	0.92	1.66	8.67	6.28	10.05
	October	1.55	0.89	3.96	1.29	0.95	3.54	1.38	0.9	3.77
	November	1.85	0.93	3.39	1.59	0.9	2.38	2.19	1.17	3.81
	December	1.49	0.88	2.85	3.04	1.62	4.48	1.79	0.99	3.08
2012	January	2.35	1.34	4.46	2.83	1.59	4.57	3.21	2.04	4.11
	February	1.82	1.3	2.41	1.77	1.03	2.17	2.67	1.35	3.34
	March	0.3	0.16	2.3	0.21	0.17	2.01	1.39	0.92	3.53
	April	4.6	1.11	9.56	1.67	0.91	2.96	2.42	1.48	2.78
	May	3.73	1.57	6.15	3.54	2.48	4.97	2.49	1.74	4.15
	June	0.82	0.56	6.35	0.08	0.06	2.62	1.04	0.75	2.04
Monthly Average		1.90			1.66			2.43		
2011		3.22			2.38			2.56		
2010		2.27			2.18			2.55		

# **Attachment 5C**

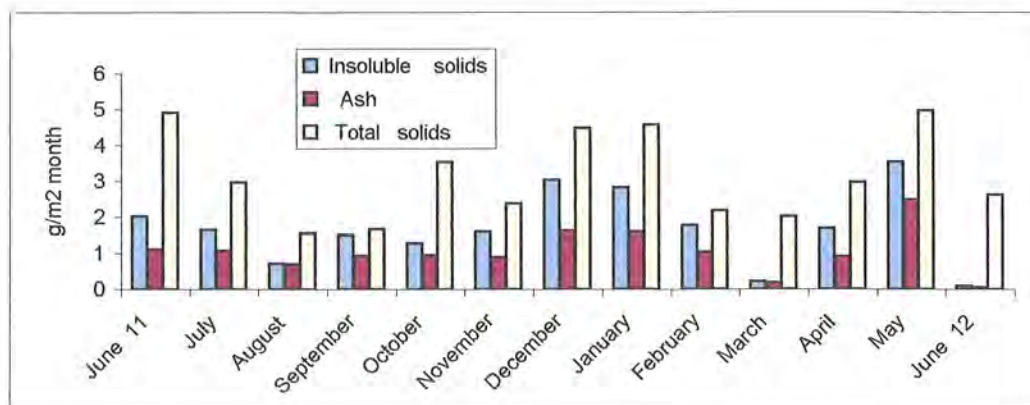
## Monthly Dust Monitoring Results

## Dust Monitoring

Maroota Site 2

Vuck's House

	Insoluble solids	Ash	Total solids
June 11	2.02	1.10	4.91
July	1.64	1.07	2.96
August	0.72	0.69	1.56
September	1.50	0.92	1.66
October	1.29	0.95	3.54
November	1.59	0.90	2.38
December	3.04	1.62	4.48
January	2.83	1.59	4.57
February	1.77	1.03	2.17
March	0.21	0.17	2.01
April	1.67	0.91	2.96
May	3.54	2.48	4.97
June 12	0.08	0.06	2.62







MATERIALS TECHNICAL SERVICES  
BORAL RESOURCES (NSW) PTY LTD  
ABN 51 000 756 507

Unit 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  
1774 Wisemanns Ferry Road Maroota NSW 2756

**FILE No.:** 250 / 12

**PROJECT:** Gravimetrical Dust Monitoring at Maroota for P.F. Formation for the month of June 2012

**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.:	130837	130838	130839	130840
Location:	Site 1	Site 2	Site 3	Site 4
Date sampled from:	1/6/2012	to	2/7/2012	

### RESULTS:

Insoluble Solids (g/m <sup>2</sup> month):	0.82	0.08	1.04	1.29
Ash (g/m <sup>2</sup> month):	0.56	0.06	0.75	0.99
Combustible Matter (g/m <sup>2</sup> month):	0.27	0.03	0.29	0.31
Soluble Matter (g/m <sup>2</sup> month):	5.53	2.54	1.00	1.60
Total Solids (g/m <sup>2</sup> month):	6.35	2.62	2.04	2.89
Volume of liquid in the gauge, mL:	1500	1600	1400	1400

Refer to attached graph.

Joshua Graham, File.

**M. Abdulnebe**

Approved Signatory \_\_\_\_\_  
Date 23-07-12 Serial No. 106974



ACCREDITED FOR  
TECHNICAL  
COMPETENCE

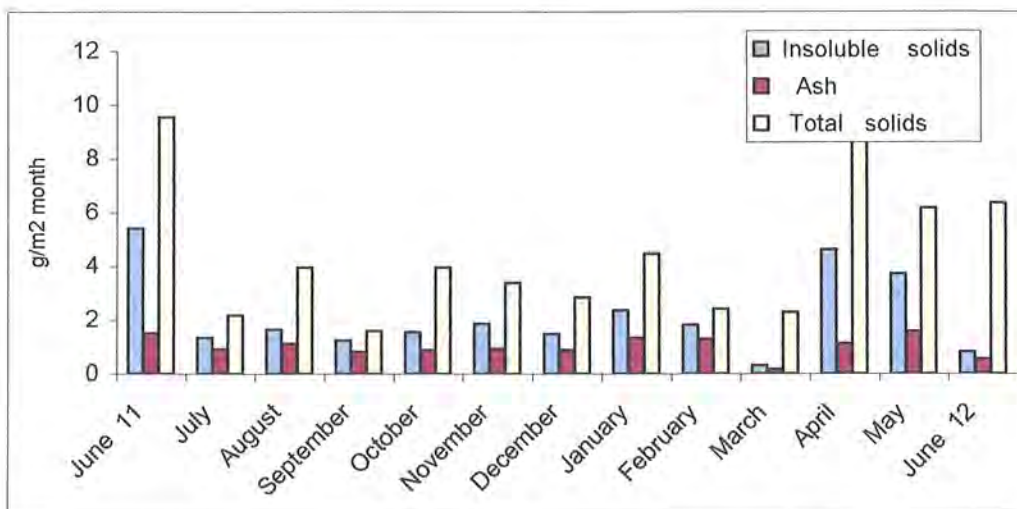
This document is issued in accordance with NATA's accreditation requirements.  
Accredited for compliance with ISO/IEC 17025

NATA Accredited Laboratory  
Number: 9968



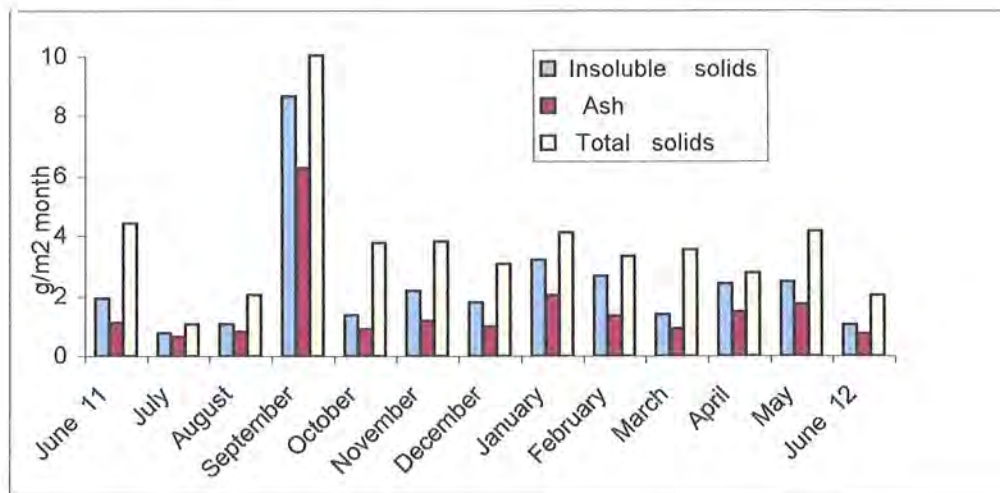
**Dust Monitoring**  
**Maroota Site 1**  
**Maroota Public School**

	Insoluble solids	Ash	Total solids
June 11	5.39	1.50	9.54
July	1.34	0.91	2.18
August	1.65	1.13	3.96
September	1.25	0.82	1.60
October	1.55	0.89	3.96
November	1.85	0.93	3.39
December	1.49	0.88	2.85
January	2.35	1.34	4.46
February	1.82	1.30	2.41
March	0.30	0.16	2.30
April	4.60	1.11	9.56
May	3.73	1.57	6.15
June 12	0.82	0.56	6.35



**Dust Monitoring**  
**Maroota Site 3**  
**Jurd's House**

	Insoluble solids	Ash	Total solids
June 11	1.92	1.12	4.41
July	0.78	0.65	1.07
August	1.07	0.81	2.05
September	8.67	6.28	10.05
October	1.38	0.90	3.77
November	2.19	1.17	3.81
December	1.79	0.99	3.08
January	3.21	2.04	4.11
February	2.67	1.35	3.34
March	1.39	0.92	3.53
April	2.42	1.48	2.78
May	2.49	1.74	4.15
June 12	1.04	0.75	2.04



## **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/m<sup>3</sup> 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

JUL 11

DATE	TEMP-MIN	TEMP-MAX	WIND-SPD	WIND-DIR	BAR	RAIN	CONDITION
1/07/2011	10		0-	ESE-	1034	1	CLOUDY
2/07/2011	11	12	0-0	ESE-S	1028.6	5	CLOUDY/RAIN
SUNDAY							
4/07/2011	8		5-	WNW-	1016.2		FINE
5/07/2011	11	16	0-17	W-W	1010.4		FINE/ CLOUDY
6/07/2011	-	-	-	-	-	-	-
7/07/2011	9	17	15-14	W-W	1008.4		FINE
8/07/2011	3	18	0-0	W-WNW	1024.5		FINE
9/07/2011	3	16	0-0	WNW-W	1021.2		FINE
SUNDAY							
11/07/2011	9	19	0-0	WNW-WNW	1015.7		FINE
12/07/2011	3	19	0-0	SSW-W	1023.6		FINE
13/07/2011	9	11	0-0	WNW-WNW	1018		CLOUDY
14/07/2011	4	17	-5	WNW-SSW	1025.3		CLOUDY
15/07/2011	5	11	0-0	ESE-ESE	1035.9		CLOUDY/RAIN
16/07/2011	9	12	0-0	ESE-ESE	1034.1		CLOUDY/RAIN
SUNDAY							
18/07/2011	8		0-	WNW-	1019	7	CLOUDY/RAIN
19/07/2011	5	14	0-7	SSW-S	1016.4	2	CLOUDY
20/07/2011	11		16-	SSE-	1013		
21/07/2011	10	10	0-0	SSW-SSW	1016	35	CLOUDY/RAIN
22/07/2011	10	11	0-11	SSW-S	1019.7	50	CLOUDY/RAIN
23/07/2011	8	12	5-Oct	SSE-S	1022.1		
SUNDAY							
25/07/2011	8		0-	N-	1018.5	12	CLOUDY
26/07/2011	6	19	0-0	WNW-SSW	1020.3		CLOUDY
-	-	-	-	-	-	-	-
28/07/2011	5	20	0-0	ESE-N	1030.1		FINE
29/07/2011	5	21	0-0	WNW-WNW	1028		FINE
30/07/2011	4	19	0-0	W-WNW	1026.9		FINE
SUNDAY							



# PF FORMATION WEATHER CHART

AUG 11

DATE	TEMP-MIN	TEMP-MAX	WIND-SPD	WIND-DIR	BAR	RAIN	CONDITION
1/08/2011	8		0-	NNE-	1024.6		FINE
2/08/2011	8	25	0-	NNE-WNW	1023.6		FINE
3/08/2011	13		0-	W-	1023.6		FINE
4/08/2011	9	26	0-0	N-WNW	1027.8		FINE
5/08/2011	11	22	0-0	WNW-WNW	1027.5		CLEAR/CLOUDY
6/08/2011	10	15	5 12	N-WNW	1022.4		CLOUDY
SUNDAY							
8/08/2011	7		0-	WNW-	1011	15	CLOUDY
9/08/2011	7	14	0-	WNW-SSW	1010.1		CLOUDY
10/08/2011		18	-10	W			CLOUDY
11/08/2011	6	19	0-9	W-SSW	1010.3		CLOUDY
12/08/2011	9	16	0-13	ESE-S	1018	2	RAIN
13/08/2011	6	17	0-0	E-W	1025	0	FINE
SUNDAY							
15/08/2011	6		0-	NNE-	1028.4	4	FINE
16/08/2011	8	17	0-0	ESE-S	1023.9		CLOUDY
17/08/2011							
18/08/2011	9	17	0-11	N-W	1008.2	7	CLOUDY
19/08/2011	6	13	0-8	SSW-S	1015		CLOUDY/RAIN
20/08/2011	11	13	0-9	SSE-SSE	1029.2		
SUNDAY							
22/08/2011	8		0-	ESE-	1038	85	CLOUDY
23/08/2011	10	17	0-0	ESE-SSW	1036.7	4	CLOUDY /RAIN
24/08/2011	7		0-	NNE-	1032.4		
25/08/2011	8	24	0-0	NNW-WNW	1027.8	3	FINE
26/08/2011	8	23	0-0	NNE-NNE	1025.9		FINE
27/08/2011	11	14	0-0	NNE-ESE	1023.4		FOG/CLOUDY
SUNDAY							
29/08/2011	9		0-	NNE-	1018.8		FINE
30/08/2011	11	18	0-0	SSW-NNE	1023.4		CLOUDY
31/08/2011	9	20	0-8	ESE-ESE	1025.1		CLOUDY

# PF FORMATION WEATHER CHART

SEP 11

DATE	TEMP-MIN	TEMP-MAX	WIND-SPD	WIND-DIR	BAR	RAIN	CONDITION
1/09/2011	11	20	0-	N-NNE	1025		CLOUDY
2/09/2011							
3/09/2011	7	19	0-5	SSE-NNW	1032.7		FINE
4/09/2011	SUNDAY						
5/09/2011	12		0-	NNE-	1027.9		CLOUDY
6/09/2011	13	25	0-0	N-WNW	1022.3		CLOUDY
7/09/2011							
8/09/2011	12	17	0-0	SSW-ESE	1022.3		CLOUDY
9/09/2011	13	14	0-0	WNW-WNW	1010.3	10	RAIN
10/09/2011	5	9	0-13	WNW-S	1012.7	8	FINE/CLOUDY
11/09/2011	SUNDAY						
12/09/2011	8		0-	SSW-	1024.1		CLOUDY
13/09/2011	5	22	0-8	NNE-WNW	1026.9		FINE
14/09/2011							
15/09/2011	11	22	0-0	SSE-N	1023.4		FINE
16/09/2011	10	27	0-10	SSW-W	1020		FINE
17/09/2011	12	22	0-0	SSW-N	1017.6		FINE
18/09/2011	SUNDAY						
19/09/2011	14		0-	ESE-	1021.9		CLOUDY
20/09/2011	20	24	0-15	WNW-SSW	1006.3		FINE/CLOUDY
21/09/2011	9	25	0-0	W-N	1021.3		FINE
22/09/2011	9	25	0-0	WNW-NNE	1026.4		FINE
23/09/2011	15	31	0-10	WNW-WNW	1018		FINE/CLOUDY
24/09/2011	15	17	0-0	ESE-ESE	1022.2		CLOUDY
25/09/2011	SUNDAY						
26/09/2011	10	19	0-0	SSW-ESE	1026.2	55	CLOUDY/RAIN
27/09/2011	9	20	0-0	NNE-NNE	1024.1		CLOUDY
28/09/2011	11	15	0-0	WNW-WNW	1017.3		CLOUDY
29/09/2011	14	17	0-18	WNW-WNW	1001	15	CLOUDY/RAIN
30/09/2011	12	19	0-5	W-W	1006.6	2	CLOUDY

# PF FORMATION WEATHER CHART

OCT 11

DATE	TEMP-MIN	TEMP-MAX	WIND-SPD	WIND-DIR	BAR	RAIN	CONDITION
1/10/2011	9	19	0-0	NNW-SSE	1007.6		CLOUDY
2/10/2011	SUNDAY						
3/10/2011	LABOUR DAY						
4/10/2011	8	18	0-	ESE-ESE	1024.8	25	CLOUDY
5/10/2011							
6/10/2011	12	16	0-0	NNE-NNE	1018.1	2	CLOUDY
7/10/2011	12	20	0-0	NNE-WNW	1014.6	3	FOG/CLOUDY
8/10/2011	14	19	0-15	SSW-N	1010.7		
9/10/2011	SUNDAY						
10/10/2011	9		0-	W-	1010.5	25	CLOUDY
11/10/2011	8	22	0-0	W-WNW	1011.7		CLOUDY
12/10/2011							
13/10/2011	14	20	0-7	S-WNW	1023.7		CLOUDY
14/10/2011	15	16	0-0	NNE-	1021.2		CLOUDY
15/10/2011	15	18	0-9	NNE-S	1011.1		FOG/CLOUDY
16/10/2011	SUNDAY						
17/10/2011	10		0-	S-	1030.5		CLOUDY
18/10/2011	9	23	0-0	N-S	1036		CLOUDY
19/10/2011							
20/10/2011	11	29	0-0	NNE-WNW	1029.3		FINE
21/10/2011	15	31	0-10	WNW-ESE	1024.5		CLOUDY
22/10/2011	17	25	0-0	ESE-WNW	1024.7		CLOUDY
23/10/2011	SUNDAY						
24/10/2011	19		0-	WNW-	1014.6		FINE/CLOUDY
25/10/2011	22	17	0-7	NNE-S	1007.8		CLOUDY/RAIN
26/10/2011							
27/10/2011	12	17	0-0	SSW-S	1025.1	10	FOG/RAIN
28/10/2011	13	24	0-0	NNE-SSW	1020.7	2	CLOUDY
29/10/2011	17	21	0-8	WNW-WNW	1011		CLOUDY
30/10/2011	SUNDAY						
31/10/2011	11		0-	ESE-	1021.1	4	FINE/CLOUDY

# PF FORMATION WEATHER CHART

NOV 11

DATE	TEMP-MIN	TEMP-MAX	WIND-SPD	WIND-DIR	BAR	RAIN	CONDITION
1/11/2011	14	20	0-8	ESE-	1021	1	CLOUDY
2/11/2011							
3/11/2011	16	17	0-0	ESE-E	1011.5		CLOUDY
4/11/2011	14	22	0-0	NNE-NNE	1019.9	2	CLOUDY
5/11/2011	13	23	0	ESE-WNW	1020.5		CLOUDY
SUNDAY							
7/11/2011	20	23	0-0	N-N	1012.3		CLOUDY
8/11/2011	19	36	0-19	S-WNW	1014.3		FOG/CLOUDY
9/11/2011							
10/11/2011	25	28	0-13	W-SSW	1009.4	5	CLOUDY
11/11/2011	17	25	0-0	E-NNE	1023.7		CLOUDY
12/11/2011	18	23	0-0	N-SSW	1012.3		
SUNDAY							
14/11/2011	18		0-	NNE-	1010.9		FOG/CLOUDY
15/11/2011	17	29	0-8	S-N	1018.6		FINE
16/11/2011	17		0-	NNE-	1015.1		
17/11/2011	16	18	0-0	N-N	1020.5	10	RAIN
18/11/2011	17	25	0-0	ESE-WNW	1019.2	6	FOG/CLOUDY
19/11/2011	18	30	0-	NNE-	1015.3	1	CLOUDY
SUNDAY							
21/11/2011	16		0-	E-	1017.9	4	FOG/CLOUDY
22/11/2011	17	19	0-8	WNW-ESE	1011.6	9	RAIN
23/11/2011							
24/11/2011	14	16	0-5	ESE-ESE	1026.3	60	RAIN
25/11/2011	14	18	0-0	SSW-WSW	1024.2	15	RAIN
26/11/2011	19	22	0-0	ENE	1008.1	40	RAIN
SUNDAY							
28/11/2011	16		0-	SSW-	1017.7		FINE
29/11/2011	18	30	0-0	NNE-NNE	1016.8		CLOUDY
30/11/2011							

# PF FORMATION WEATHER CHART

DEC 11

DATE	TEMP-MIN	TEMP-MAX	WIND-SPD	WIND-DIR	BAR	RAIN	CONDITION
1/12/2011	16	23	8-0	ESE-SSW	1021.1	NIL	CLOUDY
2/12/2011	13	20	0	ESE-ESE	1022.2	2	RAIN
3/12/2011	10	22	0-5	S-S	1021.8	1	FINE
SUNDAY							
5/12/2011	10	17	0-9	S-S	1022.2	6	CLOUDY/RAIN
6/12/2011	10	20	0	NNE-	1017.3	0	CLOUDY
7/12/2011	13	21	0-0	ESE-NNE	1017.4	1	CLOUDY
8/12/2011	15	21	0-0	s-ssw	1013.7	10	RAIN
9/12/2011	16	22	0-0	S-NNE	1014.9	12	RAIN/CLOUDY
10/12/2011	15	19	0-0	NNE-WNW	1011.8	1	CLOUDY
SUNDAY							
12/12/2011	17	16	0-8	SSW-S	1005.7	21	RAIN
13-Dec	15	20	0-12	S-SSW	1007.8	10	CLOUDY /RAIN
14/12/2011	15	18	0-7	SSE-	1017.2	NIL	
15/12/2011	15	21	0-0	ESE-NNE	1020		CLOUDY
16/12/2011	13	22	0-8	SSW-ESE	1021.3	NIL	CLOUDY
17/12/2011	16	20	0-0	ESE-ESE	1024.3	NIL	CLOUDY
SUNDAY							
19/12/2011	17	20	0-0	NNE-NNE	1011.6	NIL	CLOUDY/RAIN
20/12/2011	17	24	0	WNW-S	1011.7	15	CLOUDY/RAIN
21/12/2011	-	-	-	-	-	-	-
22/12/2011	18	20	0-0	SSW-N	1018.2	6	CLOUDY /RAIN
23/12/2011	18	22	0-	ESE-SSW	1015.1		CLOUDY/FOG
24/12/2011	SATURDAY						
25/12/2011	CHRISTMAS	DAY					
26/12/2011	BOXING DAY						
27/12/2011	TUESDAY						
28/12/2011	WEDNESDAY						
29/12/2011	THURSDAY						
30/12/2011	FRIDAY						
31/12/2011	SATURDAY						



