



Douglas Partners

Geotechnics • Environment • Groundwater

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REPORT

on

STAGE 1 ENVIRONMENTAL SITE ASSESSMENT

PROPOSED WARNERVALE TOWN CENTRE

SPARKS AND HAKONE ROADS WARNERVALE, NSW

***Prepared for
WYONG SHIRE COUNCIL***

***PROJECT 41118A
March, 2006***



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EXECUTIVE SUMMARY

This report presents the results of a non intrusive Stage 1 Environmental Site Assessment (ESA) undertaken at the above site by Douglas Partners Pty Ltd (DP). The assessment was undertaken on behalf of Wyong Shire Council (WSC). It is understood that redevelopment is in the planning stages and a mixed commercial and residential land use is proposed.

The investigation area comprises part of the larger Warnervale Town Centre area, bounded by Mackillop Catholic College and existing semi-rural properties to the east; Hakone Road to the north; Sparks Road to the south and the Main Northern Railway to the west. The site layout is presented as Drawings 1A and 1B. The Stage 1 ESA comprised a review of site history and other relevant background information as well as a site inspection. No intrusive sampling was undertaken.

Previous environmental and geotechnical investigations have been undertaken within portions of the current site area. These assessments included site historical reviews, site walkovers and a limited number of intrusive investigations and analytical testing.

A summary of the potential contamination issues identified are provided below:

- Quarrying activities (clearance of vegetation and surface disturbance) historically occurred in Lot 521 DP 594725, Lot 1 DP 376264, Lot 54 DP 7527 and Lot 55 DP 7527. The approximate area affected is identified in Drawing 1B.
- Landfilling activities were likely to be restricted to Lot 1 DP 376264 and Lot 54 DP 7527, based on the disturbed area indicated in the 1973 and subsequent aerial photographs. Anecdotal information provided by WSC indicated that the site was operated by Council's Roadworks Section and materials placed were likely to comprise mainly road construction wastes, although the site was unsecured and as such illegal dumping of materials was probable. Test pits previously undertaken in this identified waste materials consistent illegal dumping.
- A nursery land use existed in Lot 521 from around 1987 to 2002. The former nursery consisted of levelled growing platforms covered with greenhouses, various ancillary buildings and three dams used for supply of irrigation water.

- Demolished buildings (including possibly small greenhouses), a reinstated dam and surface filling and/or anthropogenic surface inclusions were identified in the southern half of Lot 51 DP 561032.
- Surface filling and/or anthropogenic surface inclusions in the vicinity of the former building footprints and illegal dumping of materials mainly within the drainage alignment and adjacent surface depressions within Lot 1 DP 700096.
- Filling beneath the existing buildings (likely cut/fill) within Lot 2 DP 7738.
- Filling beneath the existing buildings and on-site access roads, and storage of mechanical equipment and products adjacent to shed within Lot 3 DP 7738.
- Surface filling and/or anthropogenic surface inclusions in the vicinity of the former building footprints and illegal dumping of materials mainly concentrated towards the northern and eastern lot boundaries within Lot 52 DP 561032.
- Surface filling within the access road alignment within Lot 1 DP 375712 & Lot 1 DP 371647.
- Illegal dumping of waste materials was observed to some degree within most lots on-site.

The potential contamination sources/activities were generally considered have the potential to impact soils (surface soils, filling or sediments). The main exception to this, would be the former landfilling activities and to a lesser degree the former quarrying activities. The former landfilling has the potential to impact soils, groundwaters and soil vapours at the site. Whereas, quarrying activities are considered to have the potential to impact both soils and groundwaters.

Potential contaminants of concern specific to each activity/land use are outlined in Section 6, although would generally include heavy metals, organochlorine pesticides, total petroleum hydrocarbons, benzene, toluene, ethyl benzene, xylenes, polycyclic aromatic hydrocarbons, phenols, polychlorinated biphenyls and asbestos. Additional specific contaminants associated with nursery land use would include organophosphorus pesticides and specific contaminants associated with the landfilled area would include volatile organic compounds, semi volatile organic compounds and landfill gases. The potential contamination source/activity assessed to have the greatest potential for affecting suitability of the site for the proposed future land use is the former landfill.

