PHASE 2 ENVIRONMENTAL SITE ASSESSMENT

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- Environmental Monitoring

SYDNEY WET 'N' WILD PROSPECT NSW

Prepared for

PROSPECT AQUATIC INVESTMENTS (PAI)

Prepared by

RCA AUSTRALIA

RCA ref 7600-403/2

DECEMBER 2010

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DOCUMENT STATUS						
Rev No	**Comment**	**Author**	**Reviewer**	**Approved for Issue (Project Manager)**		
				Name	**Signature**	**Date**
/0	Draft	N Hills	D Johnson	G Mason		23.11.10
/1	Draft	N Hills	D Johnson	G Mason		3.12.10
/2	Final	N Hills	D Johnson	G Mason		17.12.10

DOCUMENT DISTRIBUTION				
Rev No	**Copies**	**Format**	**Issued to**	**Date**
/0	1	Electronic (email)	Kellogg Brown and Root Pty Ltd	23.11.10
/0	1	Electronic (email)	Prospect Aquatic Investments	23.11.10
/0	1	Electronic report	RCA – job archive	23.11.10
/1	1	Electronic (email)	Kellogg Brown and Root Pty Ltd	3.12.10
/1	1	Electronic (email)	Prospect Aquatic Investments	3.12.10
/1	1	Electronic report	RCA – job archive	3.12.10
/2	1	Electronic (email)	Kellogg Brown and Root Pty Ltd	17.12.10
/2	1	Electronic (email)	Prospect Aquatic Investments	17.12.10
/2	2	Bound Report	Prospect Aquatic Investments	17.12.10
/2	1	Electronic report	RCA – job archive	17.12.10

Contents

APPENDICES

APPENDIX A

DRAWINGS

APPENDIX B

TEST PIT LOGS

APPENDIX C

SUMMARY OF RESULTS

APPENDIX D

PERMEABILITY CALCULATIONS

APPENDIX E

LABORATORY REPORT SHEETS

RCA ref 7600-403/2

17 December 2010

Prospect Aquatic Investments (PAI)
c/- Kellogg Brown and Root Pty Ltd
201 Kent Street
SYDNEY NSW 2000

Attention: Wojtek Zborowski

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GEOTECHNICAL • ENVIRONMENTAL

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Construction Materials Testing

PHASE 2 ENVIRONMENTAL ASSESSMENT

SYDNEY WET 'N' WILD, PROSPECT, NSW

1 INTRODUCTION

RCA Australia (RCA) has been engaged by Kellogg Brown and Root to undertake a Phase 2 Environmental Site Assessment (ESA) at Lot 1 DP1045771, Prospect NSW at the request of Mr Wojtek Zborowski on behalf of Prospect Aquatic Investments (PAI).

It is understood that the site is planned to undergo redevelopment to accommodate a "*Wet 'n' Wild*" water theme park and as part of this redevelopment a Phase 2 ESA is required.

A number of potentially contaminating activities and consequently contaminants of concern were identified within the Phase 1 ESA report (Ref [1]) including asbestos, pesticides, herbicides, hydrocarbons and heavy metals and these are outlined in Section 3 of this report. The information obtained from the Phase 1 ESA report provided a basis for the development of a scope of works for the Phase 2 assessment of the site.

The purpose of this investigation is to develop a site characterisation by identifying the location and extent of any contamination that may be present on site. This will ensure appropriate materials management is undertaken prior to or during the construction phase of the project.

At the request of the client, RCA investigated the vacant land at the site only and did not undertake any investigation of the residential properties on the site.

2 SITE DESCRIPTION AND LOCATION

The site is located at Reservoir Road, Prospect and is approximately 25.5ha in size. The site of this assessment is known as Lot 1 DP1045771. The site is bordered by bushland to the south, rural residential properties to the east and west and the 'M4' Motorway to the north (**Drawing 1** in **Appendix A**).

The site can be classed as rural residential and, as such, contains some residential development and associated buildings (ie, sheds and garages) within the southern and eastern boundaries of the site. The site is generally flat to hilly and comprises a mix of different species of grass and sparse trees.

The closest environmental feature is Blacktown Creek which appears to begin as a low-lying catchment in the centre of the site and continues to run north (**Drawing 1** in **Appendix A)**. The Prospect reservoir is located approximately 700m to the south of the site and is considered the closest sensitive environmental receptor. The closest sensitive human health land use to the site is the *Blacktown Happy Days Kindergarten*, which is located approximately 2.5km to the north of the site.