# PF FORMATION WEATHER CHART

JAN 12

DATE	TEMP-MIN	TEMP-MAX	WIND-SPD	WIND-DIR	BAR	RAIN	CONDITION
1/01/2012	SUNDAY	NEW YEAR'S	DAY				
2/01/2012	MONDAY	PUBLIC	HOLIDAY	NEW	YEAR'S	DAY	
3/01/2012	18	32	0-0	NNE-NNE	1018.5	NIL	FINE
4/01/2012	19	38	0-5	SSW-	1011.1	NIL	FINE
5/01/2012	20	26	0-0	S-WNW	1017.7	NIL	CLOUDY
6/01/2012	19	20	0-4	ESE-ESE	1012.6	1	CLOUDY
7/01/2012	13		0-	ESE-	1016.5	NIL	CLOUDY
SUNDAY							
9/01/2012	22		0-	SSW-	1003.7	NIL	CLOUDY
10/01/2012	17	30	0-11	NNE-ESE	1009.7	NIL	CLOUDY
11/01/2012	21	27	0-15	NWW-	1002.9	NIL	
12/01/2012	13	22	0-5	S-NNE	1015	NIL	FINE
13/01/2012	12	27	0-10	NNE-WNW	1017.7	NIL	CLOUDY
14/01/2012	18	19	8-	ESE-ESE	1015.5	NIL	CLOUDY/RAIN
SUNDAY							
16/01/2012	17	24	0-0	NNE-NNE	1022.2	20	RAIN
17/01/2012	17	27	0-7	NNE-NNE	1023.7	10	CLOUDY/RAIN
18/01/2012	19	30	0-0	NNE-W	1017.9	NIL	CLOUDY
19/01/2012	20	28	0-13	N-ESE	1015.1	NIL	CLOUDY/FOG
20/01/2012	19	27	0-0	ESE-NNE	1017.2	NIL	CLOUDY
21/01/2012	20	21	0-0	N-ESE	1014.5	NIL	RAIN
SUNDAY							
23/01/2012	18	23	0-12	ESE-ESE	1022.5	4	CLOUDY
24/01/2012	17	23	0-0	ESE-SSW	1018.7	2	FOG/RAIN
25/01/2012	19	21	0-0	ESE-NNE	1013.7	10	FOG/RAIN
26/01/2012	AUSTRALIA	DAY					
27/01/2012	19	24	0-0	SSW-SSW	1016.2	35	RAIN
28/01/2012	18	23	0-0	ESE-ESE	1015.3		CLOUDY
SUNDAY							
30/01/2012	20		8-	NNE-	1002.3	10	CLOUDY RAIN
31/01/2012	24	26	0-0	N-ESE	1001.9		CLOUDY RAIN

# PF FORMATION WEATHER CHART

FEB 12

DATE	TEMP-MIN	TEMP-MAX	WIND-SPD	WIND-DIR	BAR	RAIN	CONDITION
1/02/2012	11	17	0-	SSE-	1015.7		
2/02/2012	17	17	0-0	ESE-SSE	1012	35	RAIN
3/02/2012	16	20	0-0	E-S	1007.1	35	RAIN
4/02/2012	17	21	0-0	SSW-S	1004.2		
SUNDAY							
6/02/2012	19		0-0	NNE-	999.9	30	FOG
7/02/2012	18	20	0-0	SSES	1006.3		RAIN
8/02/2012	17	22	0-0	ESE-ESE	1010.4	9	CLOUDY/RAIN
9/02/2012	17	22	0-0	ESE-N	1013.4		CLOUDY/RAIN
10/02/2012	18	23	0-0	N-NNE	1011.7	9	CLOUDY/RAIN
11/02/2012	18	25	0-5	SSW-WNW	1012.4	5	RAIN
SUNDAY							
13/02/2012	17		0-	ESE-	1017.7	10	RAIN
14/02/2012	17	22	0-0	ESE-SSW	1020.7	7	FOG/RAIN
15/02/2012	17	25	0-0	N	1019.1	7	FOG/CLOUDY
16/02/2012	16	27	0-0	NNE-N	1019.8		FINE/CLOUDY
17/02/2012	16	27	0-0	WNW-WNW	1017.4		FINE/CLOUDY
18/02/2012	18	28	0-0	S-W	1016.1		CLOUDY
SUNDAY							
20/02/2012	18		0-	WNW-	1011	40	CLOUDY
21/02/2012	17	25	0-7	SSW-S	1010.1	30	RAIN/CLOUDY
22/02/2012	17	25	0-	S	1015.1	2	SUNNY/CLOUDY
23/02/2012	16	30	0-4	NNE-N	1019.5		FINE/CLOUDY
24/02/2012	18	30	0-0	NNE-NNE	1021.6		FOG/CLOUDY
25/02/2012	17	26	0-5	NNE-	1022.7		FOG/CLOUDY
SUNDAY							
27/02/2012	20	31	0-0	NNE-	1016.3		CLOUDY
28/02/2012	23	31	0-0	N-WNW	1013		CLOUDY
29/02/2012	21	22	0-0	NNE-	1013.1		CLOUDY

# PF FORMATION WEATHER CHART

MAR 12

DATE	TEMP-MIN	TEMP-MAX	WIND-SPD	WIND-DIR	BAR	RAIN	CONDITION
1/03/2012	19	30	0-0	ESE-WNW	1008.6	20	FOG / RAIN
2/03/2012	16	18	0-0	W-ESE	1011.2	25	RAIN
3/03/2012	16		0-	ESE -	1020.9	NIL	RAIN
SUNDAY							
5/03/2012	20	27	0-0	ESE-	1011.5	NIL	CLOUDY
6/03/2012	18	23	0-0	ESE-ESE	1018.1	NIL	CLOUDY
7/03/2012	16	23	0-10	SW-	1018.1	NIL	CLOUDY
8/03/2012	15	21	0-14	SSW-W	1009.2	30	RAIN
9/03/2012	14	27	0-0	WNW-S	1009.8	25	FINE/CLOUDY
10/03/2012	15	28	0-0	W-SSE	1012	NIL	FINE
SUNDAY							
12/03/2012	18	23	0-7	N-	1019.3	NIL	CLOUDY
13/03/2012	15	26	0-0	NNE-NNE	1022.1	NIL	FINE
14/03/2012	16	26	0-	NNE-N	1020.4	NIL	CLOUDY
15/03/2012	19	29	0-0	NNE-NNE	1016.6	NIL	CLOUDY
16/03/2012	19	31	0-15	NNE-NNE	1012.1	NIL	CLOUDY
17/03/2012	20	18	0-7	NNE-ESE	1012.4	15	RAIN
SUNDAY							
19/03/2012	16	21	0-	S-SW	1023	10	RAIN
20/03/2012	16	24	0-0	S-NNE	1021.2	7	FOG /CLOUDY
21/03/2012	17	24	0-0	NNE-N	1011.3	NIL	CLOUDY
22/03/2012	17	19	11-0	ESE-S	1008.5	NIL	CLOUDY
23/03/2012	18	25	0-12	W-SSW	1003.8	NIL	FOG/FINE
24/03/2012	12	19	0-8	WNW-WNW	1012.4	NIL	FINE
SUNDAY							
26/03/2012	15	23	0-9	SSW-N	1023.6	NIL	CLOUDY
27/03/2012	15	28	0-0	WNW-S	1023.1	NIL	CLOUDY
28/03/2012	18	26	0-	NE-SSE	1024	NIL	CLOUDY
29/03/2012	15	28	0-9	NNE-SSW	1019.2	NIL	CLOUDY
30/03/2012	17	24	0-10	S-SW	1018.5	7	CLOUDY
31/03/2012	15	21	0-0	NNE-NNE	1018.8	NIL	FOG/FINE

# PF FORMATION WEATHER CHART

APR 12

DATE	TEMP-MIN	TEMP-MAX	WIND-SPD	WIND-DIR	BAR	RAIN	CONDITION
1/04/2012	SUNDAY						
2/04/2012	16	28	0-0	ESE-NNE	1017.8	NIL	FINE
3/04/2012	16	29	0-0	E-N	1016.6	NIL	FOG/CLOUDY
4/04/2012	16	29	0-8	NE-N	1016.6	NIL	
5/04/2012	17	26	0-0	NE-WNW	1021.2	NIL	FINE/CLOUDY
GOOD	FRIDAY						
EASTER	SATURDAY						
EASTER	SUNDAY						
EASTER	MONDAY						
10/04/2012	9	20	0-15	SSW-S	1025.2	NIL	FINE/CLOUDY
11/04/2012	9	21	0-20	SWW-S	1031.8	NIL	
12/04/2012	13	21	0-0	SW-WNW	1034.1	NIL	CLOUDY
13/04/2012	11	25	0-7	E-WNW	1032.8	NIL	FINE/CLOUDY
14/04/2012	13	22	0-7	NNE-WNW	1029.4	NIL	FINE/CLOUDY
SUNDAY							
16/04/2012	15	25	0-8	ESE-ESE	1024.2	NIL	CLOUDY
17/04/2012	16	15	0-10	ESE-S	1023.4	NIL	CLOUDY/RAIN
18/04/2012	16	18	0-0	ESE-ESE	1020.5	50	RAIN
19/04/2012	16	21	0-0	n-ssw	1019.9	47	CLOUDY
20/04/2012	18	27	0-0	SSW-N	1016.7	2	FOG/CLOUDY
21/04/2012	18	20	0-0	NNE	1015.1		FOG/CLOUDY
23/04/2012	18	18	0-0	NNE-WNW	1013.5	2	RAIN
24/04/2012	15	18	0-19	WNW-WNW	1012.7	7	FINE/CLOUDY
ANZAC	DAY						
26/04/2012	12	23	0-0	WNW-S	1018.5	NIL	FINE/CLOUDY
27/04/2012	11	24	0-0	ESE-ESE	1021.8	NIL	CLOUDY
28/04/2012	12	19	0-0	NNE-N	1022.8	NIL	CLOUDY
SUNDAY							
30/04/2012	11	20	0-0	S-E	1028.5	NIL	CLOUDY

# PF FORMATION WEATHER CHART

MAY 12

DATE	TEMP-MIN	TEMP-MAX	WIND-SPD	WIND-DIR	BAR	RAIN	CONDITION
1/05/2012	10	21	0-0	N-WNW	1028.4	NIL	FINE/CLOUDY
2/05/2012	10		0-	NW-	1022.9		
3/05/2012	13	24	0-0	SSW-NNE	1019.9	NIL	FOG/CLOUDY
4/05/2012	10	21	0-0	ESE-ESE	1020.9	NIL	CLOUDY/FINE
5/05/2012	8	19	0-0	ESE-SSW	1018.8	NIL	CLOUDY/FINE
SUNDAY							
7/05/2012	9	20	0-0	NNE-W	1019.9	NIL	CLOUDY
8/05/2012	7	25	0-0	W-W	1017.8	NIL	FINE
9/05/2012	9	26	0-0	NWW-	1019.4	NIL	FINE
10/05/2012	11	28	0-0	WNW-	1022.7	NIL	FINE
11/05/2012	12	27	0-0	NNE-WNW	1019.9	NIL	CLOUDY
12/05/2012	10	21	0-0	W-SSW	1017.5	NIL	FINE/CLOUDY
SUNDAY							
14/05/2012	5	18	0-0	WNW-SSW	1021.3	NIL	FINE
15/05/2012	5	20	0-10	S-ESE	1024.6	NIL	FINE
16/05/2012	-	-	-	-	-	-	-
17/05/2012	7	22	0-0	SSW-N	1024.5	NIL	FINE
18/05/2012	8	23	0-0	NNE-WNW	1025	NIL	FINE
19/05/2012	7		0-	NNE-	1023.1	NIL	FINE
SUNDAY							
21/05/2012	11	20	0-0	ESE-NW	1024.6	NIL	CLOUDY/FINE
22/05/2012	7	22	0-0	NNE-WNW	1023.1	NIL	FINE
23/05/2012	8	22	0-0	NNE-NW	1024.2	NIL	
24/05/2012	10	12	0-0	NNE-NNE	1021.3		CLOUDY/RAIN
25/05/2012	14	17	0-16	NNE-WNW	1013.7	10	RAIN
26/05/2012	9	17	0-7	WNW-WNW	1015	NIL	FINE
SUNDAY							
28/05/2012	6	20	0-0	N-SSW	1026.3	NIL	FINE
29/05/2012	11	16	0-7	ESE-ESE	1032.8	2	CLOUDY/RAIN
30/05/2012	11		0-	SSW-	1035		
31/05/2012	8	18	0-0	ESE-W	1034.1	6	CLOUDY



# PF FORMATION WEATHER CHART

JUN 12

DATE	TEMP-MIN	TEMP-MAX	WIND-SPD	WIND-DIR	BAR	RAIN	CONDITION
1/06/2012	10	15	0-0	W-NNE	1029.4	NIL	CLOUDY / RAIN
2/06/2012	12	14	0-0	SSW-SSW	1023.9	NIL	FOG / FINE
SUNDAY							
4/06/2012	12	12	0-0	S-ESE	1006.6	20	FOG /CLOUDY
5/06/2012	7	13	0-0	WNW-SSW	1000.1	NIL	FINE/CLOUDY
6/06/2012	9	11	0-13	SE-SE	1014.7	24	CLOUDY
7/06/2012	8	19	0-0	ESE-ESE	1022.8	2	CLOUDY
8/06/2012	4	19	0-0	SSW-S	1027.2	NIL	FOG /FINE
9/06/2012	4	16	0-0	S-ESE	1028.4	NIL	FOG /FINE
SUNDAY							
MONDAY	QUEEN'S	BIRTHDAY					
12/06/2012	11	20	0-0	SSW-S	1020.6	25	RAIN
13/06/2012	11	17	0-0	S-SSE	1021	NIL	FINE
14/06/2012	11	18	0-0	SSW-E	1018.4	10	FOG/CLOUDY
15/06/2012	11	20	0-8	WNW-NNE	1015.7	NIL	CLOUDY
16/06/2012	11	12	0-0	NNE-S	1017.5	NIL	RAIN
SUNDAY							
18/06/2012	6	21	0-0	WNW-SWW	1021.6	NIL	FINE
19/06/2012	3	20	0-12	SW-S	1020	NIL	FINE
20/06/2012	5	19	0-0	ESE-ESE	1023	NIL	FINE
21/06/2012	9	15	6-0	WNW-NNE	1015.7	NIL	CLOUDY
22/06/2012	15	14	0-0	WNW-N	1007.2	NIL	CLOUDY
23/06/2012	4	16	0-0	WSW-NNW	1023.9	NIL	FINE
SUNDAY							
25/06/2012	6	21	0-0	ESE-W	1029.9	NIL	FINE
26/06/2012	8	12	0-0	S-SW	1032.1	NIL	RAIN
27/06/2012	8	15	0-0	SWW-W	1030.1	NIL	FINE
28/06/2012	9	16	0-0	ESE-WNW	1027.1	6	CLOUDY
29/06/2012	10	19	0-4	WNW-N	1017.3	NIL	CLOUDY
30/06/2012	10	19	0-5	NNE-SW	1013	NIL	CLOUDY

## *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 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**.

In July 2011 URS Australia updated the map of the wet weather groundwater level for the site based on all available site specific groundwater monitoring data they have reviewed over the years. This map is in **Attachment 6B**.

From the wet weather groundwater levels URS Australia has prepared an updated Maximum Extraction Depth Map for the project and this is **Attachment 6C**.

## **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 67 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). A sediment trap system has now been built in front of the dam to pump the washplant sediment back into the washplant. The system is working well and minimal operational sediment now enters the clean water dam. The capacity is 50,000 cubic metres and was estimated to be using 67% at the time of inspection. Water can be balanced between the two sites as necessary. (**Attachment 2C – Photos 9 &14**)

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 2.5 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 6D**. The PH (4.9 to 6.2), electrical conductivity and oil and grease results were all within the expected ranges.

### ***Dewatering of water pits***

Of the commissioned ponds, Numbers 9 and 10 are currently in the tailings stream cycle with Numbers 5 (partially capped) 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.

The tailings pond in Area B has been capped and those previously in Area C are used for agriculture.

### ***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 m<sup>3</sup>).

### ***Significant site features, recharge areas and natural areas***

The main extraction area changes within the site but only impacts internal water flows. 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, Maroota

2012 Annual Groundwater Management Plan

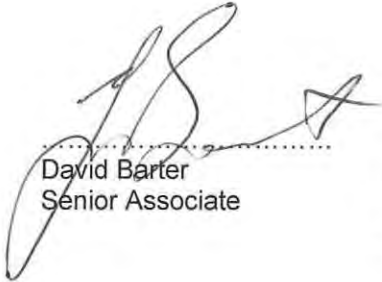
30 JUNE 2012

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Gary De Leeuw  
Principal

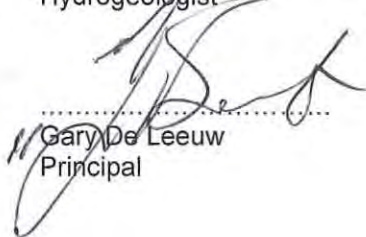
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30 June 2012

Reference:

43167955/Rep72

Status:

Hitchcock Road/01

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### Appendices

Appendix A	Water Quality Data Plots
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## Introduction

### 1.1 General

PF Formation (PFF) is required under the Development Approval conditions set for the Maroota Hitchcock Road property area (Figure 1) 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) 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 2011 to June 2012 also includes the monitoring data collected from 1996 to date for the Hitchcock Road site and for Portion 198.

## Groundwater Monitoring 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, i.e., PF198PB1 and PF198PB2 (Figure 1).

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 on the same day from 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 (PF167MW1, PF166 MW1, PFL2HitchMW1, PFP214MW1 and PF198PB1) 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 newly replaced head works did not include a sampling port. This matter will be addressed as soon as practicable.

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, Bicarbonate; and
- Oil and Grease.

#### 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

## 2 Groundwater Monitoring Facilities

with EC and rainfall records collected by PFF. An automated weather station has been installed by PFF in 2010.

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). Bore PFP214MW1 hydrograph is presented in Figure 6.

### 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). Bore PFL2HitchMW1 hydrograph is presented in Figure 7.

### 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 run-off 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.

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 Groundwater Monitoring Facilities**

### **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 weekly.

As indicated earlier, the pump in bore PF198PB2 was out of service between December 2009 and July 2011, when a new pump was installed in the bore.

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

## 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 watertables. 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 yearly rainfall for the year 2010 (1015.1mm), for the year 2011 (1115.4 mm) and for the first half of the year 2012 have been considerably above the long term average of 910.3 mm (to June 2012).

The rainfall data are reported from the BOM weather station No. 67014 located on Old Telegraph Road.

#### 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.

Since June 2011, after a period of slow decline, the water level in this bore has been rising steadily following the persistent above average rainfall. The current level is marginally above that recorded at this site in the year 2000.

#### 3.1.2 Bore PF166MW1

Since March 2011, the water level in this bore has been rising steadily, although it shows a levelling out trend since February 2012. Bore PF166MW1 taps a perched aquifer with variable responses to major and sustained rainfall events and periods. The current level is still below that recorded in the year 2002.

#### 3.1.3 Bore PFP214MW1

Bore PFP214MW1 taps the full thickness of the Maroota Sand at the southern edge of the quarry area. Since its installation in March 2009, the water level has shown a slow declining trend up to end of February 2011. Since that time the water level has risen in response to the above average rainfall.

#### 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.

The hydrograph shows that after an initial settlement period after drilling, the water level stabilised at an RL level of 189.6 m AHD without any significant response to the rainfall events until September 2012, after which time it shows a steady rise. Since May 2012 the water level appears to have levelled out.

### 3 Data Assessment

#### 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 2011 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.

As indicated earlier, the rainfall recorded at the BOM station since 2010 has been above the long term annual average of 910.3 mm. No water level has been recorded at this site during the 2011 - 2012 year, as the dam and the pump have been under water for most of the recording period due to the above average rainfall and resulting run-off experienced in the Maroota area during the 2001 and 2012 years (1115.4 and XXXX m respectively). It should be noted that the quarry area is internally draining and, therefore, collects all incident rainfall on the site.

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 also become available 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 (March 1996 to January 1999 for bore PF167MW1 and March 1998 to January 1999 for bore PF166MW1), 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.

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 3-5 and 3-6 and have been plotted in the graphs

### 3 Data Assessment

presented in Appendix A. However, as mentioned earlier, a sample could not be collected from bore PF198PB2 during the recent monitoring events.