Based on the information gathered, we recommend that Stage 2 ESA is undertaken to further assess the site's suitability for the proposed mixed residential/commercial land use. The areas of environmental concern are highlighted in Drawings 2A and 2B.

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BJK:bjk
Project 41118A
March 2006

REPORT ON
STAGE 1 ENVIRONMENTAL SITE ASSESSMENT
PROPOSED WARNERVALE TOWN CENTRE
SPARKS AND HAKONE ROADS, WARNERVALE, NSW

1 INTRODUCTION

This report presents the results of a non intrusive Stage 1 Environmental Site Assessment (ESA) undertaken at the above site by Douglas Partners Pty Ltd (DP). The assessment was undertaken on behalf of Wyong Shire Council (WSC). It is understood that redevelopment is in the planning stages and that the end land use proposed is for a mixed commercial and residential land use.

The investigation area comprises part of the larger Warnervale Town Centre area, bounded by Mackillop Catholic College and existing semi-rural properties to the east; Hakone Road to the north; Sparks Road to the south and the Main Northern Railway to the west.

The assessment comprises a review of site history and other relevant background information as well as a site inspection. No intrusive sampling was undertaken.

1.1 Purpose of Assessment

The assessment aims to fulfil the following objectives:

- Identify past and present potentially contaminating activities;
- Identify potential contamination types;

- Provide a preliminary assessment of site contamination; and
- Assess the need for further investigations.

1.2 Site Identification

The site comprises a trapezoidal shaped area of approximately 47.2 ha and can be accessed from both Sparks Road and Hakone Roads. The site is located in the parish of Munmorah and county of Northumberland and all lots within the site are understood to be zoned 10A Investigation Precinct Zone. Details for each of the individual Lots are summarised below:

Table 1: Individual Lot Details

Lot Identification	Property Address	Approximate Area (Ha)	Property Owner
Lot 1 DP 371647	236-264 Hakone Road, Woongarra	0.07	WSC
Lot 1 DP 375712	236-264 Hakone Road, Woongarra	0.34	WSC
Lot 1 DP 376264	236-264 Hakone Road, Woongarra	4.25	WSC
Lot 54 DP 7527	236-264 Hakone Road, Woongarra	5.67	WSC
Lot 55 Lot 7527	236-264 Hakone Road, Woongarra	5.67	WSC
Lot 521 DP 594725	262-283 Hakone Road, Woongarra	9.05	Fabcot Pty Ltd
Lot 52 DP 561032	99 Sparks Road, Woongarra	2.15	WSC
Lot 51 DP 561032	103 Sparks Road, Woongarra	2.14	WSC
Lot 4 DP 7738	107 Sparks Road, Woongarra	4.05	WSC
Lot 3 DP 7738	111 Sparks Road, Woongarra	4.05	Landcom
Lot 2 DP 7738	115 Sparks Road, Woongarra	4.05	Landcom
Lot 1 DP 700096	119-121 Sparks Road, Woongarra	5.73	Landcom

Lots within the site are generally unoccupied with the exception of Lot 2 DP 7738 and Lot 3 DP 7738, which are occupied by a Medical Centre and semi-rural residential dwellings respectively. The site location is presented in Drawings 1A & 1B, Appendix A.

1.3 Data Quality Objectives (DQOs)

Data quality objectives (DQOs) have been developed to define the type and quality of data required to achieve the project objectives.

The DQO process consists of seven step planning approach, as defined in Australian Standard: *Guide to the Sampling and Investigation of Potentially Contaminated Soil Part 1: Non-volatile and semi-volatile compounds* (AS 4482.1) (Ref 1). Table 2 summarises data quality objectives (DQOs), indicating the components of each step and the sections where the steps have been addressed.

