REMEDIAL ACTION PLAN

FIG TREE PARK STAGE 2

HONEYSUCKLE DEVELOPMENT ESTATE

Prepared for

HONEYSUCKLE DEVELOPMENT CORPORATION

Prepared by

RCA AUSTRALIA

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RCA ref: 3242A-002/1

27th February 2004

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Attention: Mr Peter Bowles

REMEDIAL ACTION PLAN

FIG TREE PARK STAGE 2, HONEYSUCKLE DEVELOPMENT ESTATE

1 SCOPE OF WORK

This Remedial Action Plan (RAP) has been prepared to facilitate the development of the second stage of Fig Tree Park (FTP). The proposed development is for use of the site as open space or parkland. The entire area of FTP extends from the Mariner Apartments on Hannell Street, Wickham, south down to Lee Wharf 5. Initially the site was assessed as one area, however for the purpose of remediation the site was divided into two areas, north (Stage 1) and south (Stage 2). The northern portion of the site was found to be contaminated with both total petroleum hydrocarbons (TPH) and polycyclic aromatic hydrocarbons (PAHs) in soil and groundwater while the southern portion was contaminated with a soil layer of PAHs only.

It was decided to remediate the northern portion of the site first through excavation and removal of the contamination off site. The northern portion of works has been validated by RCA Australia (RCA) in October 2003, however is yet to be signed off by the NSW EPA Accredited Auditor, Mr Graeme Nyland.

This RAP outlines the remedial options for the southern portion, Stage 2, of FTP only.

2 SITE IDENTIFICATION

The site location, description, legal titles, zoning, topography, geology and hydrogeology have all been addressed in the Parsons Brinckerhoff (PB) Environmental Site Assessment report November 2002 (Ref. 1) and can be summarised as follows:

2.1 SITE LOCATION AND DESCRIPTION

The site is located between Hannell Street and the Throsby Basin section of Newcastle Harbour (Drawing 1). The entire site begins immediately adjacent to the southern end of the Marina Apartment complex recently constructed on Hannell Street Wickham. Drawing 1 indicates the location of the site with respect to Newcastle. The second stage of the works, however, continues from the southern edge of the first stage as indicated on Drawing 2.

2.2 LEGAL TITLE AND ZONING

The site is identified as Lot 105 on DP 1015391.

Under the Newcastle Local Environmental Plan (LEP) 2003 the site, including the sea wall section, is zoned 6 (a) Open Space and Recreation.

2.3 TOPOGRAPHY

The site is predominantly flat and has been subject to extensive filling.

2.4 GEOLOGY

The site is underlain with quaternary alluvial deposits of the Cainozoic era comprising gravel, fine sandy clay and silt.

2.5 HYDROGEOLOGY

Groundwater flow across the site is expected to be in an easterly direction, toward the Throsby Basin section of Newcastle Harbour. Groundwater was encountered at depths between 2.5m and 3m below ground level.

2.6 SURFACE WATER

The nearest surface water receptor for the site is the Throsby Basin section of Newcastle Harbour. Surface water is expected to flow east toward the harbour.

3 SITE HISTORY / BACKGROUND INFORMATION

Reports detailing site history and background information for the Fig Tree Park site have been reviewed in the PB Environmental Site Assessment report November 2002 (Ref 1) and include the following in relation to Stage 2 of the works:

- The Marina Precinct (which contains the current Fig Tree Park site) was a foreshore area approximately 50 –70m wide adjacent to the eastern side of Hannell Street between Lee Wharf Road and Cowper Street.

- Fill was encountered to a maximum depth of 1.9m below ground level and consisted of gravely sands, sandy gravels with varying amounts of wood, broken pipes, slag, general rubble and occasional household refuse. Alluvial sands were encountered below this fill layer. Alluvial grey clayey sands were encountered at the base of a number of pits.

4 PREVIOUS REPORTS

This RAP considered only one previous report as well as the previous RAP for the site, however there have been a number of investigations undertaken at the site. A list of these can be found in the PB (2002) report (Reference 1).

4.1 ENVIRONMENTAL SITE ASSESSMENT, FIG TREE PARK (LOT 105 DP1015391), HONEYSUCKLE NSW, PARSONS BRINCKERHOFF, NOVEMBER 2002, REV A

RCA have reviewed the quality assurance/quality control (QA/QC) of this report and consider that the data is suitable to use in characterising the site. The following presents a summary of the results and conclusions.

This investigation consisted of thirty three (33) soil samples at eighteen (18) locations (Ref 1). Two groundwater samples were collected as part of an overall groundwater assessment. A table showing all results is presented in Appendix B, with results specific to Stage 2 for both soil and groundwater presented in Appendix C.

Contamination indicated includes:

- Three (3) locations that exhibited concentrations of benzo(a)pyrene (BaP) in excess of the Recreational Open Space and Playing Fields guidelines (Ref. 2), one of which was at hotspot levels. One of these locations (FTTP17) is within the Stage 2 works.

- Three (3) locations that exhibited concentrations of total petroleum hydrocarbons (TPH) C_{10}-C_{36} in excess of the recreational Open Space and Playing Fields guidelines, two of which were at hotspot levels, however all are located within the Stage 1 works.

- The groundwater sample (on the western margin of Fig Tree Park – MW02) exhibited elevated concentrations of some metals. Arsenic concentrations were in excess of the 95% ANZECC guidelines (Ref. 3) in the bore, which was at a hotspot level. Both cobalt and zinc exhibited concentrations above the site criteria. Copper concentrations were in excess of the site criteria in both bores, one of which was at hotspot levels (MW11 in Stage 2). Manganese concentrations were at hotspot levels in both bores.

PB stated that the site was not suitable for the proposed Parks, Recreation and Open Space Land use and recommended remediation and management prior to redevelopment. These included further sampling to delineate the extent of the contamination and the preparation of a RAP. Groundwater samples from the site detected elevated levels of some metals however PB stated that these metal concentrations were indicative of the natural regional conditions. PB recommended further investigations down gradient of the site to delineate the potential groundwater impacts in this area.

It is considered that the data set produced by PB was unsuitable to assess the site and further delineation sampling was undertaken by RCA (see section 7).

4.2 REMEDIAL ACTION PLAN, FIG TREE PARK, HONEYSUCKLE DEVELOPMENT ESTATE, RCA AUSTRALIA, JULY 2003, 3242-001/0

This RAP was aimed at the remediation of the entire Fig Tree Park site, however it was subsequently decided to remediate the most northern portion of the site, immediately adjacent to Marina Apartments(Drawing 2). This included excavation and removal of the contaminated soil materials (including PAHs and TPH/BTEX) and remediation of the groundwater. It was decided to remediate the remainder of the site through the cap and contain method. This current RAP refers to this portion of the works only (referred to as Stage 2).

The RCA July 2003 RAP (Reference 7) identifies the fieldwork conducted by RCA in early 2003, with the aim of defining the extent of the two main hotspots identified by PB at FTTP13 (TPH contamination) and FTTP20 (PAH contamination).

Fieldwork consisted of the excavation of seven test pits around the areas of FTTP13 and FTTP20. Samples were collected from within several different soil stratigraphies. A clayey layer was encountered in TP5 and TP7 (surrounding FTTP13), with the layer observed to have fuel based contamination. Two groundwater bores were also installed (BH1 and BH2), centred in the areas of FTTP20 and FTTP13 respectively, and samples collected. The groundwater bore installed between TP5 and TP7 (BH2) was also found to contain evidence of fuel based contamination. Locations of the wells are presented on Drawing 3.