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 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 the 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 site monitoring 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 <sub>3</sub>	mg/L	<1	<1	<1	<1	<1	<1	<1	<1	<1	1	<1	<1	<1
Sulphate, SO <sub>4</sub>	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	22.6.11	20.6.12				
pH		5.42	4.32	4.27	4.88	5.29	4.00	4.30	5.3	4.39				
Electrical Conductivity, EC	µS/cm	215	205	199	188	161	177	190	170	174				
Total Dissolved Solids, TDS	mg/L	137	141	119	76	100	104	111	101	112				
Calcium, Ca	mg/L	5	4	4	2	6	5	3	4	7				
Magnesium, Mg	mg/L	4	4	4	3	5	4	3	4	4				
Sodium, Na	mg/L	28	25	23	16	13	14	15	18	12				
Potassium, K	mg/L	3	3	3	2	4	4	2	4	4				
Bicarbonate, HCO <sub>3</sub>	mg/L	2	1	<1	<1	<1	<1	2	2.4	<1				
Sulphate, SO <sub>4</sub>	mg/L	13	10	6	10	30	22.6	17.1	18	28				
Chloride, Cl	mg/L	56.6	57.4	53.1	36.1	26.4	34.8	39.9	29	22				
Oil and Grease	mg/L	<5	<5	<5	<5	<5	<5	<5	<5	<5				

### 3 Data Assessment

**Table 3-2 Bore PF166MW1 Chemical Analyses Summary**

<b>ANALYTE</b>	<b>Unit</b>													
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 <sub>3</sub>	mg/L	<1	<1	<1	<1	<1	<1	<1	<1	<1	1	<1	<1	<1
Sulphate, SO <sub>4</sub>	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	22.6.11	20.6.12				
pH					4.76		3.58	4.06	4.22	4.08				
Electrical Conductivity, EC	µS/cm	DRY	DRY	DRY	163	NA	240	247	261	229				
Total Dissolved Solids, TDS	mg/L				98		140	141	172	124				
Calcium, Ca	mg/L						<1	<1	1	1				
Magnesium, Mg	mg/L						4	4	6	5				
Sodium, Na	mg/L						26	24	24	19				
Potassium, K	mg/L						2	2	3	3				
Bicarbonate, HCO <sub>3</sub>	mg/L						<1	<1	<1	<1				
Sulphate, SO <sub>4</sub>	mg/L						2.21	1.77	1	1				
Chloride, Cl	mg/L						49.1	56.3	53	43				
Oil and Grease	mg/L						<5	<5	<5	<5				



### 3 Data Assessment

**Table 3-3 Bore PFL2HitchMW1 Chemical Analyses Summary**

ANALYTE	Unit	3.7.2009	16.6.2010	22.6.2011	20.6.2012
Date		3.7.2009	16.6.2010	22.6.2011	20.6.2012
pH		3.96	4.1	4.1	4.03
Electrical Conductivity, EC	µS/cm	182	154	167	195
Total Dissolved Solids, TDS	mg/L	84	88	110	99
Calcium, Ca	mg/L	1	<1	<1	<1
Magnesium, Mg	mg/L	2	2	2	2
Sodium, Na	mg/L	19	16	22	22
Potassium, K	mg/L	2	<1	<1	<1
Bicarbonate, HCO <sub>3</sub>	mg/L	<1	<	<1	<1
Sulphate, SO <sub>4</sub>	mg/L	7.88	4.06	5	1
Chloride, Cl	mg/L	40.3	36.9	32	43
Oil and Grease	mg/L	<5	<5	<5	<5

### 3 Data Assessment

**Table 3-4 Bore PFP214MW1 Chemical Analyses Summary**

ANALYTE		Unit			
Date		3.7.2009	16.6.2010	22.6.2011	20.6.2012
pH		4.19	4.16	4.31	4.27
Electrical Conductivity, EC	µS/cm	168	164	158	179
Total Dissolved Solids, TDS	mg/L	100	96	88	103
Calcium, Ca	mg/L	<1	<1	<1	<1
Magnesium, Mg	mg/L	6	5	4	6
Sodium, Na	mg/L	18	15	18	17
Potassium, K	mg/L	1	<1	1	<1
Bicarbonate, HCO <sub>3</sub>	mg/L	<1	<1	<1	<1
Sulphate, SO <sub>4</sub>	mg/L	1.90	<0.5	<1	<1
Chloride, Cl	mg/L	24.3	23.8	34	24
Oil and Grease	mg/L	<5	<5	<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 <sub>3</sub>	mg/L	13	29	22	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Sulphate, SO <sub>4</sub>	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	22.6.11	20.6.12				
pH		5.22	5.74	5.16	NA	4.59	3.94	4.43	5.52	5.72				
Electrical Conductivity, EC	µS/cm	157	158	155		144	174	163	170	170				
Total Dissolved Solids, TDS	mg/L	105	115	98		85	83	88	102	99				
Calcium, Ca	mg/L	1	2	1		<1	1	<1	2	2				
Magnesium, Mg	mg/L	2	4	3		2	2	2	4	3				
Sodium, Na	mg/L	23	21	20		18	19	16	21	18				
Potassium, K	mg/L	2	2	2		1	2	1	2	2				
Bicarbonate, HCO <sub>3</sub>	mg/L	1	12	5		<1	<1	<1	3.7	9.8				
Sulphate, SO <sub>4</sub>	mg/L	8	6	2		10	9.31	6.89	6	6				
Chloride, Cl	mg/L	47.1	43.4	43.8		31.1	38.8	41.1	36	32				
Oil and Grease	mg/L	<5	5	<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 <sub>3</sub>	mg/L	23	33	19	NA	4	3	13	8	16	<1	<1	9	2
Sulphate, SO <sub>4</sub>	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	22.6.11	20.6.10				
pH		6.43	5.3	5.46	4.37	5.25	4.50	NA	NA	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 <sub>3</sub>	mg/L	14	7	24	<1	24.4	9.2							
Sulphate, SO <sub>4</sub>	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. Due to the above average rainfall over the last two years, no pumping has been necessary from this source. (The licensed limit for the Portion 167 dam is 50 ML/year).

**Table 3-7 Portion 167 Dam Annual Pumpage Records**

<b>YEAR</b>	<b>TOTAL, ML</b>
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
1 July 2010 – 30 June 2011	48.9
1 July 2011 – 30 June 2012	No pumpage

### 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 2011 to June 2012 are tabulated in Table 3-8 below. The total pumpage of 23 ML for the year has been significantly below the combined annual allocation of 60 ML. This lower consumption rate is due to the non-operational status of bore PF198PB2 for part of the year, above average rainfall and overall improved efficiency of the plant.

**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 2009 – 30 June 2010*	Bore PF198PB1	9.5
	Bore PF198PB2**	8.1
1 July 2010 – 30 June 2011*	Bore PF198PB1	11.8
	Bore PF198PB2	NA
1 July 2011 – 30 June 2012*	Bore PF198PB1	9.8
	Bore PF198PB2	13.2

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



## 4 Conclusions

### Conclusions

#### 4.1 Conclusions

The assessment of the data collected on the groundwater levels and quality in the Maroota Hitchcock Road site, 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.
- water quality in the Maroota Sand aquifer varies, albeit marginally, with rainfall recharge.
- no pumpage has occurred from the dam in Portion 167 for the year to the end of June 2012 as a result of the site having remained under water for most of the recording period.
- records indicate that the water level in the dam recovers rapidly upon cessation of pumping.
- groundwater pumpage from the deep water supply bores in Portion 198 (11.8 ML) has been effected only from bore PF198PB1, as the second production bore PF198PB2 has been out of operation since December 2009. The pump in this bore has been replaced in July 2011.
- the chemical composition 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 an adverse impact upon the groundwater sustainability, and meets the DA Approval Conditions.

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

## Limitations

### 1.1 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 contract dated 18 June 2012.

The methodology adopted and sources of information used by URS are outlined in this the Report.

Where this report indicates that information has been provided to URS by third parties, URS has made no independent verification of this information unless required as part of the agreed scope of work. URS assumes no liability for any inaccuracies in or omissions to that information.

This Report was prepared between 26 June 2012 and 30 June 2012. The information in this report is considered to be accurate at the date of issue and is in accordance with conditions at the site at the dates sampled. Opinions and recommendations presented herein apply to the site existing at the time of our investigation and cannot necessarily apply to site changes of which URS is not aware and has not had the opportunity to evaluate. This document and the information contained herein should only be regarded as validly representing the site conditions at the time of the investigation unless otherwise explicitly stated in a preceding section of this report. 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 uniformity of conditions and on the frequency and method of sampling 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.

## 5 Limitations

Except as required by law, no third party may use or rely on this Report unless otherwise agreed by URS in writing. Where such agreement is provided, URS will provide a letter of reliance to the agreed third party in the form required by URS.

To the extent permitted by law, URS expressly disclaims and excludes liability for any loss, damage, cost or expenses suffered by any third party relating to or resulting from the use of, or reliance on, any information contained in this Report. URS does not admit that any action, liability or claim may exist or be available to any third party.

URS does not represent that this Report is suitable for use by any third party.

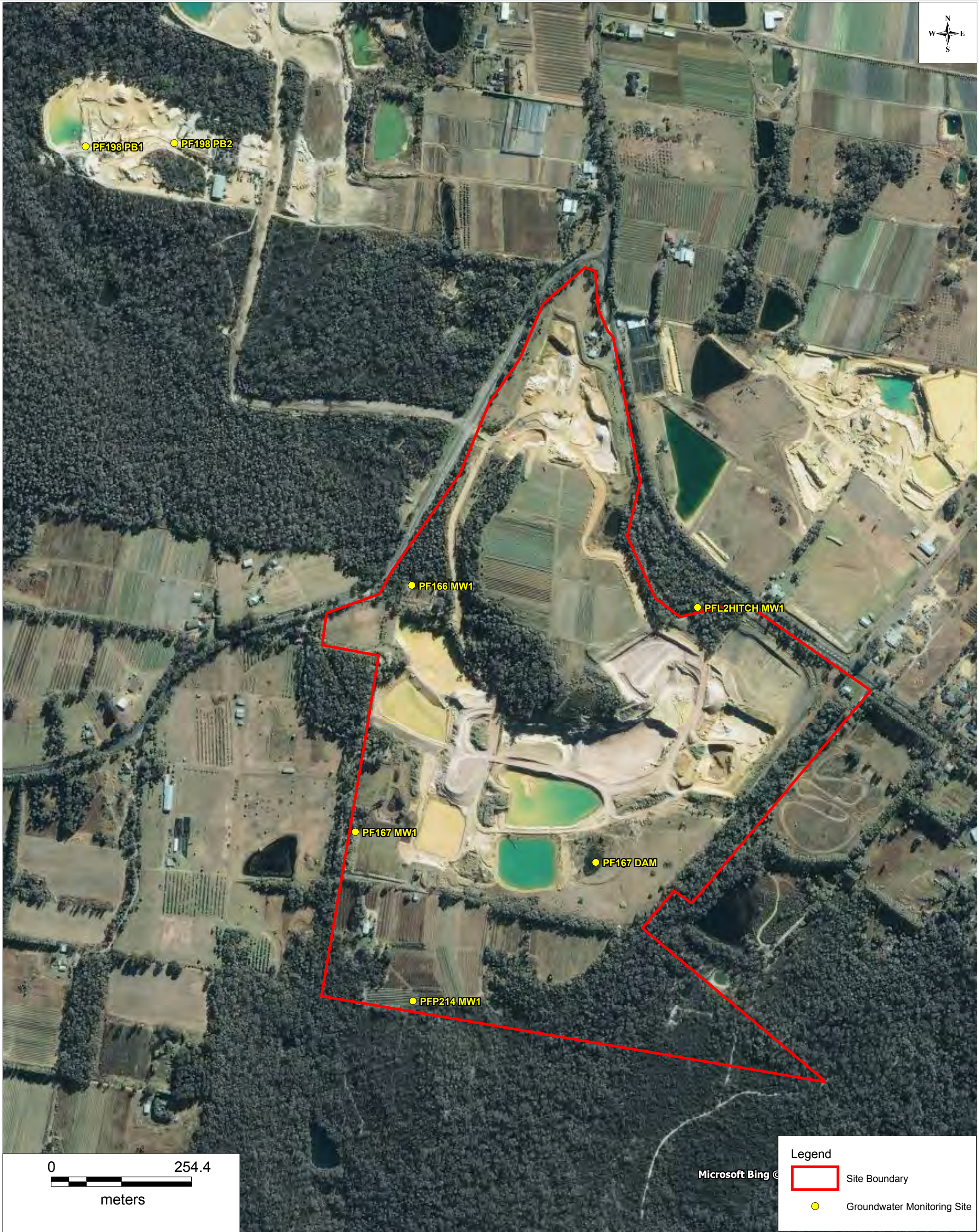
Except as specifically stated in this section, URS does not authorise the use of this Report by any third party.

It is the responsibility of third parties to independently make inquiries or seek advice in relation to their particular requirements and proposed use of the relevant property.

Any estimates of potential costs which have been provided are presented as estimates only as at the date of the Report. Any cost estimates that have been provided may therefore vary from actual costs at the time of expenditure.

## Figures





Source: Aerial imagery from Bing Maps © 2010 Microsoft Corporation and its data suppliers. Whilst every care is taken by URS to ensure the accuracy of the digital data, URS makes no representation or warranties about its accuracy, reliability, completeness, suitability for any particular purpose and disclaims all responsibility and liability (including without limitation, liability in negligence) for any expenses, losses, damages (including indirect or consequential damage) and costs which may be incurred as a result of data being inaccurate in any way for any reason. Electronic files are provided for information only. The data in these files is not controlled or subject to automatic updates for users outside of URS.

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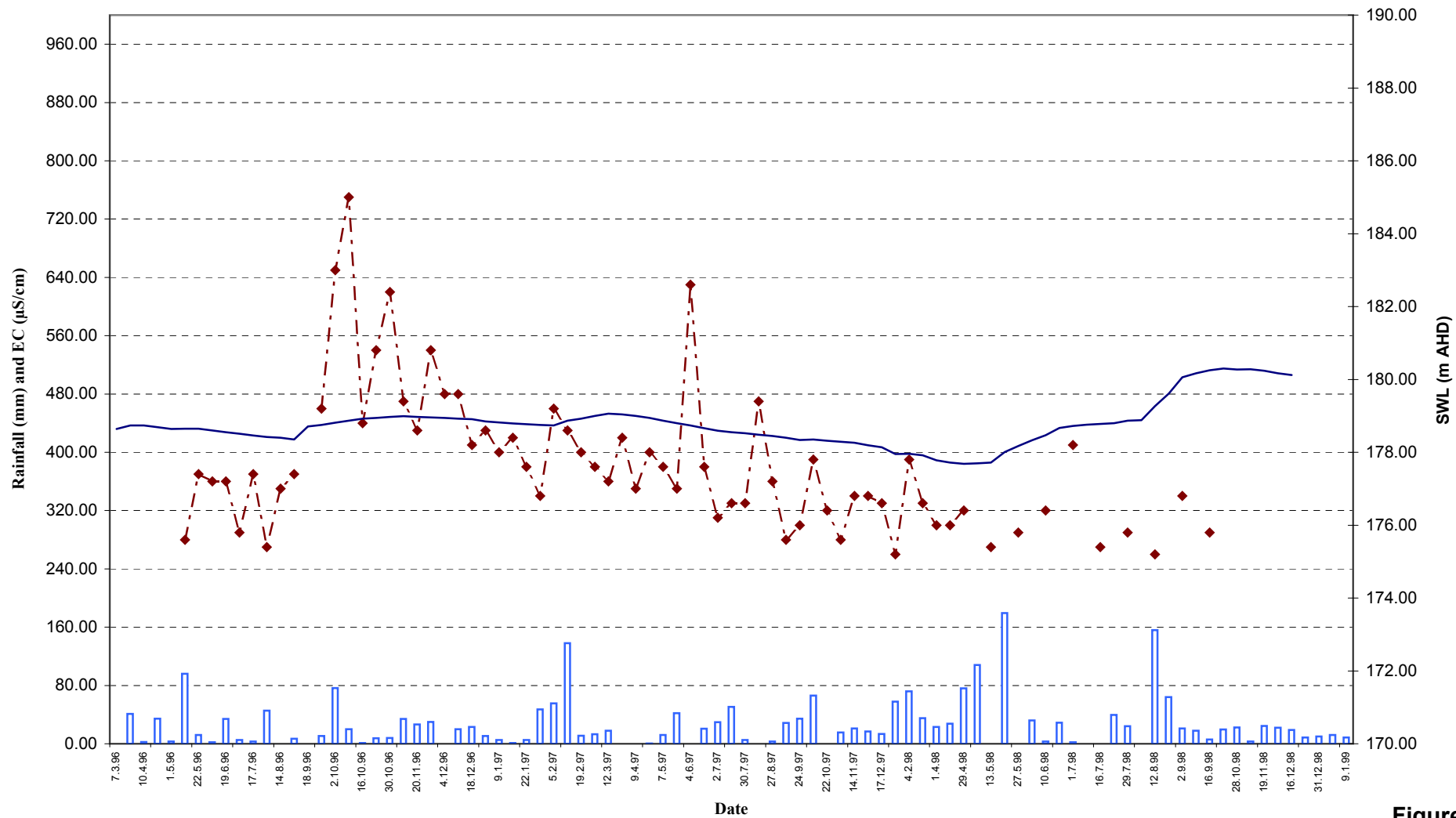
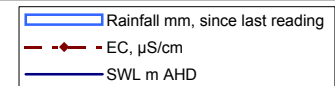
HITCHCOCK ROAD, SAND EXTRACTION  
AND REHABILITATION PROJECT

HITCHCOCK ROAD  
SITE LOCALITY PLAN





**P.F.FORMATION**  
**Bore PF167MW1 Groundwater Monitoring Data**



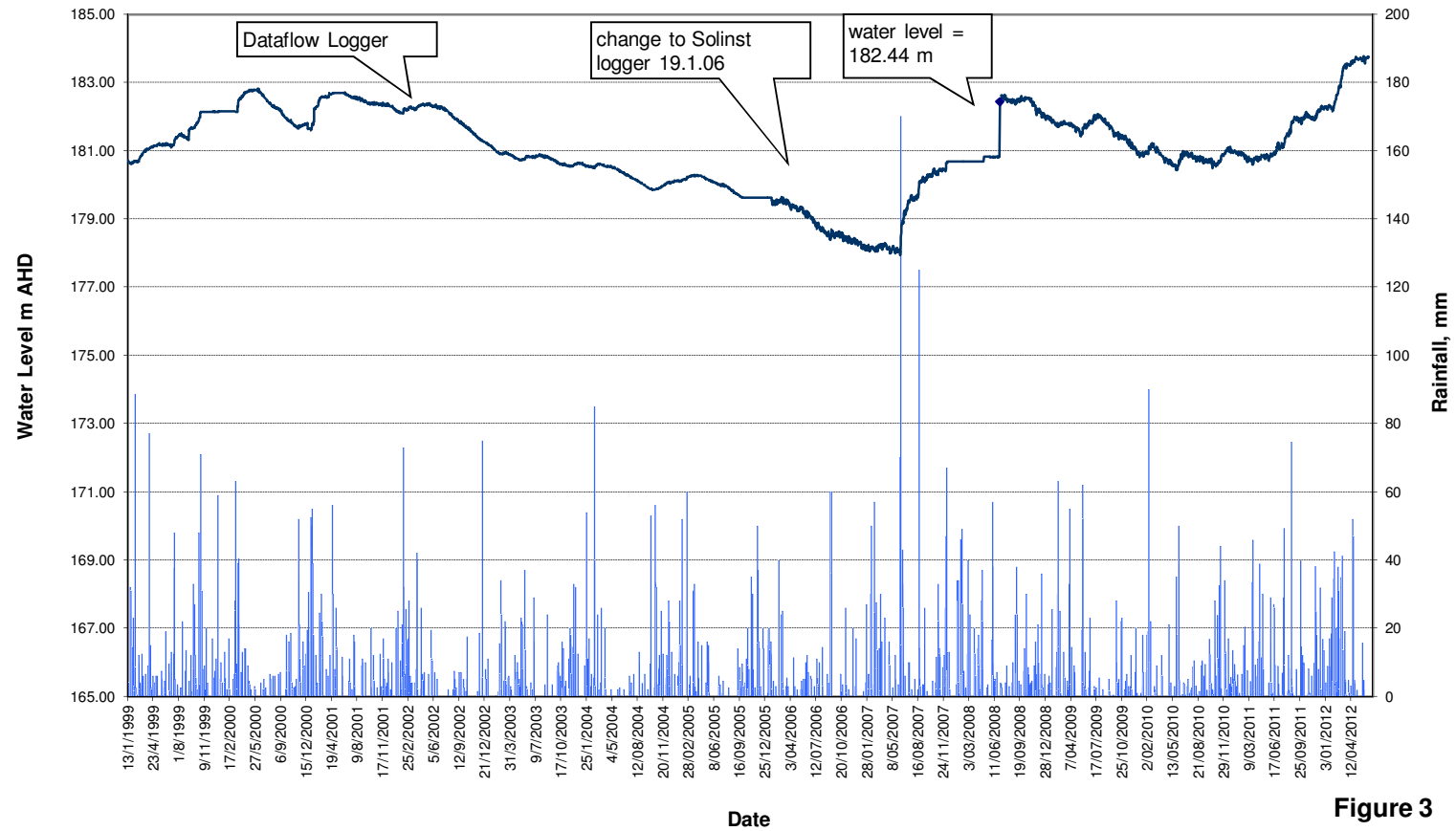
**Figure 2**





**PF FORMATION**  
**Bore PF167MW1 Groundwater Monitoring Data**

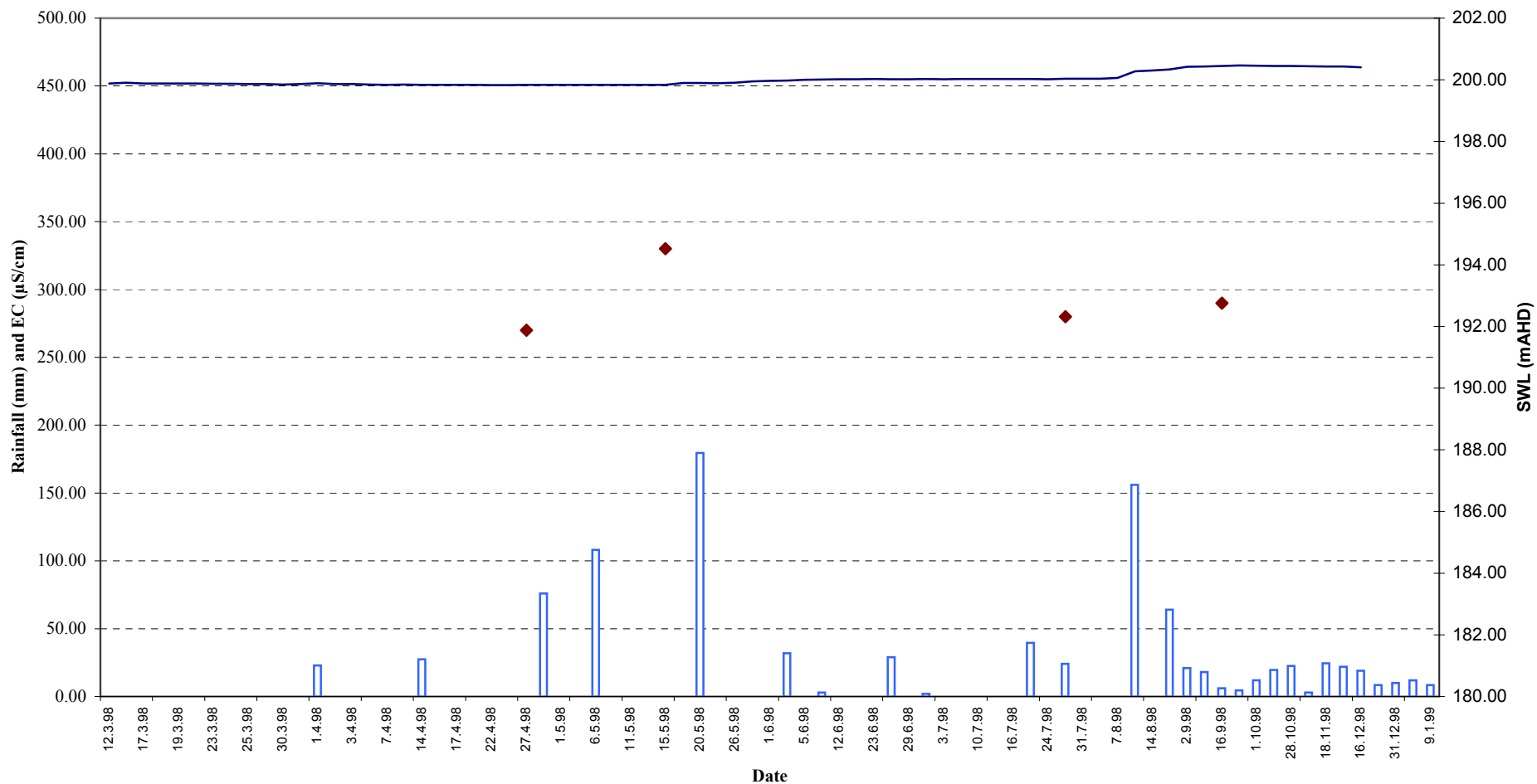
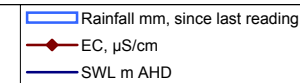
— Rainfall, mm  
— Water level m AHD