3 SITE HISTORY AND BACKGROUND INFORMATION

The site is currently unzoned under State Environmental Planning Policy (SEPP) (Western Sydney Parklands) 2009. The site is presently utilised as rural residential land, however the proposed site use is for a commercial leisure development.

Review of the *Section 149 Certificate for the site, contained within the Phase 1 report (Ref [1])* shows that the land is not affected by the Blacktown Development Control Plan (DCP) 2006 or the Blacktown Local Environment Plan (LEP) 1998. A number of State Environmental Planning Policies (SEPPs) that do apply to the land can be found within the Phase 1 report (Ref [1]).

Based on a review of site history contained within the Phase 1 report (Ref [1]), including historical aerial photographs for the years 1951, 1961, 1978, 1986, 1996 and 2005, the following Contaminants of Concern (COCs) have been identified that may be associated with activities undertaken at the site:

- Asbestos – in fill material from demolition activities and around areas of present and former buildings.
- Pesticides and herbicides – across the majority of the site from past agricultural use.
- Hydrocarbons – in fill material and areas of present and former storage sheds and potentially around present and former residential developments.
- Heavy metals – across the entire site from past agricultural use and development activities on the site.

Whilst no Phase 2 works were undertaken on the residential properties on the site at the request of the client, it was noted that all appeared to contain asbestos building products in their construction.

4 FIELDWORK

An environmental scientist experienced in the handling of potentially contaminated soil and groundwater undertook the fieldwork from 18 to 22 October 2010.

The collection of all soil and groundwater samples was undertaken in compliance with RCA methodology, which forms part of our accreditation. Soil and groundwater sample collection methods comprised:

- disturbed soil samples from the bulk of soil within the backhoe bucket;
- disturbed samples direct from the hand auger; and
- hand bailer – following bore development (three (3) bore volumes) and the purging of one bore volume, continuing until pH and EC readings were within 0.1 units to ensure a representative sample is collected.

These soil and groundwater collection methods were chosen for the site due to the requirement for limited disturbance at the site and limited access at the site.

Test pitting was undertaken at a total of twenty four (24) locations using a rubber-tyred backhoe. Test pits were located in a 50m spaced general grid pattern across the site (**Drawing 1**, **Appendix A**) and undertaken to a depth of approximately 2.0m or until excavator bucket refusal on hard materials. Samples were taken directly from the backhoe bucket from two (2) separate depths varying between 0 to 0.5m in fill materials and 1.0 to 1.5m from natural materials from each test pit. Deeper samples were not able to be obtained due excavator bucket refusal on hard materials.

Surface soil samples were collected from a total of sixteen (16) locations using a hand auger. Again, these locations were located in a grid pattern across the site (**Drawing 1**, **Appendix A**) and were collected from depths varying between 0 to 0.5m.

All soil samples collected were analysed for total petroleum hydrocarbons (TPH), Benzene Toluene Ethyl-benzene and Xylenes (BTEX), and metals 8 (As, Cd, Cr, Cu, Ni, Pb, Zn and Hg).

All surface soil samples from hand auger locations, as well as samples collected from TP4a, TP8a, TP9a, TP9b, and TP11a had the additional analysis of Polycyclic Aromatic Hydrocarbons (PAHs), Organo-chlorine pesticides (OCPs) and Organo-phosphorus pesticides (OPPs) to assess potential impacts from historical agricultural practices in these areas.

A total of five (5) groundwater monitoring wells (piezometers) were installed at targeted locations across the site. These wells were developed by removing three times the well volume, at which time the rising head permeability was measured. Permeability calculations are attached in **Appendix D**. Groundwater samples were collected from all locations and analysed for TPH, BTEX, Metals (8), and PAHs (low level).

Decontamination of the sampling equipment was undertaken by washing the bailer with Decon 90 then rinsing with potable water between samples. No decontamination of the backhoe bucket was undertaken, however the collection of the sample from within the bulk of the excavated soil material (rather than against the side of the bucket) is considered to prevent potential cross-contamination.

All test pits were logged by a qualified scientist and all samples were described for future reference.

Examination of the NSW Department of Mineral Resources 1:100,000 scale Penrith geology sheet (Ref [8]), indicates the site lies within the mapped extent of the Bringelly Shale of Triassic age. Listed rock types for the Bringelly Shale are: shale, carbonaceous claystone, laminite, fine to medium grained lithic sandstone and rare coal and tuff.

The subsurface profile encountered on the site is detailed on the attached field logs and is summarised in **Table 1**.