The testpits excavated around FTTP20 did not show evidence of PAH contamination, however results indicated that the layer of brown silty sands throughout the pits was contaminated with elevated PAH concentrations. Further review of the PB data indicated that the PAH hotspot they had identified was a function of an incomplete data set. RCA therefore noted that further delineation and site characterisation for PAH contamination was required.

The additional works consisted of the excavation of 19 test pits, with soil samples collected from each soil stratigraphy in order to classify the material. Locations of all test pits are presented on Drawings 2 and 3.

During these works three distinct layers were encountered in the sandy fill at the site overlying a fourth layer of natural alluvial sand and on one occasion a fifth, old top soil layer was identified. Table 1 provides a brief description of the layers encountered. The various layers are discussed in detail in the July 2003 RAP by RCA.

Table 1 *Description of Soil Layers Present at the Site*.

Layer	Description
A	Layer A is fill material, typically containing a mixture of silty SAND with occasional rubble. Sand is fine grained. Particles include; small brick fragments, concrete, wire and in one test pit styrofoam. Fill colour is dark grey/brown. Commonly occurs in most locations.
B	Layer B is fill material made up of a medium grained SAND containing minor gravel. Gravel particles are made up of fragments of brick, concrete, rock and shell. Fill colour is light grey/brown, sometimes with yellow mottling. Commonly occurs in most locations.
C	Layer C marks the beginning of natural sediment. It is made up of medium-coarse grained sand deposited in an estuarine environment. The sediment contains occasional gravel consisting of shell fragments and has a light grey colouring. Commonly occurs at depths >2.3m, but has occurred at depths > 1.25 in the north of the site where the colour is light brown becoming grey. Although this layer was not encountered in all test pits due to collapse, it is expected that it occurs underlying the fill over the majority of site.

Layer	Description
D	Layer D is fill material, typically gravelly SAND to sandy GRAVEL (roadbase) with an orange colouring. It sometimes contains cobbles and occurs sporadically across the site.
E	Layer E was only observed at one location. It is the beginning of natural sediment for that test pit and is considered to be the old topsoil horizon. It consists of a clayey silty SAND which contains organic material and roots, and has a grey/black colouring.

The area of PAH contamination was able to be defined as a shallow layer of brown silty sands (Layer A). The depths of the Layer A stratigraphy are presented in Drawing 4.

The areas of TPH contamination and PAH contamination were defined and subsequently excavated and remediated from within the Stage 1 area. The TPH contaminated material was landfarmed on the adjacent southern portion of FTP (southern edge of Stage 2 area) on a hardstand area comprising bitumen and plastic, while the PAH material was removed to Summerhill Waste Disposal Facility as solid waste.

Pump and treat with disposal to sewer or recirculation into the excavation was considered to be the most economical and effective treatment method for groundwater at the Stage 1 area of the site. The recirculation method was decided upon, which would involve pumping from the excavation and passing the effluent through an oily water separator and activated carbon treatment system. The treated water was then returned to the excavation. Samples were collected periodically until the results indicated limited TPH remained in the groundwater and PAH concentrations were below guidelines. Heavy metal concentrations were also monitored. The results will form part of the ultimate validation report of Stage 1.

5 SUBSURFACE CONDITIONS

5.1 PB INVESTIGATION

The site is relatively flat and has been extensively filled. The topographical map of the area indicates that the ground elevations at the site are less than 10m AHD. Therefore any alluvial soils at the site have the potential to contain acid sulphate mineralogy.

The following land uses were identified:

- Newcastle Harbour is located to the east of the site;

- The Throsby site is located south of the site;
- The heritage fig tree and park site owned by Newcastle City Council is located east of the site; and
- A marina development currently undergoing construction is located to the north of the site.

The main environmental receptor in the vicinity of the site is Newcastle Harbour located east of the site. Newcastle Harbour is considered to be a slightly to moderately disturbed ecosystem.

Fill was encountered across the site to a maximum of 3.0mBGL. A slag layer was observed at FTBH11 at a depth of approximately 1.7mBGL. Wood chips and sawdust were identified within alluvials at FTTP13 at approximately 1.0mBGL. Concrete, slag and/or bricks were noted in FTTP08 at 0.4mBGL, FTBH19 at 0.2mBGL, and FTTP15 at 0.1mBGL however these inclusions were not found to correspond to any contamination detected during PBs assessment. Underlying the fill was a light brown to dark grey alluvial sand.

5.2 RCA INVESTIGATION

5.2.1 FIELDWORK

Further to the fieldwork previously conducted by RCA and detailed in the RAP (2003), an additional two groundwater bores (BH3 and BH4) were installed in the area of Stage 2 during August 2003 as indicated on Drawing 3. These groundwater bores were installed using hollow flight augers and were to a depth of approximately 4.4m below ground level. The bores were sampled in August 2003 and analysed for TPH/BTEX, PAHs and heavy metals. Groundwater was observed to be at approximately 2.5m below ground level. The groundwater results indicated concentrations of TPH/BTEX below laboratory detection limits, and PAH concentrations either below the relevant guidelines or below laboratory detection limits. The results indicated elevated concentrations of heavy metals, particularly arsenic and zinc and to a lesser extent, copper. It is proposed to resample these bores during and after the capping of the southern portion of the site to confirm that the contaminants are not leaching into the groundwater.

Generally it has been considered that elevated concentrations of heavy metals in groundwater around the Newcastle Harbour area are a regional phenomenon. This theory was again raised with a groundwater study of the foreshore area conducted by PB in 2002.

During the remediation of Stage 1, validation samples were collected from the walls and base of the excavations for both TPH/BTEX and PAHs. It was necessary to remove additional TPH and PAH contaminated material in order to validate this area (Stage 1) of the site. PAHs were removed as solid waste and the TPH contaminated material is currently being landfarmed on Stage 2 of FTP on a hardstand area. There is approximately 2000 tonnes of TPH contaminated material being landfarmed, which will require periodic sampling and turning to allow aeration and biodegradation of the contaminants. RCA expect the material to be remediated in approximately 12 months. It may then be possible to reuse the material on site, or dispose off site to a landfill facility. This choice will ultimately be dependent on the success of the bioremediation.

The groundwater in the excavation was treated and sampled periodically until the TPH/BTEX was removed from the groundwater and the PAHs were below the guideline criteria. The excavation was then backfilled with virgin excavated natural material (VENM) and compacted. This validation fieldwork is to be detailed in the validation report currently being completed by RCA.

6 BASIS FOR ASSESSMENT CRITERIA

6.1 SOIL

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

The criteria 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. 2). 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 use is currently vacant and, based on information provided to RCA, the proposed use would be considered recreational open space. Therefore the results have been compared to the following guidelines:

- HIL ‘E’ Parks, recreational open space and playing fields: includes secondary 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 sample exceeds the chosen guidelines by more than 250%;

- The standard deviation of the analyte does not exceed 50% of the guideline.

However this approach does not allow for sampling and analytical variability, therefore the Sampling Design Guidelines (Ref. 5) recommends the use of the 95%UCL_{ave} for comparison with the guidelines.