**Figure 3**



**PF FORMATION**  
**PF166MW1 Groundwater Monitoring Data**

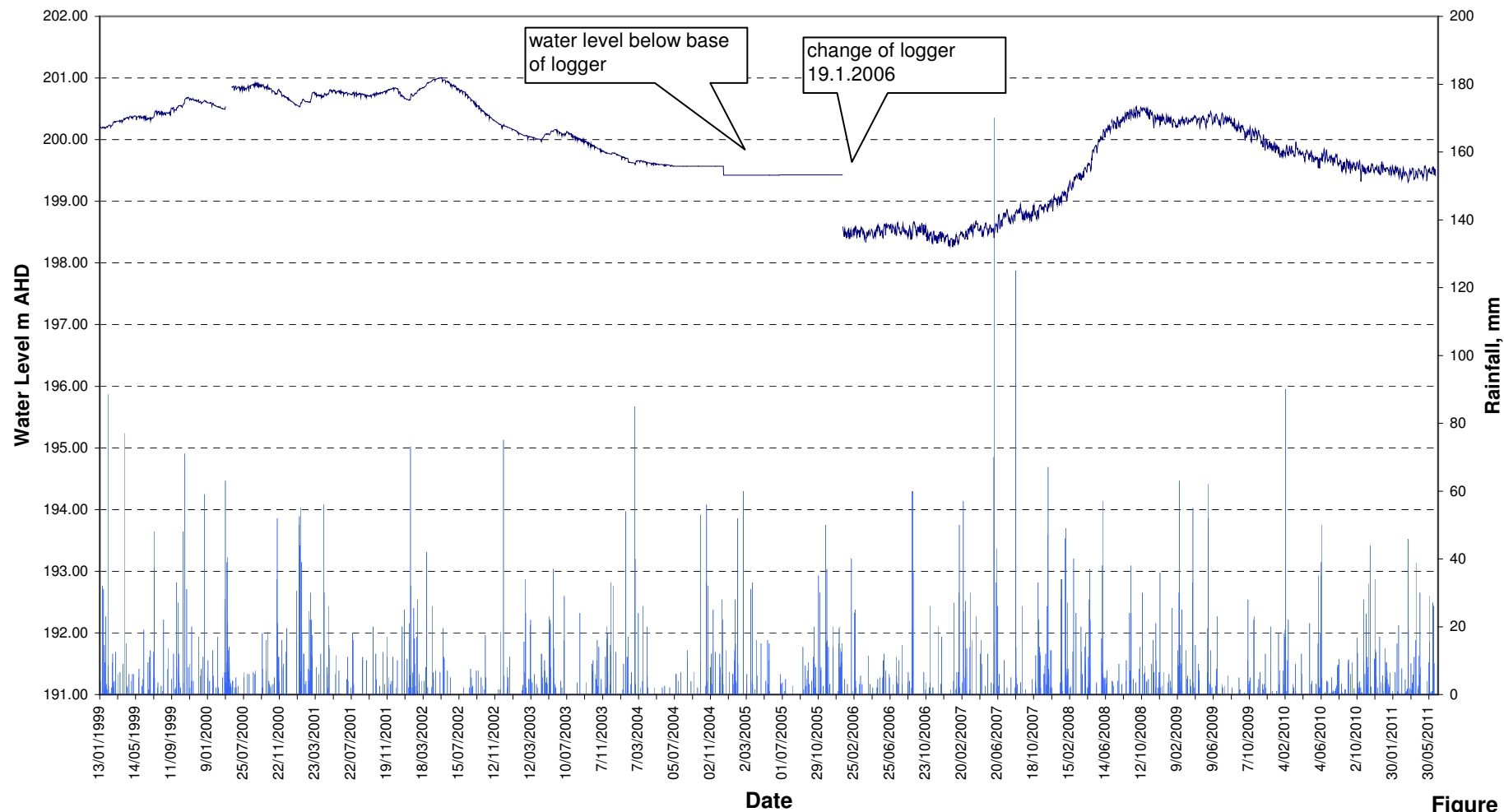


**Figure 4**



**PF FORMATION**  
**Bore PF166MW1 Groundwater Monitoring Data**

□ Rainfall, mm  
— Water Level m AHD

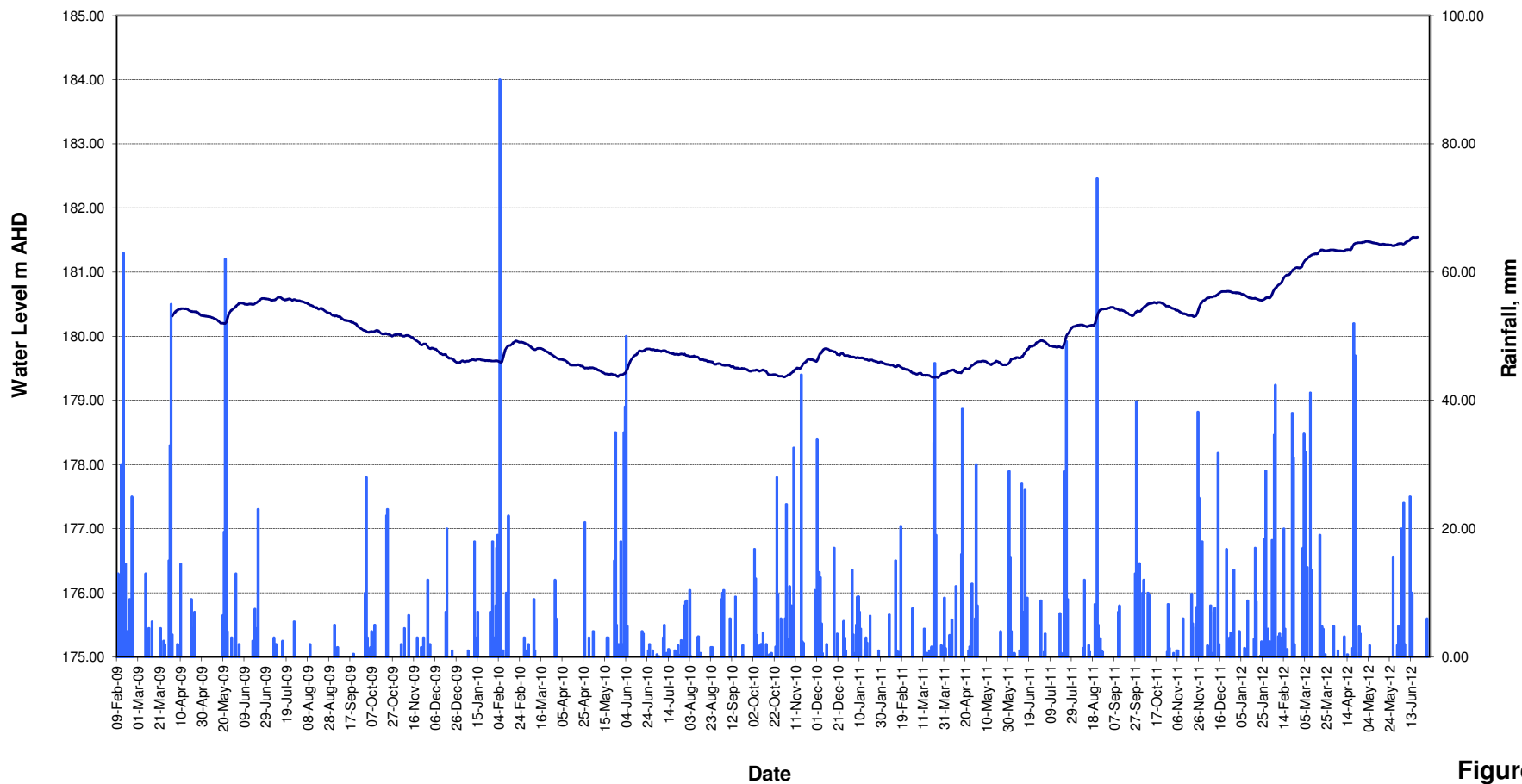


**Figure 5**



**PF FORMATION**  
**Bore PFP214MW1 Groundwater Monitoring Data**

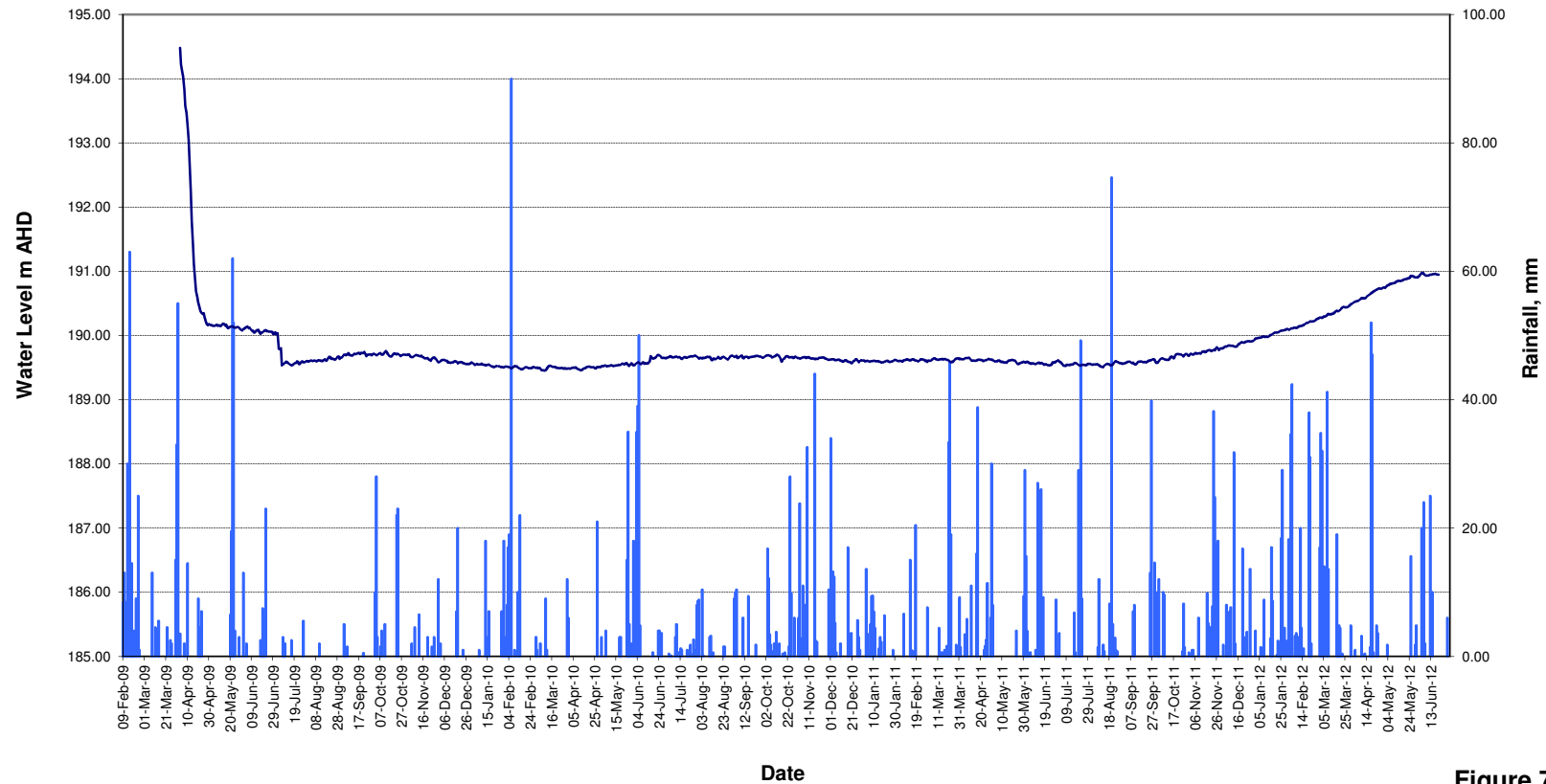
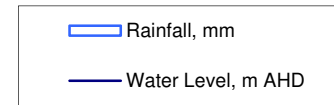
- Rainfall, mm
- Water Level, m AHD



**Figure 6**



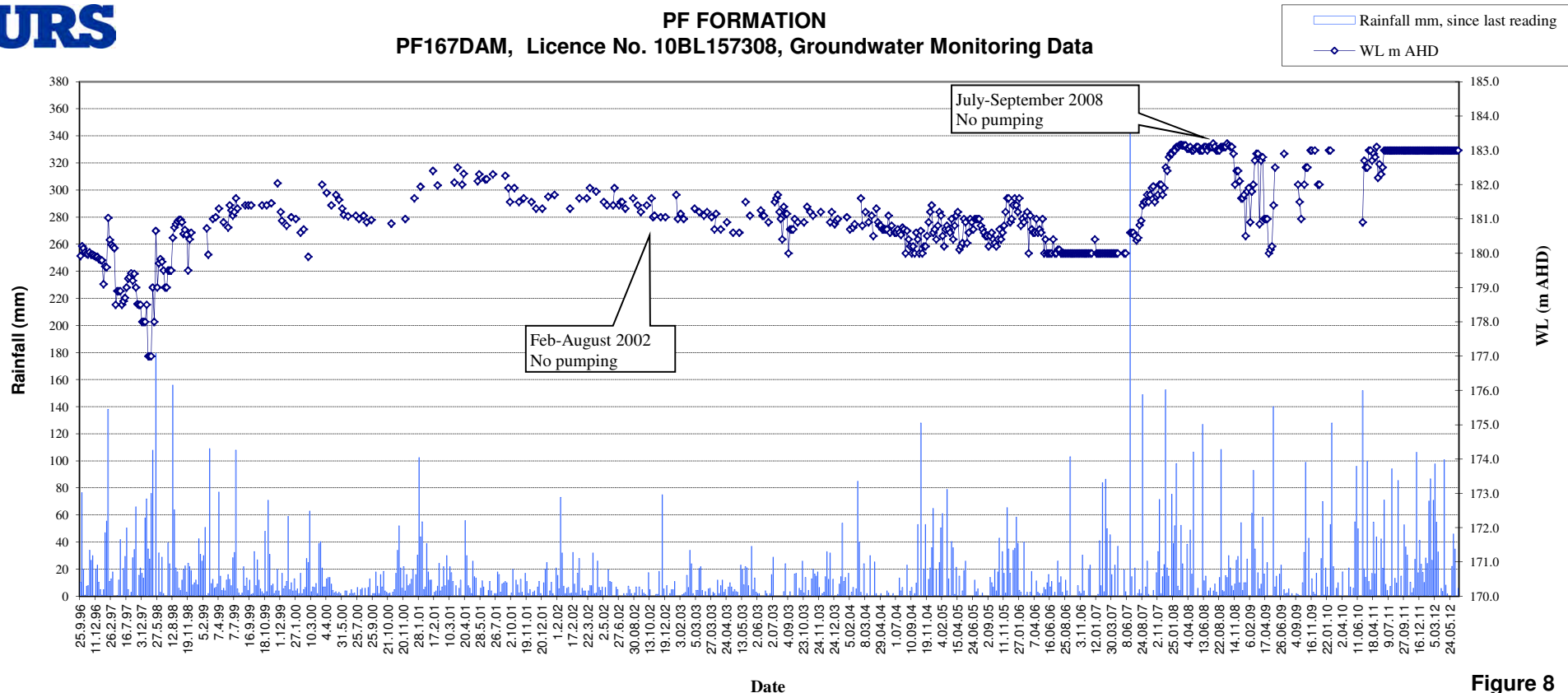
**PF FORMATION**  
**Bore PFL2HitchMW1 Groundwater Monitoring Data**