Table 1 *General Summary of Subsurface Conditions (or Summary of Subsurface Conditions at Test Locations)*

Typical Depth (m)		Material Type	Description/Comment
Top	Base		
0.0	0.2-0.4	Filling	Uncontrolled. Mixture of clay and topsoil, with occasional bricks.
0.2-0.4	0.4-0.6	Topsoil	Silty sand, wet, black. Typically 200mm thick.
0.4-0.6	1.0-1.2	Clay	Stiff becoming hard with depth. Moist, brown.
1.0-1.2	>1.5	Claystone rock	Highly weathered, friable, white.

Test pit logs are attached in **Appendix B**.

Fill was identified at Reservoir Road extending in a northerly direction and is outlined on **Drawing 1**, **Appendix A**.

The depth to groundwater measured at each of the monitoring wells ranged between 0 to 9.26m below ground level. A summary table of depths is presented below in **Table 2**.

Table 2 *Summary of Piezometer Specifications and Depth of Groundwater*

	BH10	BH9	BH8	BH5	BH2
Stick-up (m)	0.6	0.62	0.54	0.65	0.45
Depth to aquifer (m)	9.86	1.8	5.45	0.65	1.33
Depth of bore (m)	10.33	7.74	10.51	8.94	6.93
Depth Below Ground-Level (m)	9.26	1.18	4.91	0	0.88

A rising head permeability test was conducted for each of the monitoring wells. This was done by removing one bore volume using a bailer and measuring the rate at which the bore recharged. Permeability calculations are attached in **Appendix D**.

QUALITY ASSURANCE/QUALITY CONTROL

All samples were preserved as recommended by the analytical laboratory and stored in the field in an Esky on ice (at approximately 4^{o}C). Samples were then stored in the RCA refrigerator until transport.

All samples were sent under Chain of Custody (COC) documentation detailing the sample identification, required analysis, the name of the sampler and date released from custody. The laboratory acknowledged the receipt of samples by signature and date and returned the COC with a sample receipt notice indicating the condition of the samples received upon receipt.

A total of eight (8) soil duplicate samples and four (4) soil blanks were submitted blind to the laboratory for analysis, including four (4) inter-laboratory and four (4) intra-laboratory duplicates. This represents a percentage of 11%, in accordance with the Australian Standard and RCA protocol.

One water duplicate and one blank were submitted blind to the laboratory, in accordance with RCA protocol.

Results are summarised in **Appendix C**.

Results indicate a total of three (3) soil analyses which report a Relative Percentage Difference (RPD) in excess of the acceptance criteria:

- TP15a/QA1 - Reported an elevated RPD for chromium, copper nickel and zinc. This sample is described as red/brown silty CLAY and it is therefore considered that sample heterogeneity is not the likely cause of the high RPD. Whilst there is some uncertainty associated with this sample, both the sample and duplicate reported concentrations well below the site guidelines and the data is considered to be reliable for use in this report.

- TP18b/QA3 - Reported an elevated RPD for copper. This sample is described as grey/red/brown SILTSTONE and it is therefore considered that sample heterogeneity is not the likely cause of the high RPD. Whilst there is some uncertainty associated with this sample, both the sample and duplicate reported concentrations well below the site guidelines and data is considered to be reliable for use in this report.

- TP19a/QA4 - Reported an elevated RPD for nickel. This sample is described as red silty CLAY with grey sandstone bands and it is therefore considered that sample heterogeneity is the likely cause of the high RPD due to the banding present in the sample. Both the sample and duplicate reported concentrations well below the site guidelines and data is considered to be reliable for use in this report.

Results indicate a total of five (5) soil and one (1) groundwater field blank analyses which reported analyte concentrations that were equal to or in excess of the laboratory Limit of Reporting (LOR):

- QB1 Reported detect results for As, Cr, Ni, and Zn.
- QB2 Reported detect results for As, Cr, Cu, Ni, and Zn.
- QB3 Reported detect results for As, Cr, Ni, and Zn.
- QB4 Reported detect results for Cr, and Ni.
- WB1 Reported detect results for Cr, Cu and Zn.

All blanks reported the above analytes equal to or slightly above the LOR. This is considered to have resulted from the source of the blank material and not as a result of cross-contamination. This minor non-compliance is not considered to affect the overall integrity of results.

Labmark was chosen as the primary laboratory and ALS was chosen as the secondary laboratory.

All laboratories used for analysis are NATA accredited and are experienced in the analytical requirements for potentially contaminated soil and groundwater.

Both laboratories undertook internal quality assurance testing. Results are contained within the laboratory report sheets, **Appendix E**. **Table 3** presents a summary of their review.