6.1.2 NSWEPA – SERVICE STATION CRITERIA

The acceptance criteria adopted for TPH C6-C9, and BTEX are the "Guidelines for Assessing Service Station Sites" produced by the NSWEPA, December 1994 (Ref. 6). These guidelines provide assessment criteria for soil and water on service station sites and are applicable for all sites where fuel has been stored. Guidelines for TPH C10-C36 from this reference were also used for screening of samples prior to additional aromatic and aliphatic testing as required by the NEPM.

6.1.3 NSWEPA – ASSESSMENT, CLASSIFICATION AND MANAGEMENT OF LIQUID AND NON-LIQUID WASTES

These guidelines (Ref. 7) were compiled to enable classification of waste material depending on contamination status. These guidelines will be utilised to classify any material designated for disposal to a licensed waste facility.

6.2 WATER

6.2.1 ANZECC 2000

The ANZECC 2000 water quality guidelines have been endorsed by the NSWEPA (Ref. 3). These are complex guidelines that consider not only the level of protection (eg 99% or 95%) but also the state of the receiving water (eg. moderately disturbed). Additional allowances are also made for the bioaccumulation of some chemicals. These guidelines replace the NEPM guidelines for water.

The receiving water in this instance is considered to be Newcastle Harbour. This is a tidal waterway and so marine guidelines are used. The Harbour is considered a highly modified waterway, therefore a 90% protection level would be considered sufficient. However the assessment investigations have utilised the 95% protection level and for consistency, this guideline will be applied from the boundary of the site. 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. 3).

6.2.2 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 exposure settings on which the NEPM criteria are based directly affect the investigation concentration used to assess the contamination status of the site. While the development appears to fit into the listed categories it is possible that a change in the development may designate the site into a more sensitive land use.

At present there are no endorsed groundwater guidelines in Australia, therefore guidelines are chosen based on the receiving waters. The results therefore do not necessarily represent the final concentration of the contaminants in the Harbour and may be conservative.

7 SITE CHARACTERISATION

7.1 ASSESSMENT OF TYPE OF ENVIRONMENTAL CONTAMINATION

7.1.1 SOIL

Based on the previous investigations at the site the contamination at the site is generally elevated PAHs in shallow soils across the southern portion of the site.

The following tables summarise the contaminant levels encountered in layer “A” in the southern portion (Stage 2) of FTP only. PAHs and benzo(a)pyrene were the only contaminants which exceeded any guidelines. Samples were also analysed for TPH/BTEX and heavy metals however, did not exceed guidelines and therefore the 95% UCL has not been calculated. Results have been summarised in Appendix C.

Table 2 *Data Summary for Contaminants of Concern, Stratum A in Southern Portion*

Analytes	Guideline	No. of samples	Minimum	Maximum	No. of hot spots	Mean	95% UCL Mean
PAHs							
Benzo(a)pyrene	2	16	0.25	11	**6**	4.98	5.1
Total PAHs	40	16	15	101.3	**1**	50.57	51.4

All units mg/kg

7.1.2 GROUNDWATER

The results of the groundwater analysis for the southern portion of the site are summarised in Table 3.

Table 3 *Groundwater Results*

Analytes	Guideline	No. of samples	Minimum	Maximum
BTEX				
Benzene	700*	4	0.5	0.5
Toluene	300**	4	0.5	0.5
Ethylbenzene	300**	4	0.5	0.5
meta- & para-Xylene	200*	4	0.5	1.0
ortho-Xylene	350*	4	0.5	0.5
VOLATILE TPH				
C6-C9	NA	4	10	25
PETROLEUM HYDROCARBONS (TPH)				
C10-C14 Fraction	NA	4	25	25
C15-C28 Fraction	NA	4	50	200
C29-C36 Fraction	NA	4	25	50
Sum of TPH C10 - C36	NA	4	100	275
POLYAROMATIC HYDROCARBONS				
Naphthalene	70*	4	0.05	1
Acenaphthylene	NA	4	0.005	1
Acenaphthene	NA	4	0.05	1
Fluorene	NA	4	0.05	1
Phenanthrene	2*	4	0.05	1
Anthracene	0.1^	4	0.005	1
Fluoranthene	1.4*	4	0.05	1

Analytes	Guideline	No. of samples	Minimum	Maximum
Benzo(a)pyrene	0.2*	4	0.005	1
METALS				
Arsenic	13*	4	12	**37**
Cadmium	5.5*	4	0.05	5
Chromium	4.4*	4	0.5	1
Copper	1.3*	4	**2.0**	**9**
Nickel	70*	4	6	10
Lead	4.4*	4	0.5	0.5
Zinc	15*	4	**93**	**120**
Mercury	0.004*	4	0.05	0.5

All units ug/L -- = Not Analysed NA = Guideline Not Available

This data includes the two most recent bores installed by RCA in the area of the proposed Stage 2 works as well as the previous bores installed by RCA and PB in this area. All groundwater bores are indicated on Drawings 2 and 3.

The results show that TPH and PAH levels are either below the level of detection by the laboratory or below the relevant guidelines. Heavy metals (arsenic, copper and zinc) are elevated generally in all bores, however this is considered a regional phenomenon in the groundwater of the Newcastle Harbour area, based on the PB groundwater study of the area in 2002.

The table below indicates the heavy metal concentration hotspots within the Stage 2 area of works.

Table 4 *Groundwater Results and Guideline Exceedances*

Location	As (x guideline)	Cu (x guideline)	Zn (x guideline)
MW11	--	9 (7 times)	**--**
BH1	7 (5 times)	5 (4 times)	**1880 (125 times)**
BH2	37 (28 times)	--	**120 (8 times)**
BH3	**12 (9 times)**	**7 (5 times)**	**93 (6 times)**

All units ug/L

7.2 ASSESSMENT OF THE EXTENT OF CONTAMINATION

7.2.1 SOIL

The PAH contamination is contained in Layer A which occurs mainly in the southern half of the site and increases to a significant depth along the eastern boundary. Contaminant levels in this layer are almost entirely all above the relevant acceptance criteria. Drawing 4 shows where the layer is present and the depth interval where it occurs. The PAH contamination layer requires remediation and generally is present across the entire southern portion of the site to depths of up to 1.8m.

7.2.2 GROUNDWATER

Groundwater flow across the site is expected to be in an easterly direction, toward the Throsby Basin section of Newcastle Harbour. Groundwater was encountered at depths between 2.5m and 3m below ground level.

The results show that TPH and PAH levels are either below the level of detection by the laboratory or below the relevant guidelines. Specific heavy metals (generally arsenic, copper and zinc) are elevated in all bores in the area of the proposed Stage 2 works, however this is generally considered a regional phenomenon in the groundwater of the Newcastle Harbour area. The metals in these bores have been found in hotspot concentrations in the 2002 sampling round as well as the 2003 sampling events.

The groundwater in the area is not considered to require remediation for the heavy metals, however will be monitored prior to the remediation, during and following the remediation to ensure the PAH contaminants are not leaching into the groundwater.

7.3 ASSESSMENT OF THE CHEMICAL DEGRADATION PRODUCTS

PAHs are biodegradable, but in the concentrations reported are unlikely to do so, to any significant extent, without active intervention to aid the biodegradation process.