**Figure 7**



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



**Figure 8**





# PF FORMATION PF167DAM Monthly Pumpage Records

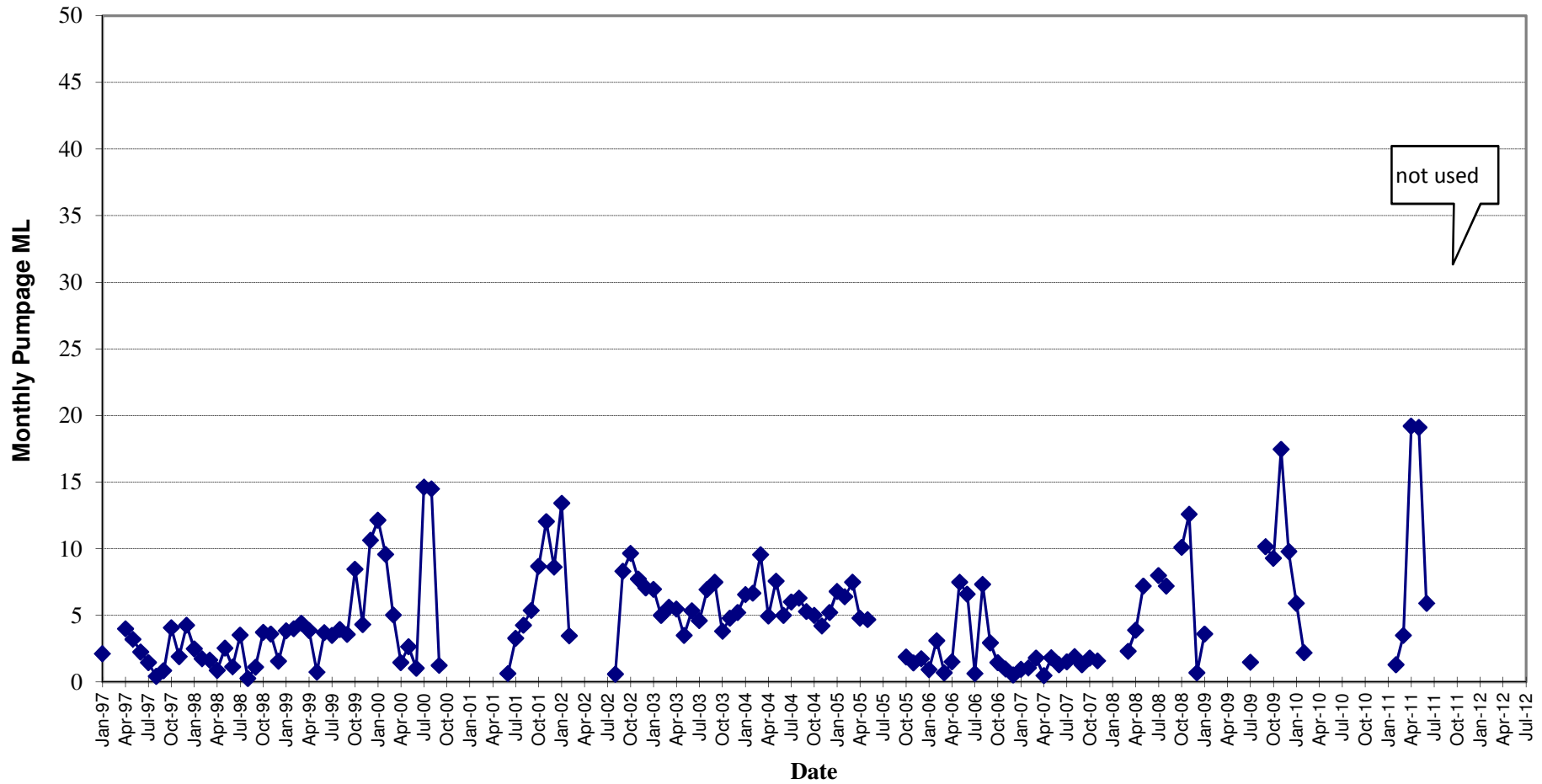


Figure 9

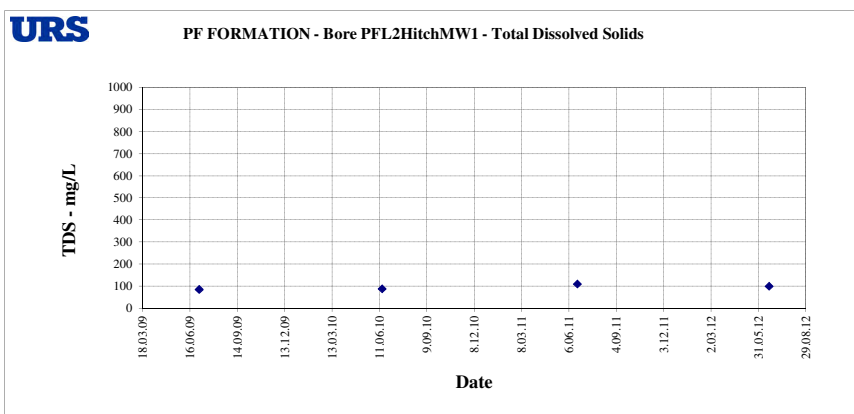
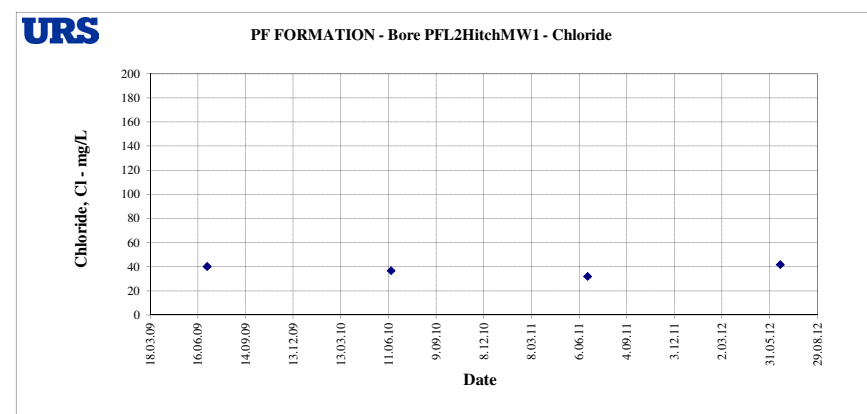
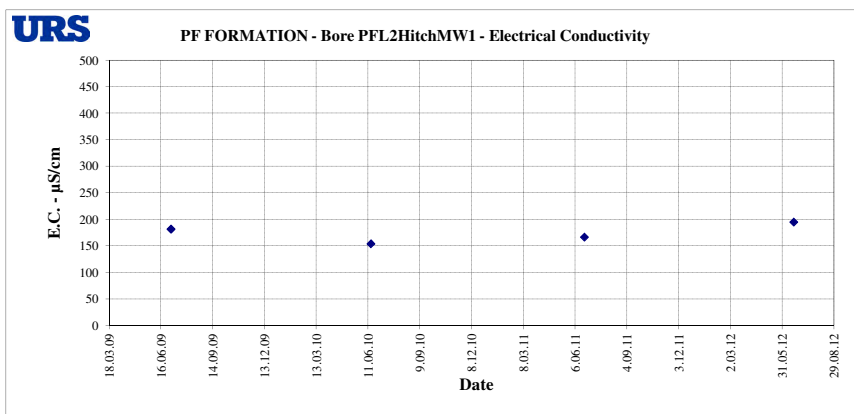
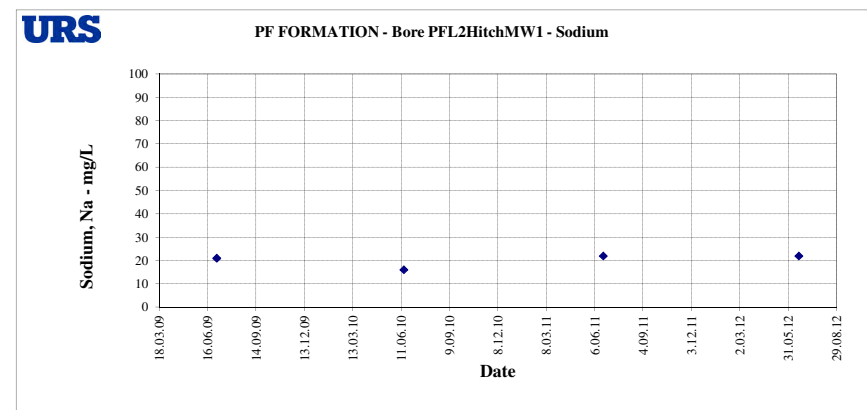
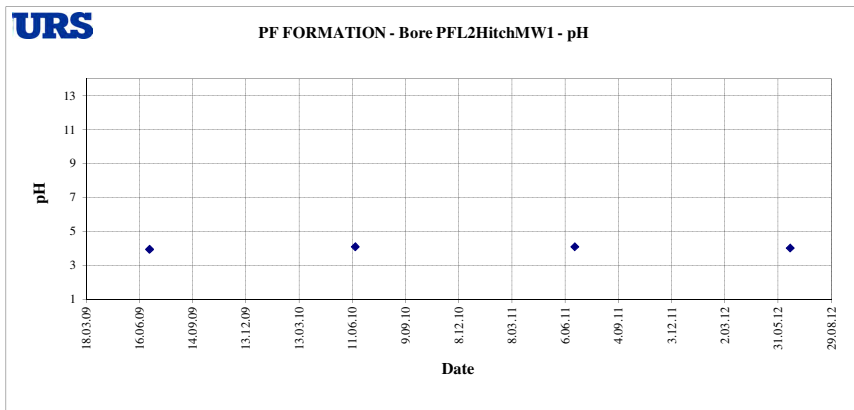
## Appendix A Water Quality Data Plots

**PF FORMATION - MAROOTA**  
**BORE PFL2HitchMW1 GROUNDWATER ANALYTICAL SUMMARY**

Analysis	Units	LOR	3.07.09	16.06.10	22.06.11	20.06.12
pH		0.01	3.96	4.1	4.1	4.03
Electrical Conductivity	µS/cm	1	182	154	167	195
Total Dissolved Solids	mg/L	1	84	88	110	99
Calcium	mg/L	1	<1	<1	<1	<1
Magnesium	mg/L	1	2	2	2	2
Sodium	mg/L	1	21	16	22	22
Potassium	mg/L	1	<1	<1	<1	<1
Bicarbonate	mg/L	1	<1	<1	<1	<1
Sulphate	mg/L	1	7.88	7.06	5	4
Chloride	mg/L	1	40.3	36.9	32	42
Oil and Grease	mg/L	5	<5	<5	<5	<5

LOR = Limit of Reporting

Average EC = 175 µS/cm  
Average TDS = 95 mg/L  
Average pH = 4.05

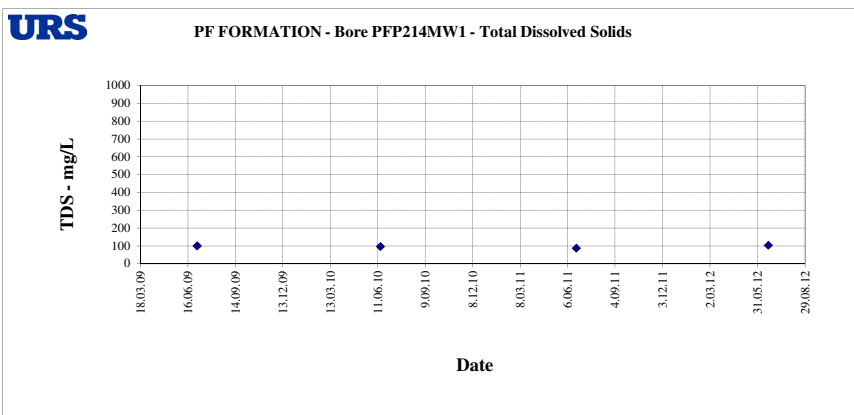
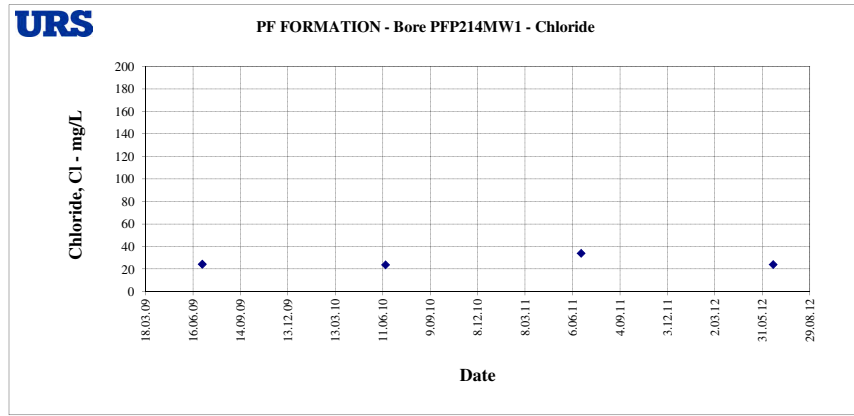
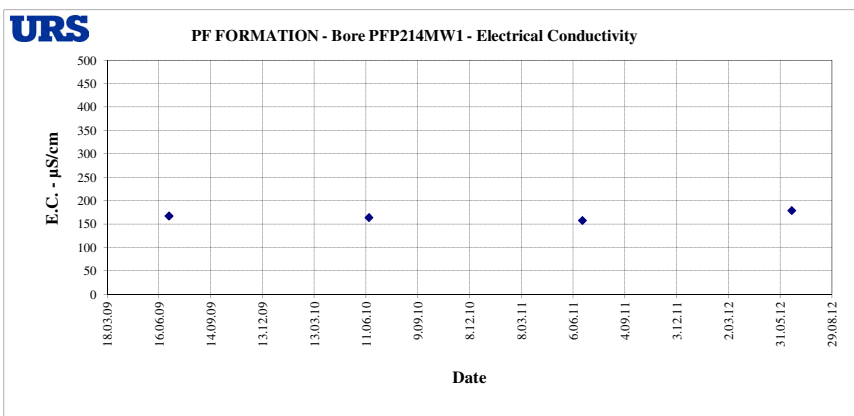
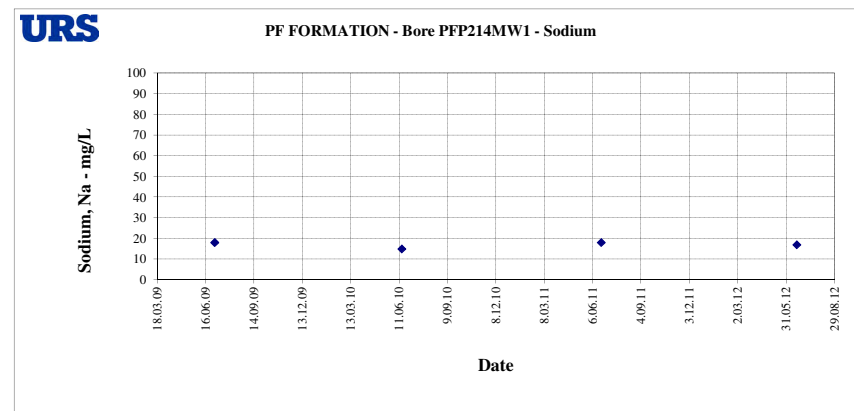
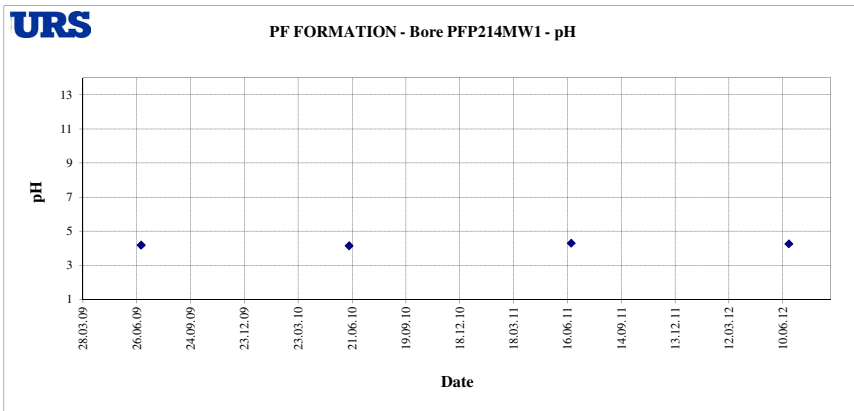


**PF FORMATION - MAROOTA**  
**BORE PFP214MW1 GROUNDWATER ANALYTICAL SUMMARY**

Analysis	Units	LOR	3.07.09	16.06.10	22.06.11	20.06.12
pH		0.01	4.19	4.16	4.31	4.27
Electrical Conductivity	µS/cm	1	168	164	158	179
Total Dissolved Solids	mg/L	1	100	96	88	103
Calcium	mg/L	1	<1	<1	<1	<1
Magnesium	mg/L	1	6	5	4	6
Sodium	mg/L	1	18	15	18	17
Potassium	mg/L	1	1	<1	1	<1
Bicarbonate	mg/L	1	<1	<1	<1	<1
Sulphate	mg/L	1	1.9	<0.5	<1	<1
Chloride	mg/L	1	24.3	23.8	34	24
Oil and Grease	mg/L	5	<5	<5	<5	<5

LOR = Limit of Reporting

Average EC = 167 µS/cm  
Average TDS = 97 mg/L  
Average pH = 4.23





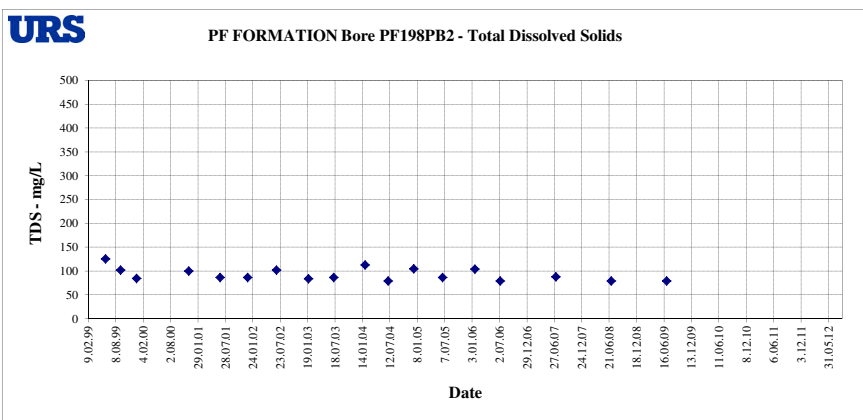
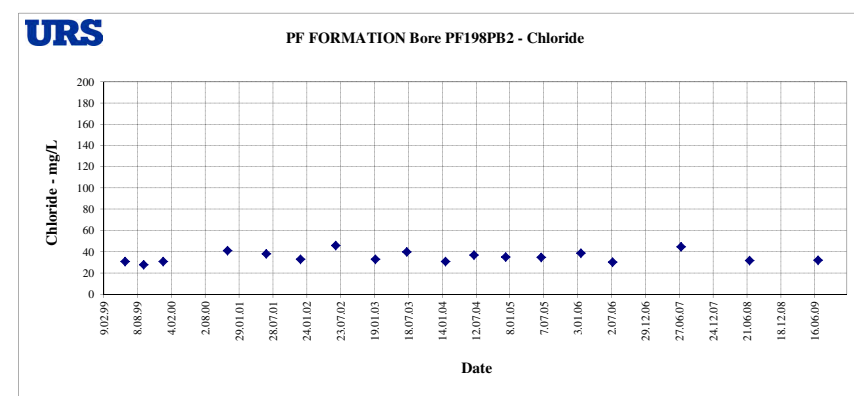
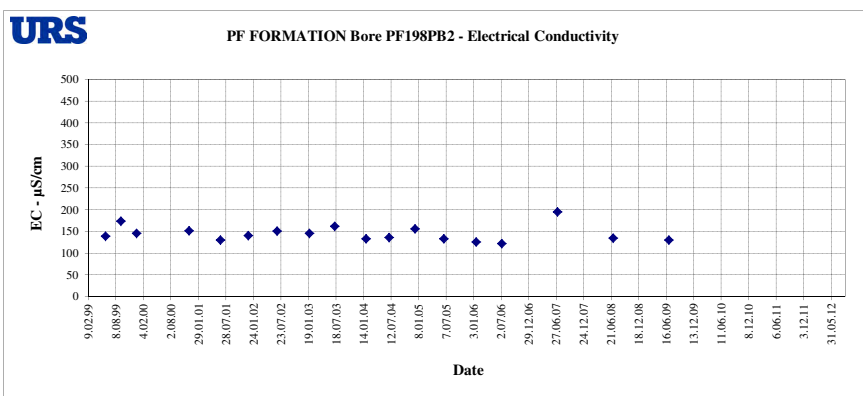
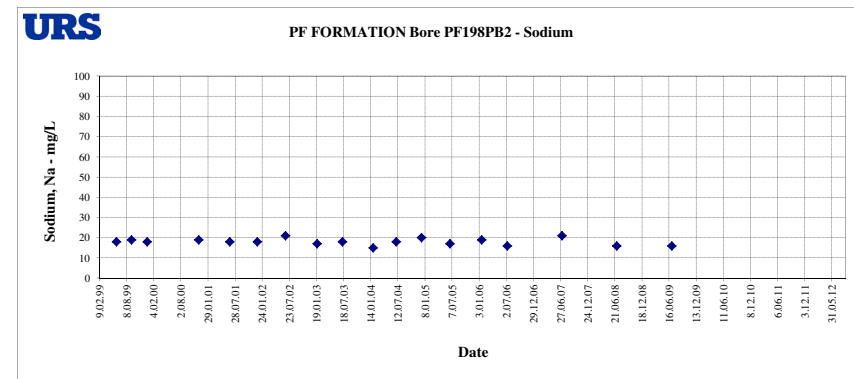
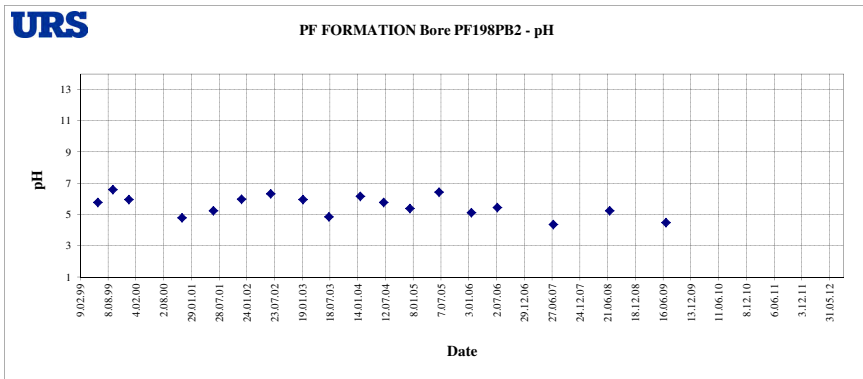
**PF FORMATION - MAROOTA**  
**BORE PF198PB2 GROUNDWATER ANALYTICAL SUMMARY**

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	22.06.11	20.06.12
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	NA	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 = 5.56

Note: PF198PB2 could not be sampled in March 2000



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	22.06.11	20.06.12
																DRY	DRY	DRY		DRY				
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				4.76		3.58	4.06	4.22	4.08
Electrical Conductivity	µS/cm	1	222	240	230	214	266	194	228	219	203	221	193	235	203				163		240	247	261	229
Total Dissolved Solids	mg/L	1	118	108	137	170	460	115	210	280	128	134	204	280	120				98		140	141	172	124
Calcium	mg/L	1	1	1	1	1	1	1	1	2	1	1	<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	6	5
Sodium	mg/L	1	26	23	23	22	29	21	22	24	19	20	18	19	19						26	24	24	19
Potassium	mg/L	1	<1	<1	1	1	1	1	2	1	<1	<1	<1	1	1						2	2	3	3
Bicarbonate	mg/L	1	<1	<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	1	1
Chloride	mg/L	1	58	49	51	52	58	49	58	61	46	50	47	44	36						49.1	56.3	53	43
Oil and Grease	mg/L	5	<5	<5	<5	<5	<5	<5	<5	<5	6	<5	<5	5	<5						<5	<5	<5	<5

\* field measurements

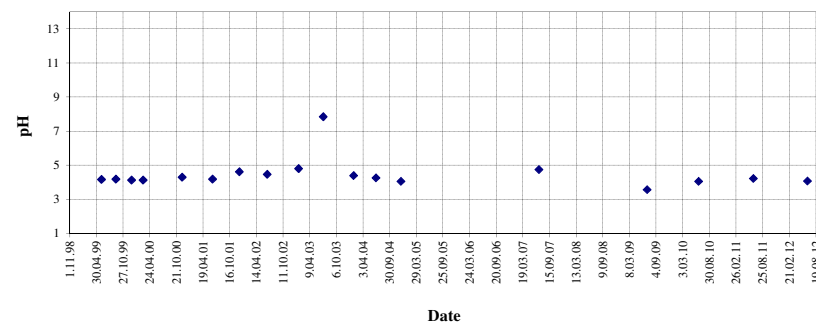
Average EC = 223 µS/cm  
Average TDS = 174 mg/L  
Average pH = 4.46

LOR = Limit of Reporting

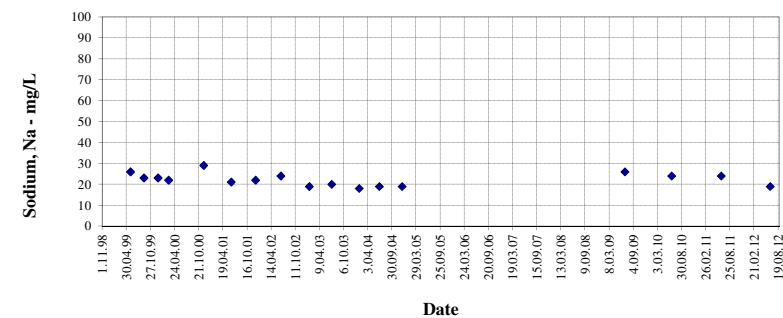
N.B. = TDS value in November 2000 is unusually high because of the presence of particulate matter in the sample.  
NA = Not enough water for sample