Table 3 *Internal Quality Assurance Review*

	Number Samples (including QA)	Laboratory Duplicates	Spikes	Laboratory Control Samples	Laboratory Blanks
Requirement		**10%**	**5%**	**One every batch**	**One every batch**
Soil					
BTEX	70	8	4	2	2
TPH C_6-C_9	70	8	4	2	2
TPH C_{10}-C_{36}	70	8	4	2	2
Metals (As, Cd, Cr, Cu, Ni, Pb, Zn and Hg)	70	8	4	2	2
PAHs	24	3	2	2	2
OCP/OPP	24	3	2	2	2
Water					
BTEX	6	1	1	1	1
TPH C_6-C_9	6	1	1	1	1
TPH C_{10}-C_{36}	6	1	1	1	1
Metals (As, Cd, Cr, Cu, Ni, Pb, Zn and Hg)	6	1	1	1	1
PAHs	6	1	1	1	1

Examination of the above table reveals that Labmark have undertaken laboratory quality assurance testing in accordance with the NEPM.

- Recoveries of Surrogates were within acceptance criteria of 70-130%.
- Holding Times were within laboratory specified timeframes.
- Recoveries of laboratory control samples were within the acceptance criteria of 70-130%.
- Recoveries of Spikes were within acceptance criteria of 70-130% with the exception of:
    - E050669 - Copper in Sample TP1b which reported recoveries of 45%;
    - E050669 - Copper in Sample TP6b which reported recoveries of 66%;
    - E050669 - Arsenic, Chromium and Copper in Sample ES10 which reported recoveries of 44%, 34%, and 10% respectively.
    - E050669 - Arsenic in Sample QA1 which reported recoveries of 67%.

The non-compliance of some spike recoveries is considered to be minor due to the good performance of external QA, remaining internal QA and low concentrations in samples compared to guideline values.

- Relative Percentage Differences for Duplicates were within acceptance criteria the exception of:
    - E050669 - Arsenic in Sample TP23b reported a RPD of 120%. This sample is described as mottled brown/grey silty CLAY and it is therefore considered that sample heterogeneity is not the likely cause of the high RPD. There is some uncertainty associated with this sample, however a triplicate undertaken indicated that the representative concentration is most likely similar to that reported for the duplicate and as such this value has been used in the characterisation of the site.
- No Laboratory Blank result was detected above the PQL.

It is therefore considered that the data obtained from this testing is accurate and reliable in as far as it can be ascertained.

5 SITE GUIDELINES

The following guidelines have been adopted for the assessment of this site.

5.1 SOIL

5.1.1 DECC – WASTE CLASSIFICATION GUIDELINES (2008)

These guidelines have been prepared by the DECC and apply to any material which requires offsite disposal. Any material which is required to leave the site must be characterised against the NSW waste classification guidelines prior to disposal off site to a licensed facility.

5.1.2 NEPM – NATIONAL ENVIRONMENT PROTECTION (ASSESSMENT OF SITE CONTAMINATION) MEASURE (1999)

The guidelines used for the assessment of the soil on site were sourced from the National Environment Protection Measure (NEPM) for the Assessment of Site Contamination, 1999 (Ref [4]). Schedule B (1) of this measure provides a table for the investigation concentrations for contaminants based on human health risk and certain exposure scenarios due to site use.

The site can currently be classed as rural residential, however based on information provided to RCA the intended site use will be of a commercial nature. While HIL 'F' (commercial) guidelines are applicable for the intended site use, RCA has adopted the more conservative HIL 'A' (residential) guidelines for comparison of analytical results.

RCA therefore considers the following guidelines to be appropriate for site assessment:

- HIL 'A' Residential, access to soil, fruit and vegetable consumption <10%, no poultry, no groundwater consumption: This category includes children's day care centres, kindergartens, preschools and primary schools.

Results were also compared to the ecological investigation levels (EILs).

The NEPM sets out an acceptance procedure by which sites can be considered as suitable for use depending on the sample results. The mean of the sample results can be compared to the guidelines as long as:

- no single value exceeds 250% of the chosen guidelines;
- the standard deviation of the results for each analyte is less than 50% of the guideline.

However, this approach does not allow for sampling and analytical variability, therefore the Sampling Design Guidelines (Ref [2]) recommends the use of the 95%UCL_{ave}, calculated for a site using samples collected from the same lithology, for comparison with the guidelines.

5.1.3 NSWEPA – SERVICE STATION GUIDELINES

The guidelines adopted for TPH C_6-C_9, TPH C_{10}-C_{36} and BTEX were the "Guidelines for Assessing Service Station Sites" produced by the NSWEPA, December 1994, (Ref [3]). These guidelines are applicable for soil and water concentrations on all sites where fuel has been stored.