7.4 ASSESSMENT OF POSSIBLE EXPOSURE ROUTES AND EXPOSED POPULATIONS (HUMAN, ECOLOGICAL)

At the time of investigation it is not considered that there are any populations significantly exposed to the contamination. The site is fenced and either grassed or sealed in gravel or bitumen. The site is not in use and pedestrian traffic would be concentrated along the side of the road.

Any use of the site will increase the exposed population.

8 REMEDIAL ACTION PLAN

8.1 REMEDIATION GOAL

The aim of this Remedial Action Plan (RAP) is to undertake remediation to the extent that the site is considered to be suitable for the proposed use as parkland and open space.

8.2 EXTENT OF THE REMEDIATION REQUIRED

Based on the site characterisation discussion in Section 7, we consider that the site would be suitable for the proposed development as long as the PAH contaminated soil (Layer A) is remediated.

The TPH material excavated from the northern portion of FTP is currently being landfarmed on a bitumen and plastic hardstand area in the southern portion of FTP. This material also requires remediation.

Heavy metal contamination in the groundwater is most likely a regional phenomenon and remediation of the groundwater will not be required.

8.3 REMEDIAL OPTIONS

There are several options available for the remediation of the identified soil contamination:

- Do nothing – this is considered unacceptable as there are contaminant concentrations present on site that render the site unsuitable for the proposed use. Some remediation must be undertaken to reduce this risk for the proposed use.

- Cap and Contain – this method reduces the risk to human health and the environment and reduces the leaching of contaminants into the groundwater. It will not reduce contamination arising from groundwater flow through contaminated material (if occurring) and leaves the contamination on site. A management plan would also be required to address future exposure to the soil.

- *In Situ* treatment – there are various types of remediation that may be undertaken while the material remains on the site. The most well known consist of:

    - Air Sparging and Extraction – Air is pushed through the contaminated soil and groundwater to volatilise the contaminants and extracted.
    - Soil Washing – the contaminants are leached from the soil stratum and the fluid collected for disposal. Groundwater could also be collected for treatment.
    - Bioremediation – the natural processes of degradation are hastened through the addition of nutrients and oxygen.

All of these processes are expensive and slow. Additionally, while the processes are passive and can foreseeably be undertaken while the site is in operation, there may be an outstanding liability issue with these processes.

- *Ex Situ* treatment – the above listed types of remediation can be utilised after the material has been excavated. It is also possible to use the following:

    - Landfarming – uses the natural processes of volatilisation to remove the soil contamination. The process is very slow given the TPH fractions present and the PAH compounds that are present. This is a soil process only.
    - Thermal Desorption – this process is literally a combustive one which incinerates the contaminants, however due to possible unwanted byproducts the contractor must have a licensed, approved process. This is a soil process only.
    - Disposal to Landfill – this option is available depending on the type of contamination and concentrations detected and requires rigorous testing. There are three categories of waste, ranging from inert to industrial, with increasing total and leachable concentrations. Fees are applied accordingly. This is a soil process only.

- Pump and Treat – This involves pumping the groundwater to an on surface treatment system from either wells installed for the extraction or from an open excavation.
- Natural Attenuation - This is similar to the do nothing approach but involves careful and frequent monitoring to ensure the contaminants are degrading, dispersing and not causing any harm. This is not considered a feasible option given the low rates of biodegradation envisaged for the contaminants and the close proximity to the harbour.

8.4 RECOMMENDED REMEDIAL OPTIONS

8.4.1 PAH CONTAMINATION

There are two feasible options for the PAH contamination. As it occurs in a definable layer it could be excavated and disposed of to landfill. Landfarming and bioremediation is not considered feasible given the type of PAH compounds present.

Total PAH concentrations meet the Solid Waste Guidelines (200mg/kg) however BaP does not meet the guideline limit (0.8mg/kg) with no TCLP data. However, it is considered likely that if TCLP leaching tests were undertaken then the higher guideline of 10mg/kg would be applicable and the soil would be classified as solid waste.

Another feasible option is to cap and contain the contamination. The site is to be developed as a park and will be filled and landscaped. It would be possible for the capping layer to be incorporated into this work. A minimum of 0.5m of capping is considered necessary and an identification layer such as geofabric should be placed at the capping layer/existing surface interface. Also, to assess future ecological risk, leaching tests are required to assess the PAH mobility. If the cap and contain strategy is implemented then as the PAH levels exceed the open space guidelines, an appropriate Site Management Plan would be required.

The choice between the two options is a balance between the high cost involved in removing and disposing of Layer A to landfill (in the order of about $600,000 based on mass of 8000 tonnes) and whether the eventual owners of the site agree to having a SMP in place. The NSW EPA Guidelines for the NSW Auditor Scheme (1998) refer to the Waste Minimisation Hierarchy, established from the Waste Minimisation and Management Act, 1995. The hierarchy clearly states that to avoid waste is the most preferred option, followed by reuse, recycling and that disposal is the least preferred option.

It is considered that the most appropriate option for the second stage of works at this site is to cap and contain the PAH contamination.

8.4.2 TPH CONTAMINATION

There are two feasible options for the TPH contamination. As it is currently being stockpiled on the Stage 2 area of the site, the material can either continue to be landfarmed or disposed of to landfill. Landfarming and bioremediation is considered the most feasible option at this point, with the option of reusing the material on site as part of the cap and contain remediation method once the material has bioremediated to a suitable level. Analysis of samples will be undertaken periodically to determine the suitability of the material.

8.4.3 GROUNDWATER

As discussed previously, groundwater flow across the site is expected to be in an easterly direction, toward the Throsby Basin section of Newcastle Harbour.

The results show that TPH and PAH levels are either below the level of detection by the laboratory or below the relevant guidelines. Specific heavy metals (generally arsenic, copper and zinc) are elevated in all bores, however this is generally considered a regional phenomenon in the groundwater of the Newcastle Harbour area.

No remediation is considered necessary at this point. The groundwater bores installed previously on this part of the site will be monitored as part of the cap and contain remediation method, to ensure that contamination from the soil is not leaching into the groundwater and therefore flowing into the Newcastle Harbour.

8.5 PROPOSED TESTING TO VALIDATE THE SITE

8.5.1 PAH (LAYER A)

If the site is to be capped, then samples would be collected from within layer A and analysed for TCLP (leaching potential) to ensure that the contaminants are not going to have the potential to leach into the groundwater.

Given the similar levels of PAH in most samples a total of 5 TCLP (distilled water medium) is considered suitable.

Samples would be collected from any imported material at a rate of 1/100m^3. This would include any capping material used, being the landfarmed material or otherwise. This frequency may be relaxed should the imported fill be from a single homogeneous source.

8.5.2 GROUNDWATER

Regular samples (define, say monthly, ie before during and twice after) will be taken and assessed for TPH, PAH and heavy metals during the remediation as well as after finalisation of the remediation to assess that the contaminants are not being disturbed in such a way that they leach into the groundwater.

8.6 SAMPLING AND ANALYSIS PLAN AND SAMPLING METHODOLOGY

8.6.1 SAMPLING, ANALYSIS AND DATA QUALITY OBJECTIVES (DQOS)

ACCURACY

The nearness of a result to the true value, where all random errors have been statistically removed. Internal accuracy is measured using percent recovery '%R' and external accuracy is measured using the Relative Percent Difference '%RPD'.