Table 2 - Data Quality Objectives

DQO Step	Section Where DQO Addressed
Define the problem	S 1 Introduction S 1.1 Purpose of Assessment
Identify the problem	S 1 Introduction S 1.2 Site Identification
Identify the inputs of the decision	S 3 Physical Setting S 4 Site History S 5 Site Inspection / Observations
Define the study boundaries	S 1.2 Site Identification S 2 Scope of Works
Develop a decision rule	S 6 Contaminants of Concern S 7 Assessment Criteria
Specify tolerable limits on decision errors	S 2 Scope of Work S 9 Limitations of this Report
Optimise the design	S 8 Conclusions and Recommendations

2 SCOPE OF WORK

The preliminary environmental site assessment was carried out in general accordance with the staged approach outlined in *State Environmental Planning Policy No. 55 – Remediation of Land* (SEPP 55 – Ref 2) and the *Contaminated Site: Guidelines for Consultants Reporting on Contaminated Sites* (NSW EPA – Ref 3).

In brief, DP's scope of works included:

- Collation and interpretation of data from the following sources:-
 - Published public data, including topographical, geological and hydrogeological maps;
 - Aerial photographs;
 - Land title records;
 - NSW DEC Database search;
 - Section 149 Certificate, which includes information relating to contaminated land issues pertaining to the site;
 - Workcover Dangerous Goods License Search;
 - Water bore license search;
 - Site plans, archives, anecdotal information and previous reports; and
 - Interviews with individuals who may be familiar with past operations and sites usage (where available).
- Site inspection to provide a visual assessment of potential contamination sources.
- Preparation of a report outlining the works undertaken and the findings of the Stage 1 ESA.

Previous environmental investigations have been undertaken within portions of the site by various companies. The information provided in these reports has been summarised and incorporated into this report. A list of the previous reports are presented in Section 4.1.

3 PHYSICAL SETTING

3.1 Topography

According to the 1:25,000 Dooralong (9131-1-S) Topographic Map (Ref 4) and the drawing supplied by WSC indicates that site surface levels generally range from 57 mAHD down to 17 mAHD. Maximum elevations are generally in areas surrounding the former quarry site, with surface levels sloping down in all directions. Surface gradients generally range from 1 in 5 to 1 in 20 across the site.

Inspection of the survey drawing indicated that some significant modification of the natural surface levels has occurred in several lots including:

- Lot 521 DP 594725 – associated with levelled pads for nursery activities and excavation of farm dams.
- Lot 1 DP 376264 & Lot 54 DP 7527 – associated with the former quarrying and (waste) landfilling activities.
- Lot 51 DP 561032, Lot 3 DP 7738 & Lot 1 DP 700096 – associated with levelling for building pads and dams on-site.

The topographical mapping indicates there are two intermittent watercourses located within the site. The first cuts across Lot 1 DP 700096 and exits the site to the south and the other originates in the vicinity of the former quarry/landfill and flows north east, exiting the site along the eastern boundary. Several dams were identified at the site and their characteristics are further discussed in Section 5. Due to the site's elevation and surface gradients the potential for flooding is considered to be relatively low. Notwithstanding this, the area considered to have the highest flood potential would be Lot 1 DP 700096 in areas adjacent to the drainage alignment.

3.2 Adjacent Site Uses

Surrounding land uses include the following:

- North – Across Hakone Road are semi-rural properties generally consisting of residential dwellings, sheds and cleared paddocks or open spaces.
- East – Mackillop Catholic College adjoins the southern half of the site and a cleared rural property adjoins the north half of the site. Construction activities were in progress at the Mackillop Catholic College at the time of the Stage 1 ESA. Approximately 350 m east of the site boundary a commercial hydroponics business was operating.
- South – Across the former Sparks Road (Wallarah Road) alignment and the current road alignment are semi-rural properties consisting of residential dwellings, sheds and cleared paddocks or open spaces.
- West – Across the Main Northern Railway line were generally semi-rural properties with vegetation consisting of sparse to dense bushland.

The potential for contamination from these site's to have impacted the subject site is considered to be low.

Local sensitive environments include both Porters Creek Wetland and Woongarra Creek. Based on topographical mapping information it is anticipated that roughly the northern half of the site is located within the Woongarra Creek catchment area and the southern half of the site is located with the Porters Creek catchment area. Mapping indicates that Woongarra Creek is located approximately 3 km north east of the site, whereas Porters Creek Wetlands is located approximately 5 km south west of the site.

Information supplied by WSC indicates that Porters Creek Wetlands and Woongarra Creek is considered to be regionally significant. Both catchment areas drain to the Tuggerah Lakes Estuary System.