5.2 WATER

5.2.1 DECC 2007, GUIDELINES FOR THE ASSESSMENT AND MANAGEMENT OF GROUNDWATER CONTAMINATION

These groundwater quality guidelines have been introduced by the NSWDECC (Ref [5]). These guidelines recommend that ANZECC 2000 (Ref [6]) investigation levels be adopted as Groundwater Investigation Levels (GILs) for aquatic ecosystems and NHMRC and NMMC 2004 (Ref [7]) for drinking water GILs.

ANZECC 2000 is a complex set of guidelines that consider not only the level of protection (eg, 99% or 95%) but also the state of the receiving water (eg, moderately disturbed). For the protection of aquatic ecosystems the DECC recommend the use of 95% protection for all analytes. The following comments are additionally made:

- Where the existing generic GIL is below the naturally occurring background concentration of a particular contaminant, the background concentration becomes the default GIL.

- Where PQLs are greater than the recommended GIL the PQL is adopted as the GIL. Where background concentrations are proven to be greater than the GIL, the background concentration is adopted as the GIL.

- Where there is insufficient data for the derivation of marine water guidelines it is allowable to use fresh water guidelines (Section 8.3.4.5, pg 8.3-36, (Ref [6]).

5.3 APPROPRIATENESS OF THE GUIDELINES

The NEPM document has been approved by the NSWEPA for use on potentially contaminated sites and supersedes most of the preceding reference documents. The Service Station Guidelines are still current for TPH and BTEX concentrations. The DECC Waste Classification guidelines are current for classification of waste material in NSW.

The exposure settings on which the NEPM guidelines are based directly affect the investigation concentration used to assess the contamination status of the site.

The DECC guidelines are applicable for groundwater and are the current endorsed guidelines.

6 RESULTS

Phase 2 ESA was undertaken on the site and consisted of collection of soil samples from test pits excavated by backhoe excavator and shallow soil samples collected by use of hand auger. The following presents a summary of the sampling and analysis undertaken:

- A total of sixty two (62) soil samples collected from test pits were analysed for TPH, BTEX and metals 8.

- Sixteen (16) surface soil samples, as well as samples TP4a, TP8a, TP9a, TP9b, and TP11a had the additional analysis of PAHs, OCPs and OPPs.

- A total of five (5) groundwater samples were collected and analysed for TPH, BTEX, Metals 8, and PAHs (low level).

6.1 SOIL RESULTS

All soil results are compared to the relevant guidelines in **Appendix C**. In summary:

- Sixty two (62) soil samples were analysed for BTEX with all samples reporting concentrations below the laboratory Limit of Reporting (LOR) and therefore below the site guidelines.

- Sixty two (62) soil samples were analysed for TPH C_6-C_{36} with sample results ranging from below the laboratory LOR to 500mg/kg, and all results were below the site guidelines.

- Twenty one (21) soil samples were analysed for PAHs with all samples reporting concentrations below the laboratory LOR and therefore below the site guidelines.

- Sixty two (62) soil samples were analysed for Metals (As, Cd, Cr, Cu, Ni, Pb, Zn and Hg) with all metal species reporting concentrations below the site guideline. Samples TP3b, ES14 and ES15 reported arsenic concentrations of 26mg/kg, 21mg/kg and 23mg/kg respectively. While these concentrations slightly exceed the EIL guidelines (20mg/kg) their ecological impact is considered to be insignificant. All samples reported chromium concentrations above EIL guidelines.

- Twenty One (21) soil samples were analysed for OCPs with all samples reporting concentrations that are below the site guidelines.

- Twenty one (21) soil samples were analysed for OPPs with all samples reporting concentrations below the laboratory LOR. It should be noted that there is no specific guidelines for this group of analytes.

6.2 GROUNDWATER RESULTS

All groundwater results are compared to the relevant guidelines in **Appendix C**. In summary:

- Five (5) groundwater samples were analysed for BTEX with all samples reporting concentrations below the laboratory LOR and therefore below the site guidelines.

- Five (5) groundwater samples were analysed for TPH with all samples reporting concentrations below the site guidelines, with the exception of **EW1** and **EW2** which reported a concentration of 6900µg/L and 320µg/L for TPH C_6-C_{36} respectively. The guideline is 600µg/L.

- Five (5) groundwater samples were analysed for PAHs (low level) with all samples reporting concentrations below the site guidelines, with the exception of **EW1** which reported a concentration of 5µg/L for the analyte phenanthrene. The guideline is 2µg/L.