Internal

Internal accuracy can be tested utilising:

- Surrogates — Surrogates are QC monitoring spikes, which are added to all field and QA/QC samples at the beginning of the sample extraction process in the laboratory, where applicable. Surrogates are closely related to the organic target analytes being measured and are not normally found in the natural environment;
- Laboratory control samples — An externally prepared and supplied reference material containing representative analytes under investigation. These will be undertaken at a frequency of one per analytical batch;
- Matrix spikes — Field samples which are injected with a known concentration of contaminant and then tested to determine the potential for adsorption onto the matrix. These will be undertaken at a frequency of 5%

Recovery data shall be categorised into one of the following AQP control limits

- 70%-130 %R confirming acceptable data, note that there are some larger %R for intractable substances;
- 69%-20%R indicates discussion required. May be considered acceptable data, or may be regarded with uncertainty;
- 10-19 %R indicating that the data should be treated as an estimate result;
- <10 %R indicating that the data should be rejected.

External

External accuracy will be determined by the submission of interlaboratory duplicates at a frequency of 5%. Data will be analysed in accordance with the following control limits:

- 60% RPD at concentration levels greater than ten times the PQL.
- 85% RPD at concentrations between five to ten times the PQL.
- 100% RPD at concentration levels between two and five times the PQL.

Where concentration levels are less than two times the PQL, the Absolute Difference (AD) shall be calculated. Data will be considered acceptable if the:

- AD <3.5 times the PQL.

Any data which does not conform to these acceptance criteria will be examined for determination of suitability for the purpose of site characterisation.

PRECISION

The degree to which data generated from replicate or repetitive measurements differ from one another due to random errors. Precision is measured using the standard deviation 'SD' or Relative Percent Difference '%RPD'.

Internal

Internal precision will be determined by the undertaking of laboratory duplicates, where two sub samples from a submitted sample are analysed. These will be undertaken at a frequency of 10%. A RPD analysis is calculated and results compared to:

- 50% RPD at concentration levels greater than ten times the PQL.
- 75% RPD at concentrations between five to ten times the PQL.

- 100% RPD at concentration levels between two and five times the PQL.

Where concentration levels are less than two times the PQL, the Absolute Difference (AD) shall be calculated. Data will be considered acceptable if the:

- AD <2.5 times the PQL.

Any data which does not conform to these acceptance criteria will be examined for determination of suitability for the purpose of site characterisation.

External

External precision will be determined by the submission of intralaboratory duplicates at a frequency of 5%. Data will be analysed in accordance with the following control limits:

- 50% RPD at concentration levels greater than ten times the PQL.
- 75% RPD at concentrations between five to ten times the PQL.
- 100% RPD at concentration levels between two and five times the PQL.

Where concentration levels are less than two times the PQL, the Absolute Difference (AD) shall be calculated. Data will be considered acceptable if the:

- AD <2.5 times the PQL.

Any data which does not conform to these acceptance criteria will be examined for determination of suitability for the purpose of site characterisation.

BLANKS

The following blank samples will be submitted with the analytical samples and analysed for the contaminants of concern:

- Field Blank — One per matrix type each batch samples/each day;

The laboratory will additionally undertake a method blank with each analytical batch of samples.

Results shall be examined and any positive results shall be examined. Positive blank results may not be subtracted from sample results.

Positive results may be acceptable if sample analyte concentrations are significantly greater than the amount reported in the blank (ten times for laboratory reagents such as methylene chloride, chloroform, and acetone etc. and five times for all other analytes). Alternatively, the laboratory PQL may be raised to accommodate blank anomalies provided that regulatory guidelines are not compromised by any adjustment made to the PQL/ EQL/ LOR.

COMPLETENESS

The completeness of the data set shall be judged as:

- The percentage of data retrieved from the field compared to the proposed scope of works. The acceptance criterion is 95%, however 100% completeness is required from any crucial areas as previously identified in proposal;

- The percentage of data regarded as acceptable based on the above data quality objectives. 95% of the retrieved data must be reliable, although 100% reliability is required for crucial areas.

- The reliability of data based on cumulative sub standard performance of data quality objectives. Where two or more data quality objectives indicate less reliability than what the acceptance criteria dictates, the data will be considered with uncertainty. The data will be considered as an estimate if from a crucial area.

REPRESENTATIVENESS

Sufficient samples must have been collected from each stratum present at the site, eg all fill types, soil and groundwater. This will be calculated for soil samples by Procedure B, NSWEPA Sampling Design Guidelines, 1995 (Ref 5). Groundwater samples must include an upgradient or background bore and characterise natural groundwater and any perched water. Any surface water bodies on site must also be characterised if at risk of contamination.

COMPARABILITY

The data must show little to no inconsistencies with results and field observations and include likely associates eg TPH C_6-C_9 and BTEX.

RATIONALE FOR THE SELECTION OF:

Sampling Pattern

Samples will be collected across the site for TCLP analysis.

Sampling Depths

Samples will be collected from the appropriate stratum (Layer A) identified depths.

SAMPLES FOR ANALYSIS AND SAMPLES NOT ANALYSED

All samples collected will be analysed for the contaminants of concern, ie those which the original sample indicated in excess of the guidelines. Where there is no data for an analyte and percentage of validation samples may be analysed.

DETAILED DESCRIPTION OF THE SAMPLING METHODS INCLUDING SAMPLE CONTAINERS AND TYPE OF SEAL USED

The analysing laboratory will provide all soil sample containers. As a general rule all containers are sealed with a teflon lined screw lid.

SAMPLING DEVICES AND EQUIPMENT EG. AUGER TYPE

All soil samples will be collected either by hand (hand auger) or from the bulk of soil within the excavator/backhoe bucket.

EQUIPMENT DECONTAMINATION PROCEDURES

No equipment decontamination procedures will be implemented unless groundwater sampling is required, or soil sampling is undertaken by methods alternate to that identified in the above section.

Disposable gloves will be used for all samples.

Decontamination procedures would consist of rinsing with a biodegradable detergent (eg Decon 90, Xtran) and then double rinsing with potable water.

SAMPLE HANDLING PROCEDURES

All samples would be handled in accordance with our third party certified quality assurance system complying with AS/NZS ISO 9001:1994 which includes our NATA registered laboratories.

SAMPLE PRESERVATION METHODS

Samples will be preserved as per the laboratory requirements and stored in the field on ice in an esky at approximately 4°C. Samples will be transported to the laboratory the same day of sampling, or if not, stored in a refrigerator until transport occurs. Chain of custody documentation will accompany all samples.

8.6.2 QUALITY ASSURANCE AND QUALITY CONTROL

Duplicate samples will be collected at a rate of 10% and submitted to alternative laboratories. Blank samples will be submitted for each batch of samples and equipment washes will be undertaken if any alternate method other than that anticipated is required.

At the end of the project an assessment as to the suitability of data in accordance with the DQOs listed in the above sections will be provided.

8.7 CONTINGENCY PLAN IF THE SELECTED REMEDIAL STRATEGY FAILS

8.7.1 CAP AND CONTAIN

In the event that cap and contain remediation option is rejected, the material must be excavated for landfill disposal.

8.8 INTERIM SITE MANAGEMENT PLAN (BEFORE REMEDIATION) INCLUDING EG. FENCING, ERECTION OF WARNING SIGNS, STORMWATER DIVERSION

In its current use the site is not considered to require any management conditions. However should the cover of grass on the surface deteriorate and erosion occur, silt fencing should be erected to ensure that this material does not access either the footpath or the stormwater system.