3.3 Geology & Soil Landscape

Reference to the interim 1:25,000 Gosford Geological Series Sheet indicates the site is underlain by both Tuggerah Formation and Patonga Claystone.

Based on the mapping the majority of the site is expected to be underlain by the Tuggerah Formation. Tuggerah Formation, a member of the Clifton Sub-group within the Triassic Age Narrabeen Group is characterised by lithic sandstone, red-brown and grey-green claystone and siltstone, grey siltstone and laminate, rare conglomerate.

The mapping indicates that approximately 50% of the northern lots are underlain by Patonga Claystone. Patonga Claystone, a member of the Clifton Sub-group within the Triassic Age Narrabeen Group is characterised by red-brown and green-grey claystone and siltstone, grey siltstone, laminate and fine lithic sandstone.

The soil landscape mapping (Ref 5) indicates that Woodburys Bridge and Gorokan landscapes exist at the site. The landscapes are characterised as having a brown sandy loam or loamy sand underlain by yellow/brown sandy clay or clayey sandy. The soil landscapes can be described as having the following characteristics:

- Very high and extreme erosion hazard.
- High foundation hazard.

- Seasonal waterlogging (localised).
- Acid soils and very low fertility.

Information suggests that moderate sheet and/or rill erosion can occur where the ground cover has been cleared. Further steep batters on mudstone are prone to severe rilling or slaking and due to the low wet bearing strength of the soils steep batters should be avoided or advice sought from a geotechnical engineer prior to undertaking any major excavation or development.

3.4 Acid Sulphate Soils

Review of the NSW Soil Conservation Service for New South Wales Acid Sulphate Soil Risk Map for Doralong (Ref 6) indicates that the site is located within an area classified as having no known occurrences of acid sulphate soil materials.

3.5 Groundwater

Permanent groundwater table is likely to be present within the sandstone lithology and would be expected within approximately 20 m of the ground surface. Some minor seepage layers within the valdose zone, may be located at the interface of localised permeability boundaries such as at the interface between residual soils and weathered bedrock where some ironstone deposits may be encountered. Flow may be predominantly via secondary permeability vectors including jointing and other discontinuities, rather than as intergranular movement.

A registered groundwater bore search was undertaken as part of the Stage 1 ESA. The search results are presented in Appendix B.

The search results indicated that three bores were located within a 3 km radius of the site. Two of the bores were located between 2.5 – 3.0 km south east of the site and were reported to have agricultural (supply) purpose.

The remaining registered bore was located approximately 400 m east of the site boundary and was reported as having a domestic purpose with the water reported as being fresh. The groundwater was encountered at a depth of approximately 18 – 23 m.

4 SITE HISTORY

4.1 Previous Investigations

The following is a list of the known reports prepared for the site:

- *Property at Warnervale, Report on Stage 2 of Environmental and Geotechnical Investigations* (GHD, July 2003) (Ref 7);
- *Report on Additional Investigation, Proposed Development Hakone Road, Warnervale* (DP, September 2005) (Ref 8); and
- *Preliminary Geotechnical Investigation, Warnervale Town Centre* (RCA Australia, November 2005) (Ref 9).

The following subsections provide a brief summary of each of the previous investigations.

4.1.1 Report on Stage 2 of Environmental and Geotechnical Investigations (July 2003)

GHD Pty Ltd completed Stage 2 of Environmental and Geotechnical Investigation of properties located at Warnervale in late 2002 and early in 2003. The properties were identified as Lot 1 DP 700096, Lot 3 DP 7738, Lot 4 DP 7738, Lot 54 DP 7527, Lot 55 DP 7527, Lot 1 DP 376264 and Lot 1 DP 375712. The report summarises the Stage 1 Environmental Assessment (historical review and site inspection), Stage 2 Environmental Assessment (soil and groundwater investigation and contaminant testing), Stage 1 Geotechnical Investigations (desktop review and site inspection) and Stage 2 Geotechnical Investigations (soil investigations and geotechnical testing).

The subsurface investigations for contamination assessment included eight hand auger bores and 14 test pits across the site. Three standpipe piezometers were installed to facilitate monitoring, sampling and analysis of groundwater.