- Five (5) groundwater samples were analysed for metals. Sample EW2 reported concentrations for Cd, Ni and Zn in excess of the EIL guidelines. Sample EW3 and EW4 reported concentrations for Ni and Zn in excess of the EIL guidelines. Sample EW5 reported concentrations for Zn in excess of the EIL guideline.

The permeability was determined for all monitoring wells (BH2, BH5, BH8, BH9 and BH10). A summary of permeabilities is presented in **Table 3** and permeability calculations are presented as **Appendix D**.

Table 3 *Summary of Borehole Permeabilities*

	BH2	BH5	BH8	BH9	BH10
Permeability	8.3E-07	1.0E-07	1.4E-07	2.1E-07	7.7E-09

The direction and rate of groundwater flow was determined by creating a groundwater contour map (**Drawing 2**, **Appendix A**). Groundwater is noted as flowing from a north-east to a south-west direction at a rate of approximately 0.10 m/year.

7 DISCUSSION

Fill material was identified in one area of the site and is shown on **Drawing 1, Appendix A**. The material was identified from the bend on Reservoir Road and extends north towards the dam in the middle of the site (encompassing TP7, TP8, TP9 and TP11).

A trace amount of bonded asbestos (AC) was identified within a bulk sample taken from TP7 at a depth of approximately 1.20 to 1.50m. There was no AC material noted during excavation of any test pits and therefore the extent of AC impact is considered to be limited. It should be noted during site works that there is potential for some AC to be present within the fill material. Should any further asbestos be identified during site works, advice should be sought from a suitably qualified consultant.

Some soil samples (TP3b, ES14 and ES15) reported arsenic in excess of the EIL guideline and all soil samples exceeded the EIL guideline for chromium. These concentrations exceeded the EIL only slightly and therefore are not considered to be of concern.

Groundwater sample EW1 and EW2 reported TPH C_{10}-C_{36} concentrations of 6900µg/L and 320µg/L, respectively. These elevated concentrations are in excess of the adopted ANZECC guideline (95%Fresh[A]). Sample EW1 also recorded phenanthrene concentrations of 5µg/L, slightly in excess of the guideline (4µg/L). Following discussion with the drilling sub-contractor it was noted that drilling oils were not used during the installation of any of the monitoring wells. Based on discussion with a RCA senior engineering geologist it is believed the elevated TPH concentrations are likely due to natural shale oil deposits within the Bringelly Shale and are considered to be limited in area. Additional monitoring could be undertaken to confirm the concentrations of TPH in the groundwater at locations where TPH was identified. Due to the low permeability of underlying soils, low groundwater sensitivity at the site, and isolated occurrence RCA considers no specific soils or groundwater remediation is required.

Based on the stratigraphy of the site it is likely that the monitoring wells intersect numerous confined aquifers. The rock strata and type (shale and claystone) are likely placing the aquifer(s) under pressure which is resultant in raised groundwater levels within monitoring wells. This is not considered to affect the integrity of the data obtained and as such is appropriate for use in characterisation of this site. It has been determined that groundwater is flowing to the south west direction through the site at a rate of approximately 0.10 m/year. It should be noted that this is directly towards the Prospect Reservoir and is likely a source of recharge for the reservoir. The proposed development is not considered likely to have an impact on the groundwater of the region. In the case that groundwater is to be encountered during construction works; a hydro-geological study may be required and a suitably qualified professional should be contacted for advice.

8 CONCLUSIONS

Test pitting was undertaken at a total of twenty four (24) locations across the site in a general grid-like pattern to a depth of approximately 2.0m or until bucket refusal. Samples were collected from between 0-0.5m and 1-1.5m and analysed or TPH, BTEX and metals. Samples collected from TP4a, TP8a, TP9a, TP9b and TP11a had the additional analysis of OCPs, OPPs and PAHs.

Surface soil samples were collected at a total of sixteen (16) locations across the site in a grid-like pattern from depths ranging between 0-0.5m. All samples were analysed for TPH, BTEX, metals 8, OCPs, OPPs, and PAHs.

Groundwater monitoring wells were installed at a total of five (5) locations (BH2, BH5, BH8, BH9 and BH10) with samples collected from each and analysed for TPH, BTEX, metals 8, and PAHs (low level). The permeability was calculated for each monitoring well by conducting a rising head permeability test and measuring the rate at which the bore recharged.

All soil analyses reported analyte concentrations below site guidelines and while some metals slightly exceed EIL guidelines their ecological impact is considered insignificant.