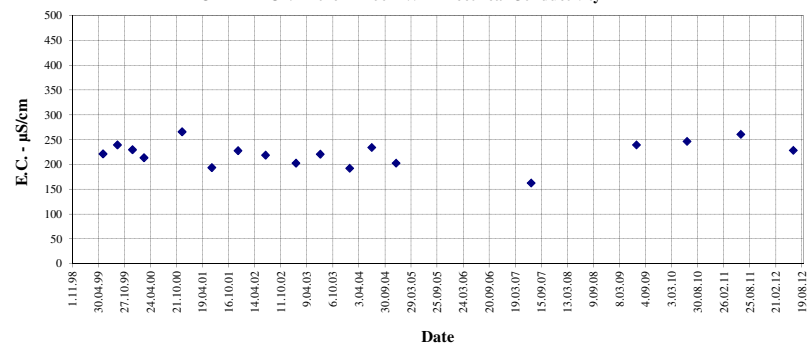
PF FORMATION - Bore PF166MW1 - pH



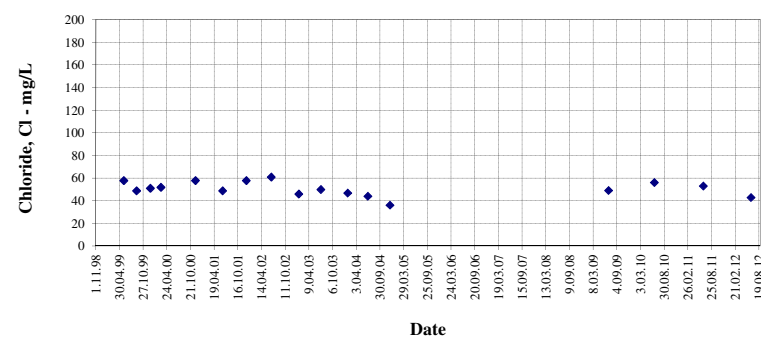
PF FORMATION - Bore PF166MW1 - Sodium



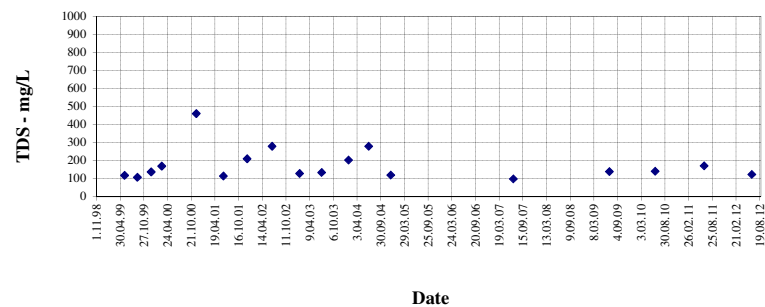
PF FORMATION - Bore PF166MW1 - Electrical Conductivity



PF FORMATION - Bore PF166MW1 - Chloride



PF FORMATION - Bore PF166MW1 - Total Dissolved Solids



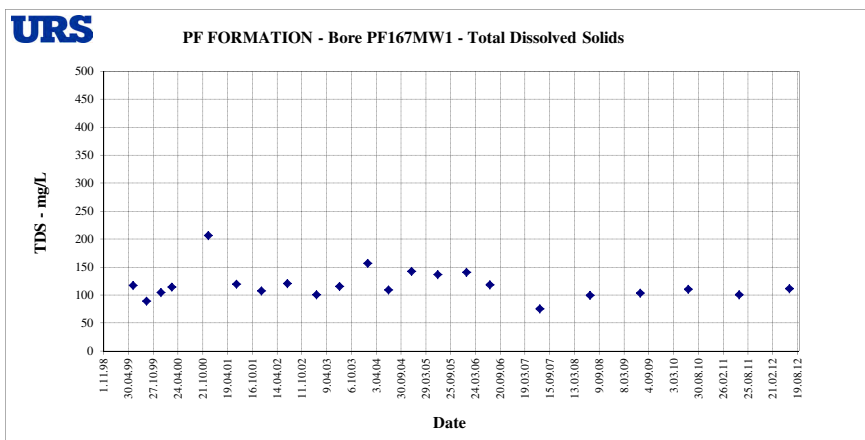
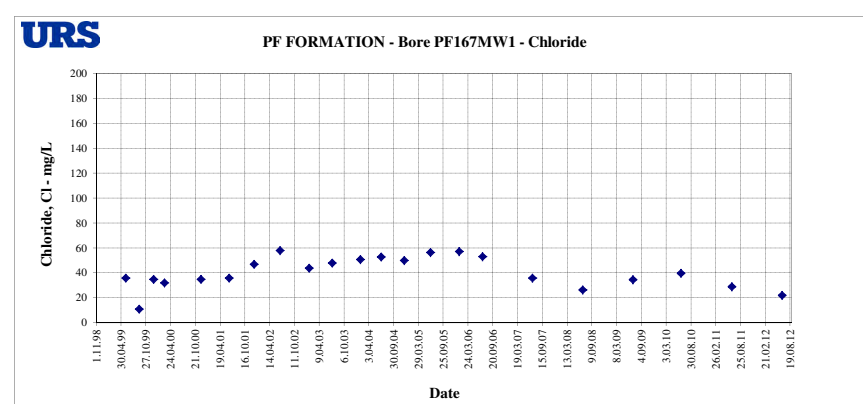
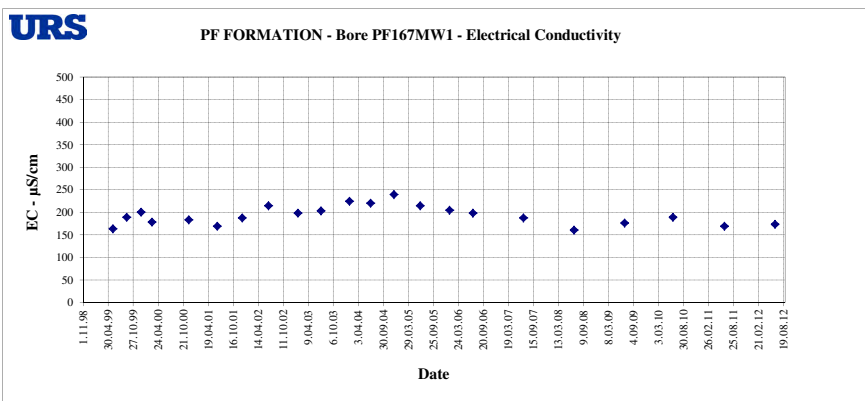
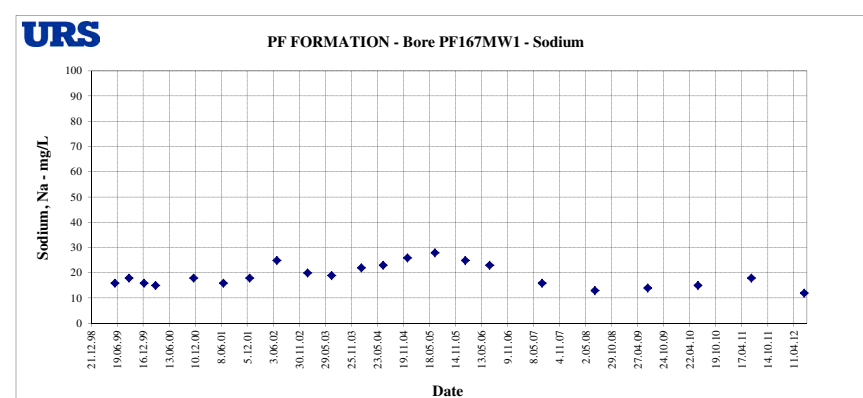
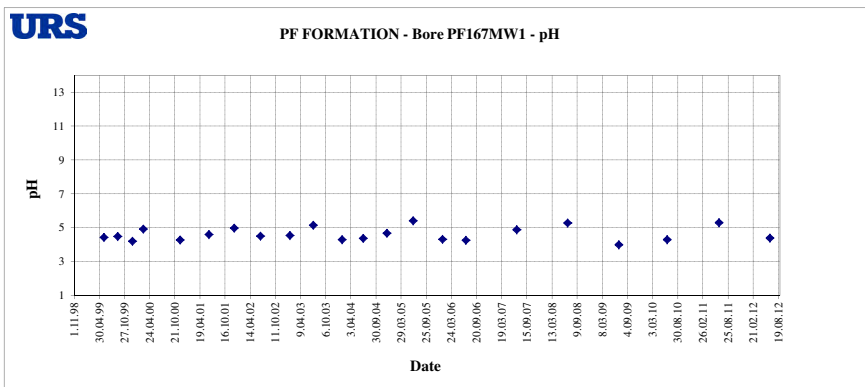
**PF FORMATION - MAROOTA**  
**BORE PF167MW1 GROUNDWATER ANALYTICAL SUMMARY**

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	22.06.11	20.06.12
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	5.3	4.39
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	170	174
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	101	112
Calcium	mg/L	1	3	3	5	6	3	6	6	5	3	4	4	5	5	5	4	4	2	6	5	3	4	7
Magnesium	mg/L	1	5	4	4	4	4	4	5	4	4	3	4	4	4	4	4	4	3	5	4	3	4	4
Sodium	mg/L	1	16	18	16	15	18	16	18	25	20	19	22	23	26	28	25	23	16	13	14	15	18	12
Potassium	mg/L	1	2	2	3	3	3	5	4	5	2	2	2	3	3	3	3	3	2	4	4	2	4	4
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	2.4	<1
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	18	28
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	29	22
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	<5	<5

LOR = Limit of Reporting

Average EC = 194 µS/cm  
Average TDS = 119 mg/L  
Average pH = 4.62

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





PF FORMATION - MAROOTA  
BORE PF198PB1 GROUNDWATER ANALYTICAL SUMMARY

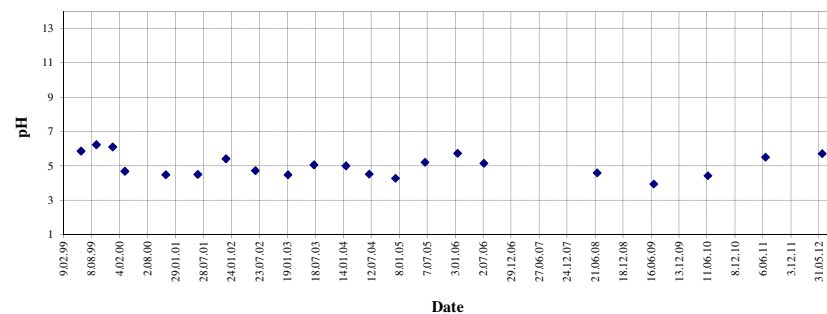
Analysis	Units	LOR	1.06.99	8.09.99	21.12.99	10.03.00	28.11.00	21.06.01	20.12.01	26.06.02	23.01.03	9.07.03	30.01.04	29.06.04	15.12.04	22.06.05	19.01.06	6.07.06	5.07.07	3.07.08	3.07.09	16.06.10	22.06.11	20.06.12
pH		0.01	5.87	6.24	6.11	4.69	4.49	4.51	5.41	4.73	4.49	5.06	5	4.53	4.28	5.22	5.74	5.16	NA	4.59	3.94	4.43	5.52	5.72
Electrical Conductivity	µS/cm	1	161	170	169	141	182	179	204	199	243	199	160	291	197	157	158	155		144	172	163	170	170
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	102	99
Calcium	mg/L	1	1	<1	1	1	3	2	2	4	3	2	2	4	1	1	2	1		<1	1	<1	2	2
Magnesium	mg/L	1	4	6	5	3	3	4	4	4	4	3	2	5	2	2	4	3		2	2	2	4	3
Sodium	mg/L	1	21	24	22	19	20	21	27	23	31	22	19	40	25	23	21	20		18	19	16	21	18
Potassium	mg/L	1	1	<1	1	1	2	5	5	3	3	2	2	3	2	2	2	2		1	2	1	2	2
Bicarbonate	mg/L	1	13	29	22	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	1	12	5		<1	<1	8.54	3.7	<1
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	6	6
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	36	32
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	<5	<5

LOR = Limit of Reporting

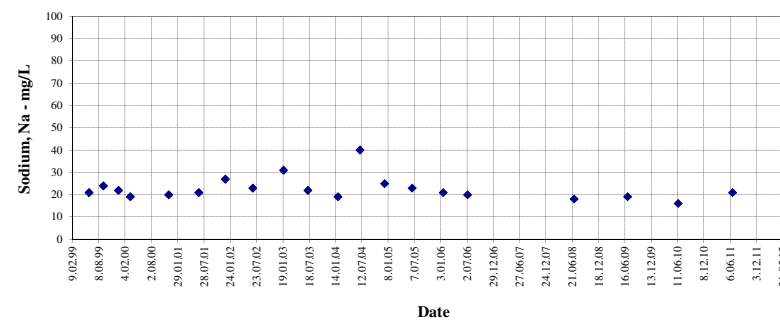
Average EC = 180 µS/cm  
Average TDS = 108 mg/L  
Average pH = 5.03



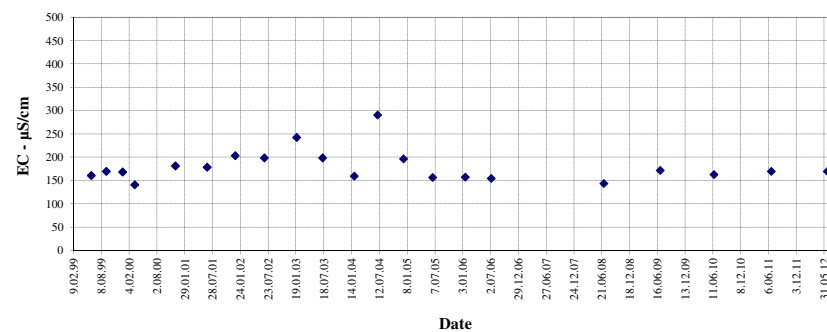
PF FORMATION Bore PF198PB1 - pH



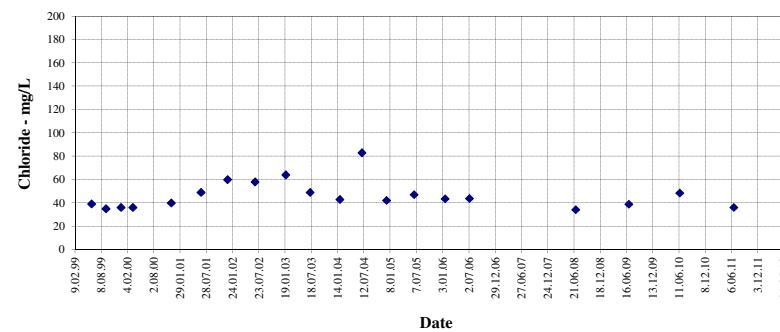
PF FORMATION Bore PF198PB1 - Sodium



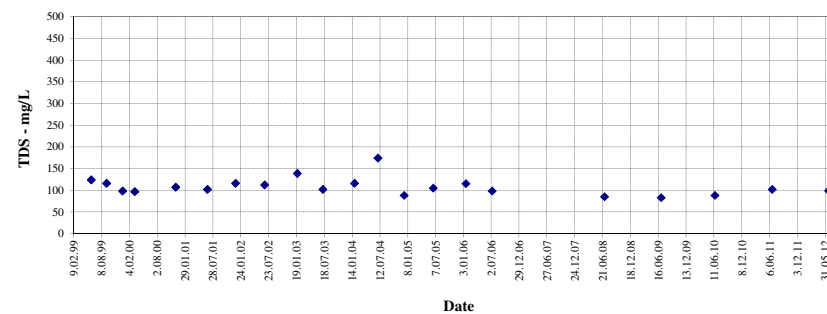
PF FORMATION Bore PF198PB1 - Electrical Conductivity



PF FORMATION Bore PF198PB1 - Chloride



PF FORMATION Bore PF198PB1 - Total Dissolved Solids



## **Appendix B      Analytical Laboratory Certificates**

## CHAIN OF CUSTODY FORM

Sheet of

THIS COLUMN FOR LAB USE ONLY		FROM: DATE: 21.6.12				TO: ALS		Container Size, Type, Preservative and Analysis			
Job Code:		ACN 000 691 690 407 Pacific Hwy Artamon 2064		277-289 Woodpark Road Smithfield NSW 2164		Container Identification					
Due Date:		Ph: 8925 5500		Fax: 8925 5555		Size	1 L	1 L			
		Project No: 43167955		Sampler(s): Fabio Carosone		Type*	P	G			
		Project Manager: Fabio Carosone		Signature(s): <i>Fabio Carosone</i>		Label colour	green	purple			
		Agreement No:		Checked:		Preservative Code		H2SO4			
		Released for URS by: Fabio Carosone		Received for Laboratory by: Frank		Number of containers	PH, EC, TDS, Ca, Mg, Na, K, Cl, HCO <sub>3</sub> , SO <sub>4</sub>	oil and grease			
Custody seal intact?		Date: 21.6.12 Time: 9 am		Date: 21-6-12 Time: 1420							
Sample cold?		YES NO		YES NO							
Lab identification	Date	Time	Matrix	Sample Number	Comments	Total no	Tick required analytes				
						HT					
	20.6.12	10.0	Water	PF167MW1		2	✓		✓		
	20.6.12	9.30	Water	PF166MW1		2	✓		✓		
	20.6.12	10.30	Water	PFL2HitchMW1		2	✓		✓		
	20.6.12	9.0	Water	PFP214MW1		2	✓		✓		
	20.6.12	11.50	Water	PF198PB1		2	✓		✓		
			Water	PF408PB2		2	✓		✓		
Remarks:						TOTAL	10	5	5		
* 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											
Courier Job No:						NOTE: SAMPLES MAY CONTAIN DANGEROUS AND HAZARDOUS SUBSTANCES					

Environmental Division  
Sydney  
Work Order  
**ES1215431**



Telephone : +61-2-8784 8555

## Environmental Division

# QUALITY CONTROL REPORT

Work Order	: ES1215431	Page	: 1 of 5
Client	: URS AUSTRALIA (NSW) PTY LTD	Laboratory	: Environmental Division Sydney
Contact	: FABIO CAROSONE	Contact	: Glenyss Weeks
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	: Glenyss.Weeks@alsglobal.com
Telephone	: +61 89255500	Telephone	: +61 2 8784 8555
Facsimile	: +61 02 89255555	Facsimile	: +61 2 8784 8531
Project	: 43167955	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Site	: ----		
C-O-C number	: ----	Date Samples Received	: 21-JUN-2012
Sampler	: FC	Issue Date	: 28-JUN-2012
Order number	: 43167955		
Quote number	: EN/001/11	No. of samples received	: 5
		No. of samples analysed	: 5

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

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	Sydney Inorganics
Celine Conceicao	Senior Spectroscopist	Sydney Inorganics
Hoa Nguyen	Inorganic Chemist	Sydney Inorganics
Sarah Millington	Senior Inorganic Chemist	Sydney Inorganics



## 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 (%)
EA005P: pH by PC Titrator (QC Lot: 2368163)									
ES1215429-001	Anonymous	EA005-P: pH Value	----	0.01	pH Unit	5.23	5.87	11.5	0% - 20%
ES1215430-001	Anonymous	EA005-P: pH Value	----	0.01	pH Unit	4.65	4.37	6.2	0% - 20%
EA010P: Conductivity by PC Titrator (QC Lot: 2368162)									
ES1215429-001	Anonymous	EA010-P: Electrical Conductivity @ 25°C	----	1	µS/cm	151	156	3.2	0% - 20%
ES1215430-001	Anonymous	EA010-P: Electrical Conductivity @ 25°C	----	1	µS/cm	100	99	0.0	0% - 20%
EA015: Total Dissolved Solids (QC Lot: 2371206)									
ES1215314-001	Anonymous	EA015H: Total Dissolved Solids @180°C	GIS-210-010	10	mg/L	9930	10100	1.7	0% - 20%
ME1201038-002	Anonymous	EA015H: Total Dissolved Solids @180°C	GIS-210-010	10	mg/L	1820	1710	6.0	0% - 20%
EA015: Total Dissolved Solids (QC Lot: 2371887)									
ES1215503-001	Anonymous	EA015H: Total Dissolved Solids @180°C	GIS-210-010	10	mg/L	4900	5080	3.6	0% - 20%
ES1215560-003	Anonymous	EA015H: Total Dissolved Solids @180°C	GIS-210-010	10	mg/L	288	282	2.1	0% - 20%
ED037P: Alkalinity by PC Titrator (QC Lot: 2368161)									
ES1215429-001	Anonymous	ED037-P: Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	0.0	No Limit
		ED037-P: Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	0.0	No Limit
		ED037-P: Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	2	9	128	No Limit
		ED037-P: Total Alkalinity as CaCO3	----	1	mg/L	2	9	128	No Limit
ES1215430-001	Anonymous	ED037-P: Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	0.0	No Limit
		ED037-P: Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	0.0	No Limit
		ED037-P: Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	<1	<1	0.0	No Limit
		ED037-P: Total Alkalinity as CaCO3	----	1	mg/L	<1	<1	0.0	No Limit
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QC Lot: 2373664)									
ES1215391-002	Anonymous	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	155	152	1.8	0% - 20%
ES1215429-002	Anonymous	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	8	8	0.0	No Limit
ED045G: Chloride Discrete analyser (QC Lot: 2373662)									
ES1215378-001	Anonymous	ED045G: Chloride	16887-00-6	1	mg/L	65	65	0.0	0% - 20%
ES1215420-003	Anonymous	ED045G: Chloride	16887-00-6	1	mg/L	37	37	0.0	0% - 20%
ED093F: Dissolved Major Cations (QC Lot: 2373665)									
ES1215430-003	Anonymous	ED093F: Calcium	7440-70-2	1	mg/L	<1	<1	0.0	No Limit
		ED093F: Magnesium	7439-95-4	1	mg/L	2	2	0.0	No Limit
		ED093F: Sodium	7440-23-5	1	mg/L	17	16	0.0	0% - 50%
		ED093F: Potassium	7440-09-7	1	mg/L	<1	<1	0.0	No Limit
ES1215439-004	Anonymous	ED093F: Calcium	7440-70-2	1	mg/L	4	4	0.0	No Limit
		ED093F: Magnesium	7439-95-4	1	mg/L	4	4	0.0	No Limit
		ED093F: Sodium	7440-23-5	1	mg/L	25	25	0.0	0% - 20%
		ED093F: Potassium	7440-09-7	1	mg/L	2	2	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	Spike Recovery (%)	Recovery Limits (%)	
Method: Compound	CAS Number	LOR	Unit	Result	Concentration	LCS	Low	High
EA010P: Conductivity by PC Titrator (QCLot: 2368162)								
EA010-P: Electrical Conductivity @ 25°C	----	1	µS/cm	<1	2000 µS/cm	102	92	116
EA015: Total Dissolved Solids (QCLot: 2371206)								
EA015H: Total Dissolved Solids @180°C	GIS-210-010	10	mg/L	<10	293 mg/L	94.9	70	130
EA015: Total Dissolved Solids (QCLot: 2371887)								
EA015H: Total Dissolved Solids @180°C	GIS-210-010	10	mg/L	<10	293 mg/L	99.2	70	130
ED037P: Alkalinity by PC Titrator (QCLot: 2368161)								
ED037-P: Total Alkalinity as CaCO3	----	1	mg/L	----	200 mg/L	87.0	75	107
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QCLot: 2373664)								
ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	<1	25 mg/L	101	77	121
ED045G: Chloride Discrete analyser (QCLot: 2373662)								
ED045G: Chloride	16887-00-6	1	mg/L	<1	1000 mg/L	99.8	79	123
ED093F: Dissolved Major Cations (QCLot: 2373665)								
ED093F: Calcium	7440-70-2	1	mg/L	<1	50 mg/L	106	88	110
ED093F: Magnesium	7439-95-4	1	mg/L	<1	50 mg/L	106	90	110
ED093F: Sodium	7440-23-5	1	mg/L	<1	50 mg/L	101	81	107
ED093F: Potassium	7440-09-7	1	mg/L	<1	50 mg/L	106	89	109
EP020: Oil and Grease (O&G) (QCLot: 2374957)								
EP020: Oil & Grease	----	5	mg/L	<5	5000 mg/L	97.6	80	125