The investigation within the former quarry area encountered filling comprising concrete, timber, asphaltic concrete, glass, wire, steel, plastic and other municipal landfill wastes. Most of the test pits and bores were unable to penetrate the filling with the depth of investigation being limited to 1.7 – 3.0 m depth. The remaining site area that had not been disturbed by quarrying or landfilling activities and previous development generally encountered residual soils overlying clay and then bedrock. No comment on soil odours was provided in the test logs or report. Selected soil samples from the pits/bores were tested for eight heavy metals, polycyclic aromatic hydrocarbons (PAHs), particle size distribution, Atterberg Limits and Emerson Class.

A summary of the conclusions by GHD includes:

- Soil and groundwater contamination as assessed at the site is not considered to represent a significant risk of harm to human health or the environment.
- Minor exceedances of the assessment guidelines for both soils and groundwaters is not considered significant.
- Based on the results of the (GHD) investigations, the site was considered suitable for continued use or redevelopment for residential and commercial use without remediation.
- Further investigations would be considered appropriate to confirm groundwater character across the site and to assess for further contaminants in fill material associated with the former quarry and its access road, as well as fill identified under various structures.
- The disturbed area around and including the former quarry/landfill site was considered unsuitable for residential or commercial development from a geotechnical perspective, unless the waste fill is removed and replaced with engineered fill. The area could otherwise be developed as parkland or open space.
- Development of the rest of the site could be carried out subject to appropriate engineering design and construction.

4.1.2 Report on Additional Investigation Proposed Development, Hakone Road Warnervale (September 2005)

The report by DP details the results of an additional investigation carried out for the proposed development within Lot 1 DP 376264, Lot 54 DP 7527 and Lot 55 DP 7527. The purpose of the investigation was to gather information on the depth of the filling material for planning and costing purposes associated with site redevelopment.

It was noted that the investigation did not constitute a contamination assessment to “characterise” the filling materials, although some limited contamination testing was undertaken for the project. Field investigations comprised the excavation of seven test pits.

The results of the investigation divided the site into undisturbed areas and disturbed/quarry areas. The pits excavated in undisturbed areas encountered shallow topsoil over loose to medium dense sands and stiff to very stiff and hard residual clay soils. Sandstone bedrock was encountered from 0.45 – 1.8 m depth. The test pits within the disturbed/quarry area encountered filling from 3.7 to 5.5 m depth. The filling generally comprised poorly compacted soils ranging from clay fines to coarse gravels. The pits also encountered inclusions of waste materials comprising bottles, metal shelving, timber, pots, chicken wire, plastic bags, carpet, concrete and fibrous cement sheeting (possibly containing asbestos) to depths of about 2 m. Other isolated potential contamination issues noted included a slight hydrocarbon odour and tree trunks. The filling was underlain by natural soils then weathered sandstone.

Groundwater seepage was observed at one test pit location. No free groundwater was observed in the other test pits over the duration of the fieldwork, although it is noted that they were backfilled immediately after excavation for safety reasons.

The limited contamination testing did not indicate any significant chemical contaminant concentrations that would affect possible future development of the site. Notwithstanding this, the presence of fibrous cement sheeting, potentially containing asbestos was noted at several locations across the site. Testing of these materials was not undertaken as part of this project, although was recommended as part future assessment works.

4.1.3 Preliminary Geotechnical Investigation, Warnervale Town Centre (November 2005)

RCA completed a Preliminary Geotechnical Investigation on properties within the proposed Warnervale Town Centre that front Sparks Road. Based on the drawing provided the investigations were limited to Lot 1 DP 700096, Lot 2 DP 7738, Lot 3 DP 7738, Lot 4 DP 7738, Lot 51 DP 561032 and Lot 52 DP 561032. The investigation comprised the inspection of the site and excavation of 12 test pits.

Observations made by RCA indicated the bedrock is shallow in the elevated portions of the site, although the depth to bedrock was greater than 3.8 m in two of the 12 test pits.

Groundwater was encountered in only one test pit at a depth of 3.1 m. No filling was encountered within any of the test pits excavated. No soil odours were noted in the test pit logs.