Groundwater sample EW1 and EW2 reported elevated TPH C_{10}-C_{36} concentrations. Sample EW1 also reported phenanthrene concentrations slightly in excess of the guideline. Following discussion with a senior engineering geologist it is believed that these elevated concentrations are likely due to natural shale oil deposits. Due to the low permeability and isolated occurrence RCA considers no specific remediation is required. While some metals reported concentrations slightly in excess of the EIL guidelines their ecological impact is considered insignificant.

RCA considers from the site characterisation of soil and groundwater contamination that the site is appropriate for its intended redevelopment.

9 LIMITATIONS

This report has been prepared for PAI in accordance with an agreement with RCA. The services performed by RCA have been conducted in a manner consistent with that generally exercised by members of its profession and consulting practice.

This report has been prepared for the sole use of PAI. The report may not contain sufficient information for purposes of other uses or for parties other than PAI. This report shall only be presented in full and may not be used to support objectives other than those stated in the report without written permission from RCA.

The information in this report is considered accurate at the date of issue with regard to the current conditions of the site. Conditions can vary across any site that cannot be explicitly defined by investigation.

Environmental conditions including contaminant concentrations can change in a limited period of time. This should be considered if the report is used following a significant period of time after the date of issue.

Yours faithfully

RCA AUSTRALIA

Nathan Hills
Environmental Scientist

David Johnson
Principal Environmental Engineer

REFERENCES

[1] RCA, *Phase 1 Environmental Site Assessment*, 5 January 2010.

[2] NSWEPA, *Sampling Design Guidelines*, September 1995.

[3] NSWEPA, *Guidelines for Assessing Service Station Sites*, December 1994.

[4] NEPC, *National Environment Protection (Assessment of Site Contamination) Measure*, 1999.

[5] DECC, *Contaminated Sites – Guidelines for the Assessment and Management of Contaminated Groundwater*, March 2007.

[6] ANZECC, *Australian and New Zealand Guidelines for Fresh and Marine Water Quality*, October 2000.

[7] National Health and Medical Research Council, *Australian Drinking Water Guidelines*, 1996.

[8] RCA, Preliminary Geotechnical Assessment, 17 December 2009

GLOSSARY

Aerobic	An environment that has a partial pressure of oxygen similar to normal atmospheric conditions.
AHD	Australian Height Datum (m), based on a mean sea level.
ANZECC	Australian and New Zealand Environmental Conservation Council.
Brownfield	An abandoned, idled, or under-used industrial or commercial facility where expansion or redevelopment is complicated by a real or perceived environmental contamination.
DECC	Department of Environment and Climate Chance
DLWC	Department of Land and Water Conservation.
EMP	Environmental Management Plan.
HIL 'A'	Standard Residential Health Based Investigation Level, pg 9 Schedule B1, *National Environment Protection (Assessment of Site Contamination) Measure.*
HIL 'F'	Commercial/industrial Health Based Investigation Levels, pg 9 Schedule B1 *National Environment Protection (Assessment of Site Contamination) Measure*.