## 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				
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QCLot: 2373664)							
ES1215391-002	Anonymous	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	10 mg/L	# Not Determined	70	130
ED045G: Chloride Discrete analyser (QCLot: 2373662)							
ES1215378-001	Anonymous	ED045G: Chloride	16887-00-6	250 mg/L	113	70	130

## Matrix Spike (MS) and Matrix Spike Duplicate (MSD) Report



The quality control term Matrix Spike (MS) and Matrix Spike Duplicate (MSD) refers to intralaboratory split samples spiked with a representative set of target analytes. The purpose of these QC parameters are 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

				Matrix Spike (MS) and Matrix Spike Duplicate (MSD) Report					
				Spike	Spike Recovery (%)		Recovery Limits (%)		RPDs (%)
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Concentration	MS	MSD	Low	High	Value Control Limit
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QCLot: 2373664)									
ES1215391-002	Anonymous	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	10 mg/L	# Not Determined	----	70	130	----
ED045G: Chloride Discrete analyser (QCLot: 2373662)									
ES1215378-001	Anonymous	ED045G: Chloride	16887-00-6	250 mg/L	113	----	70	130	----

## Environmental Division

# INTERPRETIVE QUALITY CONTROL REPORT

Work Order	: <b>ES1215431</b>	Page	: 1 of 6
Client	: URS AUSTRALIA (NSW) PTY LTD	Laboratory	: Environmental Division Sydney
Contact	: FABIO CAROSONE	Contact	: Glenyss Weeks
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	: Glenyss.Weeks@alsglobal.com
Telephone	: +61 89255500	Telephone	: +61 2 8784 8555
Facsimile	: +61 02 89255555	Facsimile	: +61 2 8784 8531
Project	: 43167955	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Site	: ----	Date Samples Received	: 21-JUN-2012
C-O-C number	: ----	Issue Date	: 28-JUN-2012
Sampler	: FC	No. of samples received	: 5
Order number	: 43167955	No. of samples analysed	: 5
Quote number	: EN/001/11		

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



## 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
EA005P: pH by PC Titrator								
Clear Plastic Bottle - Natural (EA005-P) PF167MW1, PFL2HITCHMW1, PF198PB1	PF166MW1, PFP214MW1,	20-JUN-2012	---	20-JUN-2012	----	22-JUN-2012	20-JUN-2012	✖
EA010P: Conductivity by PC Titrator								
Clear Plastic Bottle - Natural (EA010-P) PF167MW1, PFL2HITCHMW1, PF198PB1	PF166MW1, PFP214MW1,	20-JUN-2012	---	18-JUL-2012	----	22-JUN-2012	18-JUL-2012	✔
EA015: Total Dissolved Solids								
Clear Plastic Bottle - Natural (EA015H) PF167MW1, PFL2HITCHMW1,	PF166MW1, PFP214MW1	20-JUN-2012	----	----	----	25-JUN-2012	27-JUN-2012	✔
Clear Plastic Bottle - Natural (EA015H) PF198PB1		20-JUN-2012	----	----	----	26-JUN-2012	27-JUN-2012	✔
ED037P: Alkalinity by PC Titrator								
Clear Plastic Bottle - Natural (ED037-P) PF167MW1, PFL2HITCHMW1, PF198PB1	PF166MW1, PFP214MW1,	20-JUN-2012	---	04-JUL-2012	----	22-JUN-2012	04-JUL-2012	✔
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA								
Clear Plastic Bottle - Natural (ED041G) PF167MW1, PFL2HITCHMW1, PF198PB1	PF166MW1, PFP214MW1,	20-JUN-2012	---	18-JUL-2012	----	26-JUN-2012	18-JUL-2012	✔
ED045G: Chloride Discrete analyser								
Clear Plastic Bottle - Natural (ED045G) PF167MW1, PFL2HITCHMW1, PF198PB1	PF166MW1, PFP214MW1,	20-JUN-2012	---	18-JUL-2012	----	26-JUN-2012	18-JUL-2012	✔

Page : 3 of 6  
 Work Order : ES1215431  
 Client : URS AUSTRALIA (NSW) PTY LTD  
 Project : 43167955



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
ED093F: Dissolved Major Cations								
Clear Plastic Bottle - Natural (ED093F)								
PF167MW1, PFL2HITCHMW1, PF198PB1	PF166MW1, PFP214MW1,	20-JUN-2012	---	27-JUN-2012	----	26-JUN-2012	27-JUN-2012	✔
EP020: Oil and Grease (O&G)								
Amber Glass Bottle - Sulfuric Acid (EP020)								
PF167MW1, PFL2HITCHMW1, PF198PB1	PF166MW1, PFP214MW1,	20-JUN-2012	----	----	----	27-JUN-2012	18-JUL-2012	✔



## 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	20	10.0	10.0	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Chloride by Discrete Analyser	ED045G	2	20	10.0	10.0	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Conductivity by PC Titrator	EA010-P	2	20	10.0	10.0	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Major Cations - Dissolved	ED093F	2	20	10.0	10.0	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
pH by PC Titrator	EA005-P	2	20	10.0	10.0	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	2	20	10.0	10.0	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Total Dissolved Solids (High Level)	EA015H	4	39	10.3	10.0	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Laboratory Control Samples (LCS)							
Alkalinity by PC Titrator	ED037-P	1	20	5.0	5.0	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Chloride by Discrete Analyser	ED045G	2	20	10.0	10.0	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Conductivity by PC Titrator	EA010-P	1	20	5.0	5.0	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Major Cations - Dissolved	ED093F	1	20	5.0	5.0	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Oil and Grease	EP020	1	18	5.6	5.0	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	1	20	5.0	5.0	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Total Dissolved Solids (High Level)	EA015H	4	39	10.3	10.0	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Method Blanks (MB)							
Chloride by Discrete Analyser	ED045G	1	20	5.0	5.0	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Conductivity by PC Titrator	EA010-P	1	20	5.0	5.0	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Major Cations - Dissolved	ED093F	1	20	5.0	5.0	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Oil and Grease	EP020	1	18	5.6	5.0	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	1	20	5.0	5.0	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Total Dissolved Solids (High Level)	EA015H	2	39	5.1	5.0	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Matrix Spikes (MS)							
Chloride by Discrete Analyser	ED045G	1	20	5.0	5.0	✓	ALS QCS3 requirement
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	1	20	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 by PC Titrator	EA005-P	WATER	APHA 21st ed. 4500 H+ B. This procedure determines pH of water samples by automated ISE. 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 (High Level)	EA015H	WATER	In-House, 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)
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)
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	WATER	APHA 21st ed., 4500-SO4 Sulfate ions are converted to a barium sulfate suspension in an acetic acid medium with barium chloride. Light absorbance of the BaSO4 suspension is measured by a photometer and the SO4-2 concentration is determined by comparison of the reading with a standard curve. This method is compliant with NEPM (1999) Schedule B(3) (Appdx. 2)
Chloride by Discrete Analyser	ED045G	WATER	APHA 21st ed., 4500 Cl - G. The thiocyanate ion is liberated from mercuric thiocyanate through sequestration of mercury by the chloride ion to form non-ionised mercuric chloride. In the presence of ferric ions the liberated thiocyanate forms highly-coloured ferric thiocyanate which is measured at 480 nm APHA 21st edition seal method 2 017-1-L april 2003
Major Cations - Dissolved	ED093F	WATER	Major Cations is determined based on 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)  Sodium Absorption Ratio is calculated from Ca, Mg and Na which determined by ALS in house method QWI-EN/ED093F. This method is compliant with NEPM (1999) Schedule B(3) (Appdx. 2)  Total Hardness is calculated based on APHA 21st ed., 2340 B. This method is compliant with NEPM (1999) Schedule B(3) (Appdx. 2)
Ionic Balance by PCT DA and Turbi SO4 DA	EN055 - PG	WATER	APHA 21st Ed. 1030F. The Ionic Balance is calculated based on the major Anions and Cations. The major anions include Alkalinity, Chloride and Sulfate which determined by PCT and DA. The Cations are determined by Turbi SO4 by DA. 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
<b>Matrix Spike (MS) Recoveries</b>							
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA	ES1215391-002	Anonymous	Sulfate as SO4 - Turbidimetric	14808-79-8	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.

Matrix: **WATER**

Method		Extraction / Preparation			Analysis		
Container / Client Sample ID(s)		Date extracted	Due for extraction	Days overdue	Date analysed	Due for analysis	Days overdue
<b>EA005P: pH by PC Titrator</b>							
<b>Clear Plastic Bottle - Natural</b>							
PF167MW1, PFL2HITCHMW1, PF198PB1	PF166MW1, PFP214MW1,	----	----	----	22-JUN-2012	20-JUN-2012	2

### 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.

## Environmental Division

# CERTIFICATE OF ANALYSIS

Work Order	: <b>ES1215431</b>	Page	: 1 of 3
Client	: <b>URS AUSTRALIA (NSW) PTY LTD</b>	Laboratory	: Environmental Division Sydney
Contact	: <b>FABIO CAROSONE</b>	Contact	: <b>Glenyss Weeks</b>
Address	: <b>LEVEL 4, 407 PACIFIC HIGHWAY ARTARMON NSW, AUSTRALIA 2064</b>	Address	: <b>277-289 Woodpark Road Smithfield NSW Australia 2164</b>
E-mail	: <b>fabio_carosone@urscorp.com</b>	E-mail	: <b>Glenyss.Weeks@alsglobal.com</b>
Telephone	: <b>+61 89255500</b>	Telephone	: <b>+61 2 8784 8555</b>
Facsimile	: <b>+61 02 89255555</b>	Facsimile	: <b>+61 2 8784 8531</b>
Project	: <b>43167955</b>	QC Level	: <b>NEPM 1999 Schedule B(3) and ALS QCS3 requirement</b>
Order number	: <b>43167955</b>		
C-O-C number	: <b>----</b>	Date Samples Received	: <b>21-JUN-2012</b>
Sampler	: <b>FC</b>	Issue Date	: <b>28-JUN-2012</b>
Site	: <b>----</b>		
Quote number	: <b>EN/001/11</b>	No. of samples received	: <b>5</b>
		No. of samples analysed	: <b>5</b>

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

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	Sydney Inorganics
Celine Conceicao	Senior Spectroscopist	Sydney Inorganics
Hoa Nguyen	Inorganic Chemist	Sydney Inorganics
Sarah Millington	Senior Inorganic Chemist	Sydney Inorganics



## 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 sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

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

- EN055 - PG: Ionic Balance out of acceptable limits for sample ID 'PFP214MW1' due to analytes not quantified in this report.



## Analytical Results

Sub-Matrix: WATER

Client sample ID

Client sampling date / time

				PF167MW1	PF166MW1	PFL2HITCHMW1	PFP214MW1	PF198PB1
				20-JUN-2012 10:00	20-JUN-2012 09:30	20-JUN-2012 10:30	20-JUN-2012 09:00	20-JUN-2012 11:50
Compound	CAS Number	LOR	Unit	ES1215431-001	ES1215431-002	ES1215431-003	ES1215431-004	ES1215431-005
<b>EA005P: pH by PC Titrator</b>								
pH Value	----	0.01	pH Unit	4.39	4.08	4.03	4.27	5.72
<b>EA010P: Conductivity by PC Titrator</b>								
Electrical Conductivity @ 25°C	----	1	µS/cm	174	229	195	179	170
<b>EA015: Total Dissolved Solids</b>								
Total Dissolved Solids @180°C	GIS-210-010	10	mg/L	112	124	99	103	99
<b>ED037P: Alkalinity by PC Titrator</b>								
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	<1	<1	<1
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	<1	<1	<1
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	<1	<1	<1	<1	8
Total Alkalinity as CaCO3	----	1	mg/L	<1	<1	<1	<1	8
<b>ED041G: Sulfate (Turbidimetric) as SO4 2- by DA</b>								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	28	1	4	<1	6
<b>ED045G: Chloride Discrete analyser</b>								
Chloride	16887-00-6	1	mg/L	22	43	42	24	32
<b>ED093F: Dissolved Major Cations</b>								
Calcium	7440-70-2	1	mg/L	7	1	<1	<1	2
Magnesium	7439-95-4	1	mg/L	4	5	2	6	3
Sodium	7440-23-5	1	mg/L	12	19	22	17	18
Potassium	7440-09-7	1	mg/L	4	3	<1	<1	2
<b>EN055: Ionic Balance</b>								
Total Anions	----	0.01	meq/L	1.20	1.23	1.27	0.68	1.19
Total Cations	----	0.01	meq/L	1.30	1.36	1.12	1.23	1.18
<b>EP020: Oil and Grease (O&amp;G)</b>								
Oil & Grease	----	5	mg/L	<5	<5	<5	<5	<5



URS Australia Pty Ltd  
Level 4, 407 Pacific Highway  
Artarmon NSW 2064  
Australia

T: 61 2 8925 5500

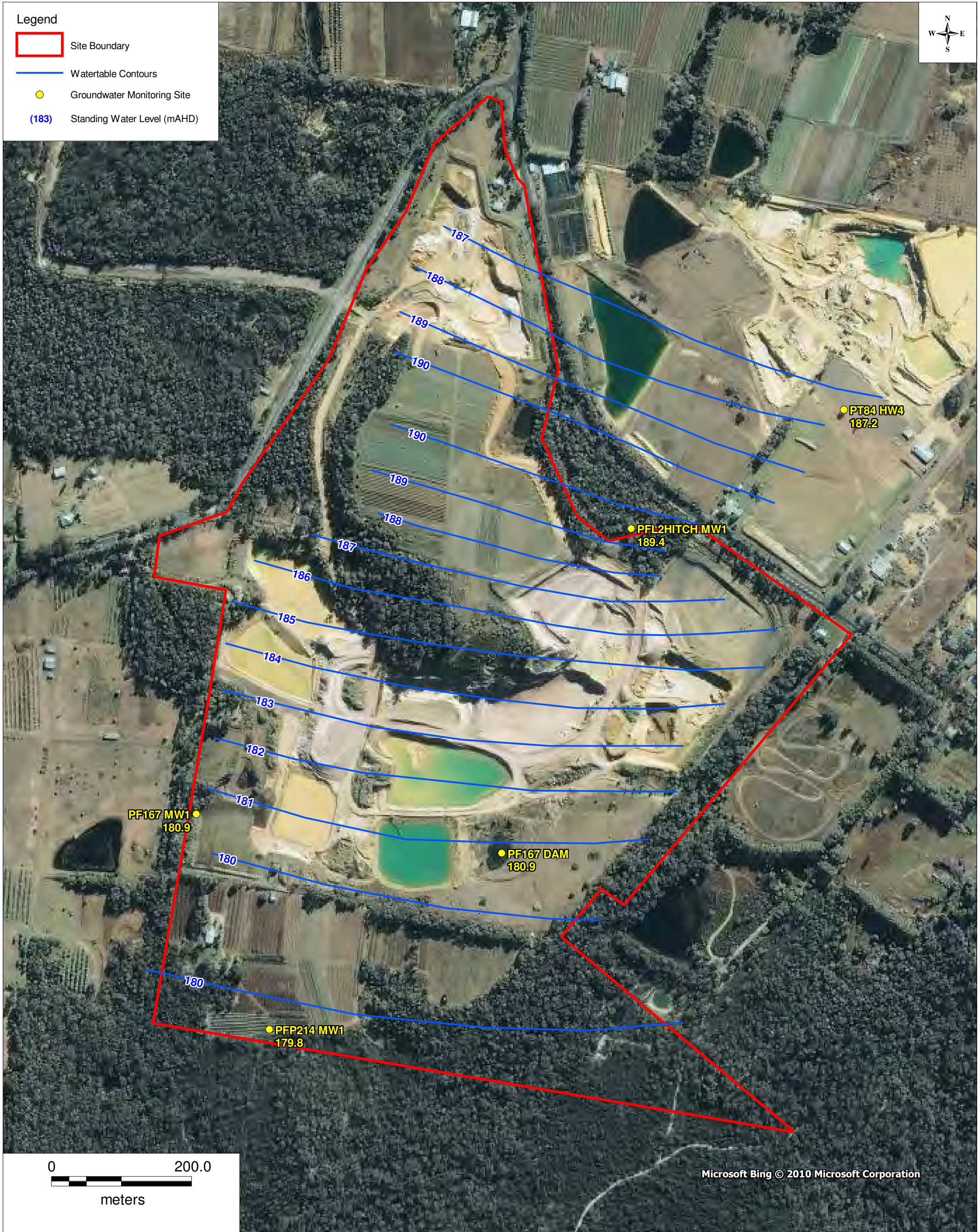
T: 61 2 8925 5555

[www.ap.urscorp.com](http://www.ap.urscorp.com)

## **Attachment 6B**

### Water Table Contours





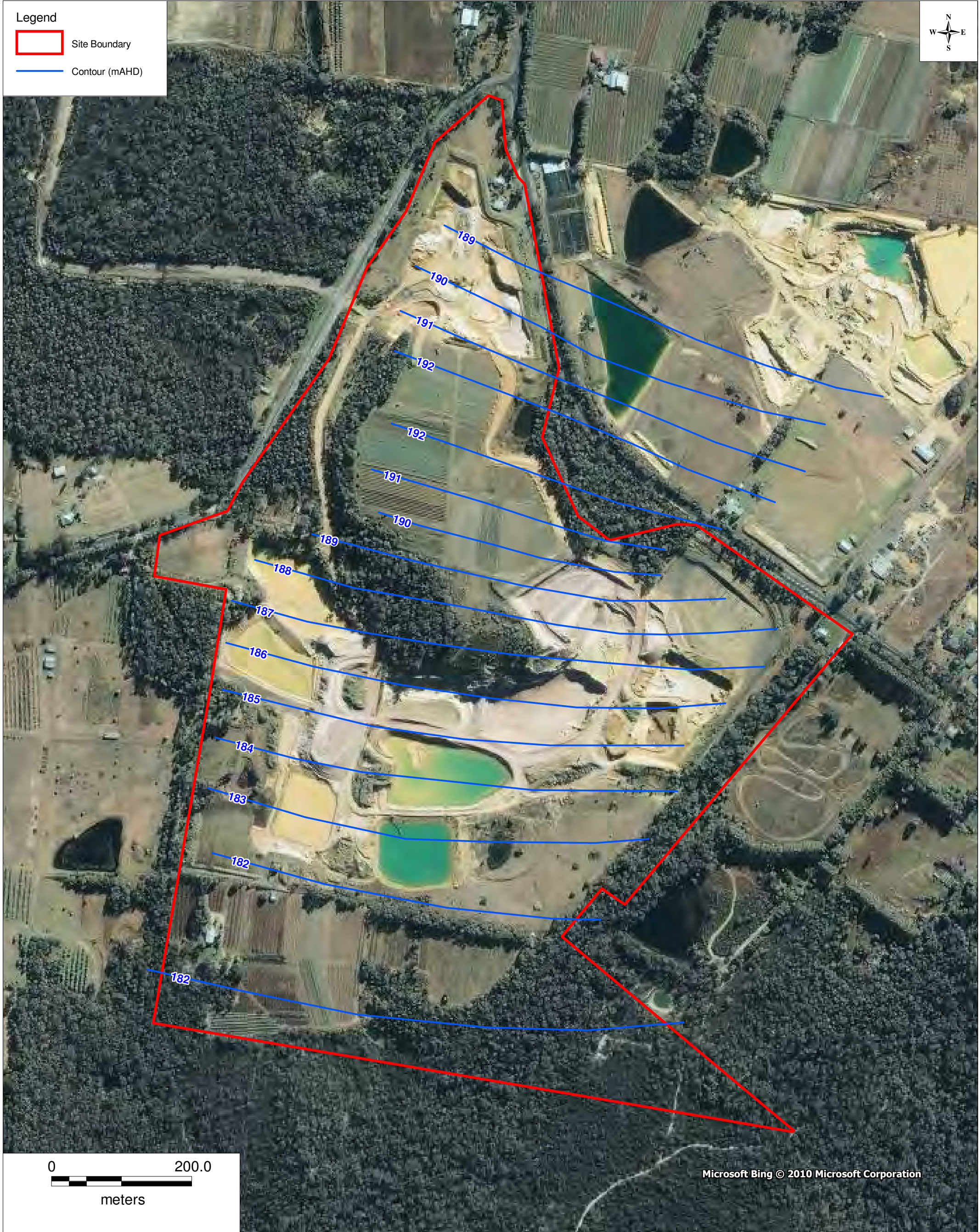
Source: Aerial imagery from Bing Maps © 2010 Microsoft Corporation and its data suppliers.  
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## **Attachment 6C**

### Depth of Mining Plan



Source: Aerial imagery from Bing Maps © 2010 Microsoft Corporation and its data suppliers.  
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PF FORMATION

HITCHCOCK ROAD, SAND EXTRACTION  
AND REHABILITATION PROJECT

**HITCHCOCK ROAD SITE  
DEPTH OF MINING CONTOURS  
@ 22/06/2011**



## **Attachment 6D**

### Quarterly Water Testing Results

Test Report

CLIENT: P.F.FORMATION

FILE No.: 250/11

ADDRESS: 1774 WISEMANNS FERRY ROAD, MAROOTA, NSW 2756

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

REQUEST No.: 44802

**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.: 120492  
Date Sampled: 5.09.11  
Date Received: 5.09.11  
Sample Description: Water -  
Downstream -  
Lot 198 -  
1:00pm

Field No.: 1

TEST RESULTS

pH	4.8
Turbidity (NTU)	4.1
Oil & Grease (mg/L)*	<1
Total Suspended Solid (mg/L)	3.7
Conductivity (µm/cm)	217

Samples submitted by the Client.