4.2 Regulatory Notices Search

The NSW EPA Web Site was searched for any Regulatory Notices that may be current on the site issued under the Contaminated Land Management Act 1997. Information obtained indicated that no notices were current for the site.

4.3 Historical Aerial Photographs

Historical aerial photographs were reviewed dating back to the earliest available record (1954) and approximately every 10 years thereafter to assess any major changes to the site and surrounding areas during this period. The following historical aerial photographs were reviewed:

- Photograph – Gosford NSW CAC 44-5120, dated 07.03.54;
- Photograph – Gosford NSW 1439 5117 Run 6, dated 08.03.66;
- Photograph – Gosford NSW 2315 55 Run 4, dated 28.5.75;
- Photograph – Gosford NSW 3371 180 Run 5, dated 26.04.84;
- Photograph – Gosford NSW 4039 Run 7, Scale 1:25 000, dated 20.9.91; and
- Photograph – Gosford NSW 4586 (M2288), Run 7, Scale 1:25 000, dated 29.10.01.

1954

The Main Northern Railway, Sparks Road and Hakone Road are all visible, with the site and adjacent areas generally undeveloped. To the east are several farming properties which generally appear to have a rural (grazing) land use, although some possibly small poultry sheds (off site) are visible. Lots 4, 51 and 52, located in the south eastern corner of the site, have been partially cleared with a dam present within Lot 51. A cleared area and disturbed surface soils are visible in areas, spreading across portion of Lots 521, Lot 1 DP 376264 and Lot 54 (former quarry). There appears to be a formed access track running perpendicular from Sparks Road along the eastern boundary (that is, within Lot 1 DP 375712 and Lot 1 DP 371647) and then traversing across Lot 55 to the cleared area of the site.

1966

The site and surrounding areas are generally consistent with the 1954 photograph, although further development in areas surrounding the site generally appears to be for rural purposes. The most significant change from 1954 photograph is the expansion of the cleared area (former quarry), now covering up to 50% of the northern half of the site and appears to be distributed across Lot 521, Lot 1 DP 376264, Lot 54 and Lot 55. A small house with access track from Sparks Road is present within Lot 4.

1975

The site and surrounding areas generally remain consistent with the 1966 aerial photograph, although the gradual development of surrounding areas continues for rural land uses. Some regrowth of vegetation has occurred within Lots in the northern half of the site, although a cleared area across Lot 1 DP 376264 and Lot 54 remains. Lot 1 DP 700096 has been cleared with a dam constructed in the north western corner of the site. Lots 2, 3 and 4 (except for a house and access road on Lot 4) generally remain undeveloped with dense bushland covering the lots.

1984

Changes from the 1975 photograph include the clearing of vegetation in Lot 521, although no buildings are visible. The quarrying or landfilling activities appear to be continuing within Lot 1 DP 376264 and Lot 54. Lots 51 and 52 appear to have a dwelling and several smaller sheds located within the lots and the dam identified in the 1954 photograph likely to have been reinstated. Development in Lot 3 has occurred, with the clearing of vegetation with the southern third of the site and the construction of one or maybe two buildings on-site. Within Lot 1 DP 700096 it appears that up to four small buildings were constructed in the south western corner of the site.

1991

Areas surrounding the site are generally developed for what appears to be semi-rural land uses, although some undeveloped/uncleared areas remain. Changes since the 1984 photograph include; construction of nursery facilities (buildings and green houses) within Lot 521, partial clearing of Lot 2 including a dwelling in the south eastern corner; and additional buildings in the northern portion of Lot 3 and additional buildings (sheds) within Lot 51. The cleared area (former quarry/landfill) appears to still be active and restricted to Lot 1 DP 376264 and Lot 54.

2001

Since the 1991 photograph the nursery has expanded to cover approximately the central third of Lot 521. Some activity remains visible in a relatively small area within Lot 1 DP 376264 possibly relating to landfilling activities or storage of materials. Surface vegetation within Lot 1 DP 376264, Lot 54 and Lot 55 generally comprises either residual or regrowth bushland, with the exception of the grass surface covering in the previous landfilling/quarrying areas within Lot 1 DP 376264 and Lot 54. Again, development within Lot 51 is restricted to several buildings/sheds and constructed dam, within the southern half of the lot. No other significant changes were observed in the 2001 photograph.