8.9 SITE MANAGEMENT PLAN (OPERATION PHASE)

8.9.1 SITE STORMWATER MANAGEMENT PLAN

There is a very limited stormwater system on site at the moment, limited to some pits in the gutter. Therefore a limited stormwater protection programme will include:

- Diversion of all runoff from any excavations or stockpiles of contaminated or potentially contaminated material;
- Prevention of any runoff from contaminated or potentially contaminated stockpiles entering the stormwater system. This may be collected in excavations and treated in conjunction with contaminated groundwater.

8.9.2 GROUNDWATER MANAGEMENT

Groundwater should be assumed to be contaminated until additional testing has been undertaken and therefore contact should be avoided where possible.

A license should be obtained from the Department of Land and Water Resources for any extraction of groundwater.

The TPH soil identified as potentially contaminated will remain stored on a hard base, ie concrete, bitumen or plastic, to prevent leaching of contaminants into the groundwater.

8.9.3 SOIL MANAGEMENT PLAN

All clean material stockpiles will be stored on site, away from stormwater lines and away from any natural runoff flows with a cover to prevent dust and odour generation. Hay bales and silt fence will be utilised to screen soil particles from any runoff water generated from the stockpiles.

All traffic leaving the site will be required to cross a grid to vibrate any adhering soil off the wheels. The grid will be frequently cleaned. Street cleaning may be required in the case of spillage or inefficient operation of the grid.

8.9.4 NOISE CONTROL PLAN

Given the situation of the site, directly adjacent to the railway line, a noise control plan is not considered necessary. Basic controls as required regardless of situation are detailed below.

- All vehicles involved in the remediation work by RCA will be registered and within the allowable limits for noise emission. Transport routes are restricted in the immediate area of the site, however chosen routes should be submitted to Council for approval before any large vehicle movements occur.

8.9.5 DUST CONTROL PLAN

Earthworks works proposed in this RAP have the potential to create a dust issue, from the actual digging and the transport and unloading of soil.

Controls that could be put in place include:

- Hessian or shadecloth around the boundary of the site, or works to act as a dust screen;
- Covering of any loads entering or leaving the site;
- Water sprays may be utilised on the excavation if required;
- It is possible that some dust may be created from the stockpiles. These stockpiles will be inspected on a weekly basis and in the case of high winds to determine if dust is an issue. Water sprays or temporary covers may be utilised if this is the case.

8.9.6 ODOUR CONTROL PLAN

It is unlikely that odours generated during the works will affect off site workers.

In the event of a complaint about odours generated from the site the following may be implemented:

- Covering of contaminated material to reduce odour release;
- PID assessment to determine significance of odours;
- Application of a surfactant to reduce odour generation.

8.9.7 OCCUPATION HEALTH AND SAFETY PLAN

The site should be considered as potentially contaminated and strict hygiene principles adhered to during remediation operations at the site. These include, but need not be restricted to:

- No smoking in areas of excavation;
- All personnel will be required to wash thoroughly before meal breaks; and
- Protective clothing such as long sleeves and long pants should be encouraged to prevent dermal exposure to contaminants.

8.10 REMEDIATION SCHEDULE

The proposed remediation program is not known at this time, although an ideal program is outlined below. The final remediation program will be highly dependent on the D.A. and the requirements of HDC.

Table 5 *Remediation Schedule*

Activity	Week 1	Week 2	Week 3 - 6	Week 7	Week 8	Week 9	Week 10
Finalise RAP							
Auditor Review of RAP							
Commence Remediation							
Cap and Contain							
Validation Sampling / Monitoring							
Draft Report							
Auditor Review							
Finalise Report							

8.11 HOURS OF OPERATION

The hours of operation would be based on those dictated by the NSWEPA and the NCC DCP 43.

- Weekdays 7am to 6pm;
- Saturdays 8am to 1pm;
- No work to be undertaken on Sundays or Public Holidays;

8.12 CONTINGENCY PLANS

If site management procedures do not work as they are envisaged, contingency plans for certain incidents have been created:

8.12.1 STORMWATER POLLUTION

If stockpile controls are not sufficient and stormwater is polluted, the following will be undertaken:

- If pollution witnessed, drains to be blocked by any available means to discontinue pollution immediately. Such means may consist of hay bales or silt fence covering the grate and stores of such materials should be left on site in case of emergency. If evidence is noted after the event, an effective TPH or sediment screen will be used to filter the stormwater.
- Newcastle City Council to be informed as soon as practicable;
- Stockpile to be repaired and measures strengthened, or stockpile relocated to a more secure position.

8.12.2 EXCESSIVE NOISE

If Newcastle City Council registers a complaint in relation to activities being undertaken on site, RCA will immediately desist with the activity upon being informed. Consultation will be held with the Council as to the most appropriate course of action and may include:

- Restricted hours of operation;
- Use of alternative machinery.

8.12.3 EXCESSIVE DUST

If excessive dust is registered off site, work will cease immediately. Increased dust controls will be implemented and work may be continued, with increased alertness as to a potential problem.

8.12.4 ODOUR

If a complaint about odours originating from the site is registered, RCA will immediately cease work upon being informed. Application of a surfactant will be initiated, or increased if already being applied.

8.13 IDENTIFICATION OF REGULATORY COMPLIANCE REQUIREMENTS SUCH AS LICENSES AND APPROVALS

Measures which are required to ensure regulatory compliance including the following:

- A Development Application will be required to be submitted to NSW Planning for the proposed remediation works, as the cap and contain method is the preferred method.

- Waste Classification – soils designated for disposal to licensed landfill should be assessed against the NSWEPA Liquid and Non-liquid Waste guidelines (Ref. 7).

- Newcastle City Council should be notified of the remediation under DCP 43 which refers to SEPP55. It is considered that this remediation falls under the Category 1 definition due to the nature of the remediation (capping), and therefore a Development Application is required, however Planning NSW is the determining Authority.

- The remediation plan has been assessed under the POEO Act 1997 and no license by the NSWEPA is required unless disposal of waste in excess of the waste guidelines is required.

- Any water discharge from the site is to be appropriately approved by HWC, NCC or NSWEPA.

Approval should also be sought from the NSWEPA accredited auditor associated with this project, Mr. Graeme Nyland, to ensure that the suggested remediation strategies are suitable for the site and the proposed use.

8.14 NAMES AND PHONE NUMBERS OF APPROPRIATE PERSONNEL TO CONTACT DURING REMEDIATION

Contact	Company	Phone	Role	Responsibility
Peter Bowles	Honeysuckle Development Corporation	49297813	Client	General Inquiries, Development issues
Graeme Nyland	Environ	99548150	NSWEPA Accredited Auditor	Ensuring compliance to this RAP and appropriate guidelines and legislation
Rachel Metcalf	Robert Carr & Associates	02 4902 9208	Senior Environmental Scientist	Project supervision and liaison
Craig Wellings	Robert Carr & Associates	02 4902 9212	Environmental Engineer	Remediation as per this Plan

8.15 COMMUNITY RELATIONS PLANS, WHERE APPLICABLE

No community relation plans are considered necessary for this site, however the immediate neighbour should be advised.