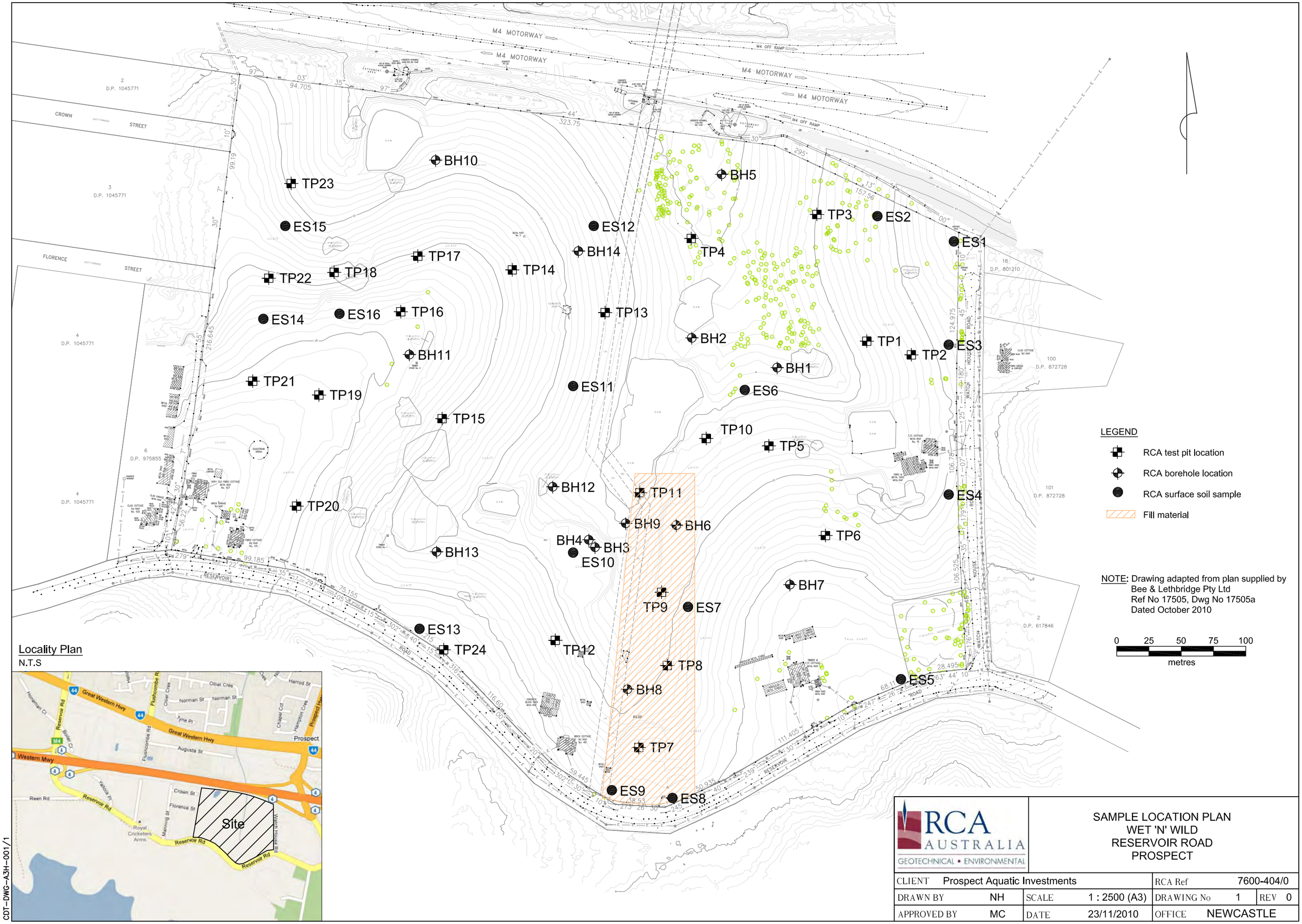
Hotspot	A sample, or location, where contaminant concentrations exceed 250% of the appropriate guideline.
Interlaboratory	Prefix inter – as meaning between. A sample sent to two different laboratories for comparative analysis.
Intralaboratory	Prefix intra – as meaning within. A sample sent twice to the sample laboratory for comparative analysis.
kg	kilogram, 1000 gram.
LEP	Local Environment Plan. A planning tool for the Local Government.
LOR	Limit of Reporting.
µg	microgram, 1/1000 milligram.
mg	milligram, 1/1000 gram.
NEPC	National Environment Protection Council.
NEPM	National Environment Protection Measure.
NHMRC	National Health and Medical Research Council.
PPE	Personal Protective Equipment.
PQL	Practical Quantitation Limit.
QA	Quality Assurance.
QC	Quality Control.
RPD	Relative Percentage Difference.
Weathering	All physical and chemical changes produced by atmospheric agents.

<u>Chemical Compounds</u>

BTEX	Benzene, Toluene, Ethylbenzene, Xylene.
OCPs	Organochlorin Pesticides.
PAH	Polycyclic Aromatic Hydrocarbons. Multi-ring compounds found in fuels, oils and creosote. These are also common combustion products.
TPH	Total Petroleum Hydrocarbons.

Appendix A

Drawings



LEGEND

- RCA test pit location
- RCA borehole location
- RCA surface soil sample
- Fill material

NOTE: Drawing adapted from plan supplied by Bee & Lethbridge Pty Ltd
Ref No 17505, Dwg No 17505a
Dated October 2010

0 25 50 75 100
metres

RCA AUSTRALIA
GEOTECHNICAL • ENVIRONMENTAL

SAMPLE LOCATION PLAN
WET 'N' WILD
RESERVOIR ROAD
PROSPECT

CLIENT	Prospect Aquatic Investments			RCA Ref	7600-404/0
DRAWN BY	NH	SCALE	1 : 2500 (A3)	DRAWING No 1	REV 0
APPROVED BY	MC	DATE	23/11/2010	OFFICE	NEWCASTLE

CDT-DWG-A3H-001/1