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

J. Graham, File.



ACCREDITED FOR  
TECHNICAL  
COMPETENCE

Approved Signatory

Date

19/09/11

Serial No.

JUSTIN DOWSE

99120

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NATA Accredited Laboratory  
Number: 9968





MATERIALS TECHNICAL SERVICES  
BORAL RESOURCES (NSW) PTY LTD  
ABN 51 000 756 507  
Unit 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.: 250/11

ADDRESS: 1774 WISEMANNS FERRY ROAD, MAROOTA, NSW 2756

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

REQUEST No.: 45890

**TEST PROCEDURE:** APHA 4500 H<sup>+</sup>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.: 123455  
Date Sampled: 24.11.11  
Date Received: 24.11.11  
Sample Description: Water -  
Downstream -  
Lot 198 -  
1:30pm

Field No.: 1

**TEST RESULTS**

pH	5.5
Turbidity (NTU)	9.0
Oil & Grease (mg/L)*	<1
Total Suspended Solid (mg/L)	5.6
Conductivity (µm/cm)	175

Samples submitted by the Client.

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

J. Graham, File.



Approved Signatory

Date 30/11/11

Serial No.

JUSTIN DOWSE

101372

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NATA Accredited Laboratory  
Number: 9968



MATERIALS TECHNICAL SERVICES  
BORAL RESOURCES (NSW) PTY LTD  
ABN 51 000 756 507

Unit 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.: 250/12

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

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

REQUEST No.: 46589

**TEST PROCEDURE:** APHA 4500 H<sup>+</sup>B - pH Value - Electrometric Method  
APHA 2130 B - Turbidity - Nephelometric Method  
APHA 5520 C - Oil & Grease - Partition-Infrared Method  
APHA 2540 D - Total Suspended Solids Dried at 103-105 °C  
APHA 2510 B - Conductivity - Laboratory Method

Laboratory Sample No.: 125251  
Date Sampled: 8.02.12  
Date Received: 8.02.12  
Sample Description: Water -  
Downstream -  
Lot 198 -  
8:45am

Field No.: 1

### TEST RESULTS

pH	5.3
Turbidity (NTU)	15
Oil & Grease (mg/L)*	<1
Total Suspended Solid (mg/L)	3.3
Conductivity (µS/cm)	169

Samples submitted by the Client.

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

J. Graham, File.



ACCREDITED FOR  
TECHNICAL  
COMPETENCE

Approved Signatory

Date 7/02/12 Serial No. 102763

Justin Dowse

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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 9999Test Report

CLIENT: P.F.FORMATION

FILE No.: 250/12

ADDRESS: 1774 WISEMANNS FERRY ROAD, MAROOTA, NSW 2756

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

REQUEST No.: 48135

**TEST PROCEDURE:** APHA 4500 H<sup>+</sup>B - pH Value - Electrometric Method  
APHA 2130 B - Turbidity - Nephelometric Method  
APHA 5520 C - Oil & Grease - Partition-Infrared Method  
APHA 2540 D - Total Suspended Solids Dried at 103-105 °C  
APHA 2510 B - Conductivity - Laboratory Method

Laboratory Sample No.: 129436  
Date Sampled: 6.06.12  
Date Received: 6.06.12  
Sample Description: Water -  
Downstream -  
Lot 198 -  
10:30am

Field No.: 1

TEST RESULTS

pH	5.5
Turbidity (NTU)	14
Oil & Grease (mg/L)*	<1
Total Suspended Solid (mg/L)	5.5
Conductivity (µS/cm)	193

Samples submitted by the Client.

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

J. Graham, File.



Approved Signatory

Justin Dowse

Date

20/06/12

Serial No.

10 6 1 3 7

This document is issued in accordance with NATA's accreditation requirements.  
Accredited for compliance with ISO/IEC 17025

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. 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 but were referred to in the Independent Environmental Audit as an area where improvement is required. The screen planting should be improved and PF Formation has commenced a planting program along Old Northern Road. Further planting in this section will occur over 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 the concentration of extraction in the high area adjacent to Wisemans Ferry Road has increased the site's visibility. The area along Old Northern Road will be the main area of focus for rehabilitation since planting of the first 4 hectare stage of the SHTW rehabilitation area was completed in 2011.

### **Conclusion**

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 Plan at **Attachment 2A**.

Rehabilitation of the project is dependent on three 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.

Whether the final landform is to be rehabilitated in accordance with Strategy A or B as detailed in the Approval.

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. 4 hectares of the eastern part has been seeded under the guidance of Greening Australia and Parsons Brinckerhoff.

### *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***

In 2010 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 1.6 hectares to be rehabilitated. Based on that plan of management the additional area was planted in Spring 2011 to give an area subject to SHTW rehabilitation exceeding 4 hectares.

### ***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 November 2012 and is appended as **Attachment 7A**. The report states that 'the rehabilitation of the area is progressing well and is meeting or exceeding the targets set'.

### ***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. Improvements are required along Old Northern Road to better screen 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. 4.2 hectares of Sydney Hinterland Transition Woodland has been planted on site. Parsons Brinckerhoff have monitored this area in October 2012 by reviewing plant species within six fixed (20 x 20 metre) quadrants and their report is in **Attachment 7A**. In general the revegetation areas appear to be progressing well and is meeting or exceeding the targets set.

# **Attachment 7A**

## Monitoring of Revegetation

*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**.



# **Attachment 8A**

## Community Consultative Committee Meeting Minutes

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

**Minutes  
1 May 2012**

**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  
John Graham – PF Formation  
Peter Cummins – PF Formation  
Joshua Graham – PF Formation

Absent: Kane Winwood – NSW Department of Planning  
David Gathercole – Department of Environment, Climate Change & Water  
Peter Harkin - Resident

**Minutes of Previous Meeting**

- Accepted

**Report on Current Status of Operations by John Graham**

- Since the spring planting was done we have had plenty of water. Weeds have stabilized the planting area and we are confident there is a good coverage of natives.
- Our annual environmental reporting is done for the year to June so Parsons Brinckerhoff (PB) will visit our rehabilitation area in the next couple of months to sample some random quadrants and assess our progress.
- Along the Old Northern Road bunding and setback areas we have poisoned the kikuyu grass to prepare an area for further native planting.
- Sediment controls were well tested with the recent wet weather but there were no discharges. The sump pump system has been working very well minimizing run-off going to our main dam and making sure capacity is maintained. The speed hump near the main intersection has been limiting runoff at the intersection.
- No official complaints were received in the period since the last meeting. A phone call was made advising us that trucks had tracked mud across the intersection and it was immediately swept up.
- Due to the wet internal roads most recent extraction has been occurring at the extraction area near the entry from Wisemans Ferry Road. This area is close to the wash plant and minimizes the use of the internal haul roads. Whilst this location is very noticeable for people leaving our main quarry it is less noticeable for cars travelling 60kmh on Wisemans Ferry Road.

### **Reporting**

- PF Formation updated the environmental management and monitoring strategies/plans/programs as required under the approval. These revised plans were approved by the Director-General of the Planning Department since the last meeting.
- All updated plans are available for viewing on the website.
- The Annual Environment Management Report (AEMR) incorporates environmental data to 30 June and therefore will be completed before our next meeting.

### **Environmental Matters**

- The monthly dust deposit results were reviewed and discussed.
- Most monthly results were very low as was expected with the wet weather we have had.

### **Other Matters**

- Rod Clair from OEH has provided PF Formation with details on the Energy Saver program whereby a subsidized review of energy use is conducted. The program looks good and will be considered over the next year as a follow up to the Energy Action review done in 2011.
- The issue in the news of truck speed limiters being disabled was discussed. PF Formation indicated that it did not see this being a concern because the majority of customers have company drivers who are paid on an hourly rate ie they have little incentive to speed. The examples in the media recently seem to relate to interstate work where trucks travel on major highways where 100kph speeds can be reached and where the trucks are under time pressure.
- The status of the Section 94 roadworks program was discussed and Council advised that the next 5 year is currently being reviewed by their Traffic Manager. The need for road repairs after the rain on Old Northern Road was discussed but generally this work is not funded from the Section 94 monies collected and is usually carried out on a regular basis by the Roads and Maritime Services as part of their general maintenance works. It was also noted that Old Northern Road is only partly in the Hills Shire with the other part in Hornsby Shire, with the Shire boundary generally following the centre line of the road
- Survey work has been occurring on Old Northern Road near the quarry. Apparently the Transport, Roads and Maritime Services are looking at widening this section of the road. It was agreed that an overtaking lane in this area would not be the best use of funds. Overtaking lanes are needed halfway between Glenorie and Maroota not at the Maroota end. SH was to talk to the Hills Shire Traffic Manager on this matter.

### **Site Visit**

- A site inspection was not conducted because of the poor state of the internal roads due to the recent wet weather.

### **Next Meeting**

- 10.00 am Tuesday 20 November 2012

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

**Minutes  
2 November 2011**

**Attendance**

Kristine McKenzie – Baulkham Hills Shire Council (BHSC) - Chairperson  
Robert Buckham – Baulkham Hills Shire Council (BHSC)  
Marianne Sheumack – Resident  
Shaunagh Hitchcock – Resident  
Peter Harkin - Resident  
John Graham – PF Formation  
Peter Cummins – PF Formation  
Joshua Graham – PF Formation

Absent: Kane Winwood – NSW Department of Planning  
David Gathercole – Department of Environment, Climate Change & Water

**Minutes of Previous Meeting**

- Accepted

**Introduction**

- Welcome to Peter Harkin
- The background to the Committee and the site operations were briefly discussed. A consultative community committee was formed as a result of the 1998 Court consent and has been operating for about 12 years.

**Report on Current Status of Operations by John Graham**

- Operations have continued in a routine manner
- Rehabilitation has been proceeding with a further 1.5 hectares seeded. A total of 4 hectares have now been planted with Shale Sandstone Transitional Woodland plant community.
- A lot of supplemental planting has occurred in line with Parsons Brinkerhoff recommendations. A walking irrigator has been acquired to assist with the watering of the newly seeded area.
- On-going improvement of the intersection has occurred to minimize any issues in storm events. A bitumen speed bump has been built to better control sediment into the sediment traps.
- All quarry vehicles have now had broad band reversing alarms installed. These alarms run at a lower frequency than the normal reversing alarm and are less intrusive to neighbours. The alarm was demonstrated on the quarry tour later in the meeting.
- No complaints were received in the period since the last meeting.

**Reporting**

- PF Formation has updated the environmental management and monitoring strategies/plans/programs as required under the approval. These revised plans have been forwarded to the Director-General of the Planning Department seeking their approval.
- When approval is received all these revised plans will be put on the website..
- The Annual Environment Management Report (AEMR) has been submitted to the Planning Department and Hills Shire Council. Copies of the report on CD were provided to member who wanted a copy.
- The AEMR will be up on the website and incorporates updated environmental data to 30 June 2011 and the independent audit report and the response to it.

**Environmental Matters**

- The monthly dust deposit results were handed out and discussed.
- Most monthly results were low but exceptions were noted but considered unrelated to quarry activities.

**Other Matters**

- Electricity efficiency and alternative energy sources were discussed. Peter Cummins to follow up with Rod Clair from DECC with regard to energy reviews.
- A energy review was done by Energy Action but no improvements could be made because PF Formation mainly uses pumps.
- The installation of flashing lights during the school hours was discussed
- No further action has occurred on the adjoining Nick Dean Development.
- The status of the Section 94 roadworks program was discussed and Council advised they were currently working on the next 5 year plan with the RTA.

**Site Visit**

- A site inspection was conducted.

**Next Meeting**

- 10.00 am Tuesday 1 May 2012

*Chapter Nine*

**INDEPENDENT AUDIT REPORTS**

**Attachment 9A** – Independent Environmental Audit Report

**Attachment 9B** – Response to Audit Recommendations

## **Attachment 9A**

### **Independent Environmental Audit Report**



## **Attachment 9B**

### Response to Audit Recommendations



Etra Pty Ltd as Trustee for PF Formation Trust  
ABN 61 113 814 256

Director-General

NSW Government Department of Planning

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NSW 2001

## SAND & CONCRETE

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14 June 2011

Dear Sir/Madam

### **Hitchcock Road Sand Project (06\_0104) Comments on Independent Environmental Audit**

Under Clause 7 of Schedule 5 of the Notice of Project Approval dated 3 February 2010 we are required to commission an Independent Environmental Audit within 12 months of the date of the approval. This audit has been completed and a copy is enclosed. Our response to the audit recommendations outlined on page 38 of the Report are detailed below:

1. *Improve screen planting on Lot 1 DP 570966 along Old Northern Road between Wisemans Ferry Road and 200 metres south and also near the project site access point on Wisemans Ferry Road.*

The bund wall along Old Northern Road will be reshaped to improve the visual screening.

With regard to the comment regarding Wisemans Ferry Road this relates to the gap in the bund wall used to access the site (photo 1). As the entry point is right opposite our extraction area there is no room to build a screening bund until this area is fully extracted which could take several years. Whilst the extraction area is clearly visible at this entry point the reality is no-one other than staff and visitors see this view. The gap in the bund wall is approximately 20 metres wide and road users only see this window while passing at 80 kilometres an hour ie for about 1.1 seconds.

2. *Old tyres need to be removed from public view near the project site access point on Wisemans Ferry Road and either stored within the main processing plant workshop area or legally disposed of.*

Agreed.

3. *The survey plan provided to the Department of Planning in May 2009 in the form of an orthophoto-map (see Appendix 5) needs amendment taking into account the approved Landscape Management Plan and re-submission to the Department of Planning and Infrastructure to show the following:*

- a. *A 10 metre buffer area (rather than 30 metres) along Old Northern Road near Lot 2 DP 570966 and Lot 2 DP 1063296.*
- b. *Areas of vegetation to be conserved including Sydney Hinterland Transition Woodland.*
- c. *An area of at least 12 hectares to be rehabilitated and re vegetated.*

The survey plan will be updated and re-submitted to the Department of Planning. The 12 hectares to be rehabilitated is conceptually shown in Appendix 5 to the Approval and will be progressively surveyed over the life of the development.

4. *Any encroachment of the extraction area within Lot 2 DP 570966 and the 10 metre buffer area near the intersection of the disused access way/Crown Road and Old Northern Road needs to be rehabilitated and revegetated during the spring months of 2011.*

There has not been an encroachment within the 10 metre set back from the Crown Road other than being used as an access track to backfill the extraction area. No extraction occurred within the setback. The area will be rehabilitated when the adjoining silt pond area is rehabilitated.

5. *All buffer setback areas need to be clearly delineated on the ground with a peg out survey and use of permanent markers such as star posts and high visibility tape, coloured stakes, fences or similar.*

The buffer setback areas in all extraction areas are all defined by existing bund walls, fences or other markers. Further identifying markers will be used.

6. *A Traffic Noise Management Strategy needs to be included in the Noise Management Plan and to refer to the Maroota local traffic management policy agreed with Maroota's major quarry operators.*

This will be included in the Noise Management Plan.

7. *The Environmental Strategy needs to be updated including the date of publication, new names of NSW government departments, new legislation, revised Australian Standards and references.*

This will be done.

8. *As required by the Environmental Strategy an annual internal audit needs to be completed and documented by the Environmental Manager and the Site Manager to provide the basis for the management of potential non-conformances and for annual reporting of environmental performance.*

Monthly the Environmental Manager has a checklist that is reviewed and signed with comments made as necessary. Annually each action required by the Environmental Operations Procedures are reviewed and signed by the relevant Manager. Annually these documents and a copy of the consent are reviewed by the Management team to make sure all matters have been completed. This review and matters taken forward are reported in the Annual Environmental Management Report (Chapter 3). The wording in 3.3.2 Compliance Audit of the Environmental Strategy will be revised to reflect the actual procedures which are satisfactory.

9. *Annual reports on the effectiveness of the retention basins need to be produced and included in the AEMRs.*

In the Water Management Statement of Commitments it says 'All retention basins will be regularly inspected and an annual report prepared on their effectiveness'. This commitment was incorporated into Strategy 5.1 of the Environmental Operation Procedures and is reviewed as part of the monthly checklist. These reports are signed off, dated and copies included in the AEMR (Chapter 3). Whilst there is no separate report it is reported in the AEMR in a satisfactory manner.

10. *In addition to the water truck the irrigation system along parts of the internal haul roads near the revegetation (other woodland) area needs to be fixed for regular use during dry windy periods.*

To minimize the need for water trucks to be used for dust suppression we have invested in fixed irrigation systems along some sections of the road. These systems require a high level of maintenance and regularly get blocked or break down. Therefore we have not expanded the use of the irrigation system and do not rely on it. We use our water truck to suppress dust from the roads when it is dry and windy.

11. *The concrete pipes and a large disused oil tank within the project site need to be removed off-site to reduce any risk of the items being buried within the areas of site excavation.*

Agreed.

12. *The depth of mining contours plan dated 08/05/2009 (see Appendix 6) and supplied to the Department of Planning needs to be updated to cover the whole extraction area of the site.*

As required by Clause 4 of Schedule 3 of the Approval Conditions this will be reviewed and updated within 3 months of the Environmental Audit.

13. *The water table contours plan dated 08/05/2009 (see Appendix 7) and supplied to the Department of Planning needs to be updated to cover the whole extraction area of the site.*

As above in point 12.

14. *Current calibration certificates for the weighbridge need to be included in the AEMRs.*

A copy of the certificate from the Department of Fair Trading will be included in the AEMR.

15. *Modified copies of the annual production data produced for the Department of Primary Industries using the standard form for that purpose need to be included in the AEMRs. With the consent of the Department of Planning and Infrastructure and to avoid disclosure of commercially sensitive information to the public and competitors, production data should be provided in 100,000 tonne bands in the AEMRs.*

The AEMR is available on our website for public viewing and therefore we are reluctant to include the detail of our sales as disclosed in the annual production data provided to the Department of Primary Industries. In the second paragraph of Chapter 2 of the AEMR we confirm that our annual volume was within the limit of 400,000 tonnes. We propose that the annual production form be appended to the AEMR but not included in the copy on the website or other copies that may potentially be publicized.

16. *Annual production data needs to be separated for Hornsby Shire and The Hills Shire in annual returns so that the maximum throughput of 400,000 tonnes/annum for the project can be independently verified.*

We are only required to complete one annual production data form for the Department of Primary Industries and there seems little point requiring more than one return. Even if a separate return was completed for Baulkham Hills Shire it still would not relate to this Approval as we have 3 different Approvals/Consents in this Council area (and 6 in the Maroota area). The throughput was readily audited in this Environmental Audit and any further paperwork serves no purpose.

17. *The Complaints Register needs to be recorded in full in response to any complaints on the project and any corrective actions undertaken.*

Agreed.

18. *Within the workshop area in PF Formations main processing area an impervious bund under a shelter needs to be provided as a storage area for disused and empty fuel, lubricant and chemical drums and containers. The bund must be designed to contain at least 110% of the volume of materials stored within the area.*

There is a storage area that should be used. Staff will be reminded of this.

19. *With the consent of the Department of Planning and Infrastructure only the three closest noise assessment locations to the project being R3 Jurd, R5 Pignataro, R10 Tornatola plus R7 Maroota Public School need be monitored in future.*

This is as required under our EPA licence after on-site meetings with the DECC before the Approval commenced.

20. *Future AEMRs need to make reference that the Site Manager and the Quarry Manager are interchangeable and the same person. Similarly future AEMRs need to make reference that the Environmental Manager and Environmental Officer positions are either one or two persons.*

Agreed.

21. *The AEMPs need to provide a plan showing all areas of in-progress rehabilitation and completed rehabilitation. The rehabilitation location plan should be based on the Vegetation Offset Plan and areas for new plantings included as Appendix 5 in the Project Approval.*

This is shown on Attachment 2A (green area) of the AEMP but will be made clearer in future AEMPs.

22. *In the interests of ecologically sustainable development the volume or quantity of fuels/lubricants, electricity and water/groundwater consumed by PF Formation's operations including the on-site and off-site processing plants should be monitored quarterly and an efficiency programme implemented to reduce annual consumption.*

We are a small company who closely monitor all expenses particularly the major components that impact our business such as fuel, electricity and water. Other than labour these are the major expenses in running our business. We constantly look for ways to reduce the usage of these items.

Fuel is used running all our quarry equipment and the fuel efficiency is a major consideration in every purchase decision.

Electricity is used to run all our sand washing equipment. We have always adopted a policy of utilizing electricity rather than diesel/petrol where we have a choice. We have had electricity specialists investigate our operations but as we mainly use it for running pumps and similar equipment there is little opportunity for introducing more efficient energy use.

Because of the shortage of water over the last few years we have an engineer implement measures to minimize our usage in our washplants. The main water loss is through evaporation in our silt ponds and we are continually looking at ways of minimizing this loss.

Formal quarterly monitoring would be an inefficient waste of resources on something that is reviewed continually and in particular each month when the bills are signed. An annual summary of work done will be incorporated in the AEMP.

23. *The PF Formation website needs regular updating for progress on approvals from the Department of Planning and Infrastructure and the audit.*

Agreed.

24. *The document Methodology to assess success of revegetation within Hitchcock Road site, September 2008, Parsons Brinckerhoff Australia Pty Limited needs to added to PF Formation's website as an addition to the Project Approval.*

Agreed and done. Included in Appendix 6 to the Project Approval.

25. *A full legible copy of the Project Approval including all Appendices as provided by the Department of Planning on 7 March 2011 needs to be included on PF Formation's website.*

Agreed and done. The copy previously on the website was the one received from the Department of Planning – a new clearer copy has now been received and put on the website.

Yours faithfully



Peter Cummins  
General Manager



**Photo 1 : Wisemans Ferry Road Maroota**