8.16 STAGE PROGRESS REPORTING, WHERE APPLICABLE

Progress reports documenting what has been done and what is proposed will be forwarded by RCA on a fortnightly basis to the client and auditor to ensure that all issues are covered.

8.17 LONG TERM MANAGEMENT PLAN

A long term management plan will be required if the Cap and Contain remediation option is utilised. This management plan could be included as part of the final validation report for the site.

9 FURTHER INVESTIGATION

It is considered the soil at the site is adequately characterised, however if a cap and contain approach is adopted then TCLP tests are considered necessary to assess future environmental concerns about leaving the contamination in place.

TCLP leaching tests are also considered necessary to conform to waste classifications should the landfill disposal method of the PAH contaminated material become necessary.

Another round of groundwater sampling should also be undertaken prior to remediation.

10 CONCLUSION AND RECOMMENDATIONS

Remediation is required for the second stage of the development of the southern portion of Fig Tree Park as a recreational area. A sandy layer is contaminated with PAH and either requires removal and landfill disposal or a cap and contain approach with an appropriate Site Management Plan. The TPH material currently being landfarmed on the site requires either further bioremediation for reuse on site or disposal to landfill also.

Groundwater remediation is not considered to be required as the heavy metals in the water are considered to be a regional issue.

11 LIMITATIONS

This RAP has been prepared for Honeysuckle Development Corporation (HDC) in accordance with the agreement between RCA Australia (RCA) and HDC. 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 RAP has been prepared for the sole use of HDC. The RAP may not contain sufficient information for purposes of other uses or for parties other than HDC. This report shall only be presented in full and may not be used to support objectives other than those stated in the report without permission.

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.

Please do not hesitate to call either of the undersigned should you require any further information.

Yours faithfully,
RCA AUSTRALIA

for Rachel Metcalf
Senior Environmental Scientist

Phillip Hitchcock
Manager Environmental Services

REFERENCES

[1] Parsons Brinckerhoff, Environmental Site Assessment, Fig Tree Park, (Lot 105 DP 1015391), Honeysuckle, NSW, November 2002 Rev A.

[2] NEPC, National Environment Protection (Assessment of Site Contamination) Measure, 1999

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

[4] NSWEPA, Sampling Design Guidelines, September 1995

[5] NSWEPA, Guidelines for Assessing Service Station Sites, December 1994

[6] NSWEPA, Assessment, Classification and Management of Liquid and Non-Liquid Wastes, May 1999

[7] RCA Australia , Remedial Action Plan, Fig Tree Park, Honeysuckle Development Estate, July 2003

GLOSSARY

95%UCL_{ave}	A statistical calculation – 95% Upper Confidence Limit of the mean concentration.
AHD	Australian Height Datum (m), based on a mean sea level
Aliphatic	Straight chain formation of carbon atoms
ANZECC	Australian and New Zealand Environmental Conservation Council
Aromatic	Ring formation of carbon atoms
Biosolve	A chemical product marketed for the increase of bioremedial activity on petroleum products. Also known to reduce odours by increasing the dissolution of volatiles into pore water.
DLWC	Department of Land and Water Conservation
HIL 'A'	HIL 'A' of the Health Based Investigation Levels, pg 9 Schedule B1, *National Environment Protection (Assessment of Site Contamination) Measure.*
HIL 'F'	HIL 'F' of the Health Based Investigation Levels, pg 10-11 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
Leachate	Fluid that has passed through a soil stratum, possibly collects contaminants.
LEP	Local Environment Plan. A planning tool for the local government.
µg	microgram, 1/1000 milligram
mg	milligram, 1/1000 gram

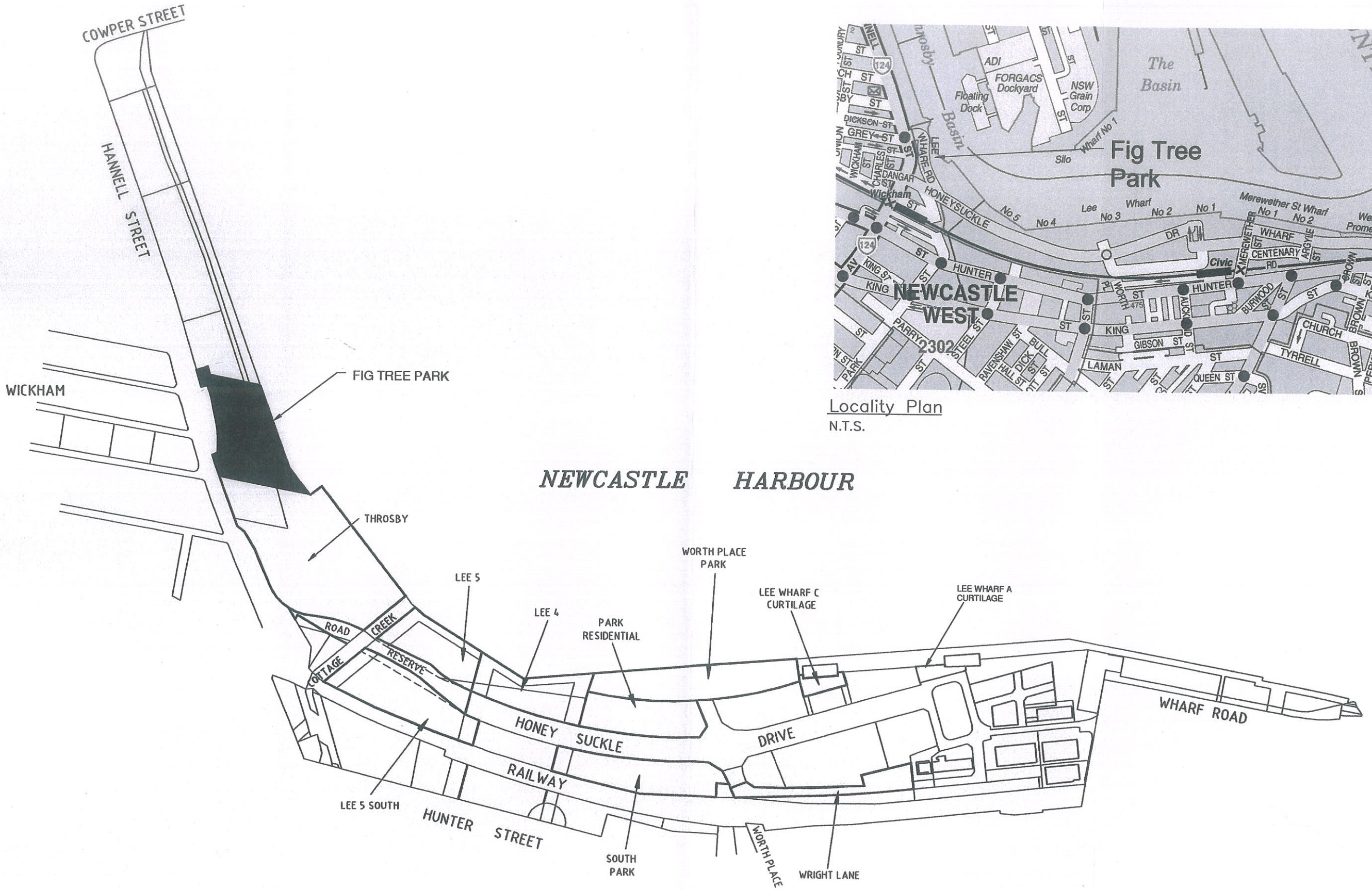
NEPC	National Environment Protection Council
NEPM	National Environment Protection Measure
NHMRC	National Health and Medical Research Council
Phytotoxicity	Poisonous, or inhibiting, to plant growth
PID	Photoionisation Detector
PPE	Personal Protective Equipment
PQL	Practical Quantitation Limit
QA	Quality Assurance
QC	Quality Control
RPD	Relative Percentage Difference
SPT	Standard Penetration Test
TCLP	Toxicity Characteristic Leaching Procedure. An analysis designed to mimic the transfer of contaminants from soil into water. Often used to determine impact in landfill conditions.

Chemical Compounds

Asphaltene	Component evident in pure bitumen
BTEX	Benzene, Toluene, Ethylbenzene, Xylene
Hardness	Content of metallic ions that react with sodium soaps. The hardness of the water impacts on the way metals behave.
OCPs	Organochlorine Pesticides
PAH	Polycyclic Aromatic Hydrocarbons
PCBs	Poly Chlorinated Biphenyls
TPH	Total Petroleum Hydrocarbons
TSS	Total Suspended Solids

Appendix A

Drawings



Locality Plan
N.T.S.

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SITE PLAN
REMEDIAL ACTION PLAN
FIG TREE PARK STAGE 2
HONEYSUCKLE DEVELOPMENT ESTATE

CLIENT	Honeysuckle Development Corporation			PROJECT No	3242A
DRAWN BY	RSM	SCALE	1 : 5000	DRAWING No 1	REV 0
APPROVED BY		DATE	7/11/03	OFFICE	NEWCASTLE

CDT-DWG-A3V-001/1

Area of TPH contamination

TPBH01

TP24
TP6
TP5
FTTP13
FTTP07
TP7
TP23
FTTP14
FTMW02
FTBH02
FTBH03
FTTP08
TP21
FTTP15
TEMPORARY SITE OFFICES
FTTP09
FTTP04
FTTP16
FTTP05
FTTP10
FTTP18
FTTP17
FTBH11
FTMW11
FENCE
OLD ROAD
GRASS VERGE
THTP34
GRASS AND BITUMEN
TP3
FTBH20
TP4
TP2
TP1
FTBH19
LIGHT TOWER
HANNELL STREET
SEA WALL
OLD ROAD
GRASS VERGE

FIG TREE PARK STAGE 1 WORKS

FIG TREE PARK STAGE 2 WORKS

LEGEND

- Previous Test Pit (PB, 2002)
- Previous Bore Hole (PB, 2002)
- Previous Groundwater Bore (PB, 2002)
- Test Pit (RCA, 2003)
- Groundwater Bore (RCA, 2003)
- Area of potential PAH contamination (Whole of Stage 2 area)
- Area of potential TPH contamination (Excavated)
- Area of former TPH contamination (landfarmed)

Note:
Drawing taken from
PPK Drawing 2122128A\PR_0598 Figure 02

0 10 20 30 40 50
metres

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TEST PIT & BORE HOLE LOCATION PLAN
REMEDIAL ACTION PLAN
FIG TREE PARK STAGE 2
HONEYSUCKLE DEVELOPMENT ESTATE

CLIENT Honeysuckle Development Corporation		PROJECT No 3242A	
DRAWN BY RSM	SCALE As Shown	DRAWING No 2	REV 0
APPROVED BY	DATE 7/11/03	OFFICE NEWCASTLE	

CDT-DWG-A3V-001/1

Area of TPH contamination

TP26
TP25
TP24
TP5
FTTP13
TP7
TP15
TP23
TP22
TP14
TP20
TP21
TEMPORARY SITE OFFICES
FTTP04
TP19
TP18
TP17
TP16
TP13
TP12
TP8
TP10
TP9
TP11

HANNELL STREET

SEA WALL

FIG TREE PARK STAGE 1 WORKS

FIG TREE PARK STAGE 2 WORKS

GRASS VERGE

GRASS AND BITUMEN

OLD ROAD

GRASS VERGE

LIGHT TOWER

LEGEND

- RCA Additional Delineation Test Pits (June 2003)
- Area of potential PAH contamination (Whole of Stage 2 area)
- Area of potential TPH contamination (Excavated)
- Area of former TPH contamination (landfarmed)

Note:
Drawing taken from
PPK Drawing 2122128A\PR_0598 Figure 02

0 10 20 30 40 50
metres

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2ND TEST PIT & BORE HOLE LOCATION PLAN REMEDIAL ACTION PLAN FIG TREE PARK STAGE 2 HONEYSUCKLE DEVELOPMENT ESTATE

CLIENT	Honeysuckle Development Corporation			PROJECT No	3242A
DRAWN BY	RSM	SCALE	As Shown	DRAWING No 3	REV 0
APPROVED BY		DATE	7/11/03	OFFICE	NEWCASTLE

CDT-DWG-A3V-001/1

9542

Area of TPH contamination

whole area 9181

TP26 TP25 TP24 TP6 B2 TP5 FTTP13 TP7 TP15 TP23 TP22 TP14 TP20 TP21

HANNELL STREET

TEMPORARY SITE OFFICES

FIG TREE PARK STAGE 1 WORKS

SEA WALL

FTTP04 TP19 TP18 TP17 BH4 TP16 TP16 (0.4–0.6m) TP13 TP12 (0–1.7m)

FIG TREE PARK STAGE 2 WORKS

GRASS VERGE

GRASS AND BITUMEN

TP3 BH1 TP4 TP2 TP8 (0–0.8m) TP1 TP9 (0–0.6m) TP10 (0–0.6m) BH3 TP11 (0–1.4m)

OLD ROAD

GRASS VERGE

LIGHT TOWER

LEGEND

- Current Test Pit (RCA, 2003)
- Current Groundwater Bore (RCA 2003)
- Location of layer A (PAH contamination) and depth of horizon
- Area of potential PAH contamination (whole of stage 2 area)
- Area of former PAH contamination (excavated)
- Area of former TPH contamination (landfarmed)

Note:
Drawing taken from
PPK Drawing 2122128A\PR_0598 Figure 02

0 10 20 30 40 50
metres

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TEST PIT LOCATIONS WITH PAH (LAYER A) DEPTHS
REMEDIAL ACTION PLAN
FIG TREE PARK STAGE 2
HONEYSUCKLE DEVELOPMENT ESTATE

CLIENT Honeysuckle Development Corporation		PROJECT No 3242A	
DRAWN BY RSM	SCALE As Shown	DRAWING No 4	REV 0
APPROVED BY	DATE 7/11/03	OFFICE NEWCASTLE	

CDT-DWG-A3V-001/1

LEGEND

- Current Groundwater Bore (RCA 2003)
- Validation Groundwater Bore (RCA 2003)

Note:
Drawing taken from
PPK Drawing 2122128A\PR_0598 Figure 02

0 10 20 30 40 50
metres

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EXISTING GROUNDWATER MONITORING WELLS
FIG TREE PARK STAGE 2
HONEYSUCKLE DEVELOPMENT ESTATE

CLIENT	Honeysuckle Development Corporation			PROJECT No	3242A
DRAWN BY	SMA	SCALE	As Shown	DRAWING No	5 REV 0
APPROVED BY		DATE	7/11/03	OFFICE	NEWCASTLE

CDT-DWG-A3V-001/1