Change in Land Use

Since the first aerial photograph in 1954 some significant development or changes in land use have occurred at the site. A summary of the changes for each of the individual lots includes:

- Lot 521 DP 594725 – Partial clearing and surface disturbance for possible quarrying activities were evident in the 1954 and 1966 photographs. Some vegetation regrowth was visible in the 1975 photograph before the site was cleared in the 1984 photograph and nursery activities commenced prior to 1991.
- Lot 1 DP 371647 and Lot 54 DP 7527 – Both lots partially cleared and surface disturbance for possible quarrying activities with the cleared area increasing from 1954 to 1966, the area contracting to the approximate area marked in Drawing 1B (Appendix A) in the 1975 and 1984 photographs. No visual evidence of landfilling was obtained from the aerial photographs.
- Lot 55 DP 7527 – Some land clearing and surface disturbance evident in the 1954 and 1966 aerial photographs with vegetation regrowth visible in 1975 and 1984 photographs. An access track from Hakone Road towards the cleared area previously described was visible in the 1991 and 2001 photographs.
- Lot 1 DP 700096 – The lot was cleared of vegetation and dam constructed prior to the 1975 photograph. Four small buildings/sheds are visible in the south western corner of the site in the 1984 photograph. The buildings and dam indicated in Drawing 1A were visible in the 2001 photograph.
- Lot 2 DP 7738 – The lot remained undeveloped and covered with dense native vegetation until 1991 aerial photograph, where some clearing was evident and construction works appear to be in progress in the south eastern corner of the site.

- Lot 3 DP 7738 – The lot remained relatively undisturbed, other than some vegetation clearing adjacent to Sparks Road, until the 1984 photograph where access road, a dam and buildings were constructed. The access roads, dam and buildings appear to be in similar positions in the 1991 and 2001 photographs.
- Lot 4 DP 7738 – A small building (south eastern corner) and some vegetation clearing was visible in the 1954 and 1966 photographs. In the 1975 photograph regeneration of vegetation had occurred with the lot appearing to be densely vegetated in the 1991 and 2001 photographs.
- Lot 51 DP 561032 – The 1954 aerial photograph presents the lot as being partially cleared of trees and with what appears to be a dam located approximately 90 m from the Sparks Road boundary. In the 1966 photograph the dam is no longer visible and by 1984 what appears to be a house and shed are located in the southern half of the property. In the 1991 photograph an additional shed(s) were constructed, adjacent to the previous two buildings. The 2001 aerial photograph indicated that a further shed was constructed between the existing buildings and dam. The elongated sheds may indicate the presence of greenhouses, although Ref 7 indicated that rural residential properties were located in this area.
- Lot 52 DP 561032 – The 1954 aerial photograph presents the lot as being partially cleared of trees and with what appears to be possibly a small building adjacent to the eastern boundary. The 1984 photograph indicates that the small building remains on-site and the northern half of the lot is covered in dense vegetation. The 1991 photograph indicates that an additional two small structures have been constructed adjacent to the existing building. Similar conditions were observed in the 2001 photograph.
- Lot 1 DP 375712 and Lot 1 DP 371647 – The 1954 photograph indicates both lots were used as an access road from Sparks Road to the cleared area in the northern half of the site. The access road was still present in the 2001 photograph.

4.4 Historical Land Titles

The results of the title deed searches are summarised in the tables below and a copy of the search results are included as Appendix C.

Table 3 – Results of Title Deed Search, Lot 1 DP 371647

Date	Registered Proprietor	Occupation/Possible Land Use
April 1951	# Council of the Shire of Wyong	Council / None indicated (Access Road)

Denotes current registered proprietor

Table 4 – Results of Title Deed Search, Lot 1 DP 375712

Date	Registered Proprietor	Occupation/Possible Land Use
February 1952	# Council of the Shire of Wyong	Council / None indicated (Access Road)

Denotes current registered proprietor

Table 5 – Results of Title Deed Search, Lot 54 & 55 DP 7527 & Lot 1 DP 376264

Date	Registered Proprietor	Occupation/Possible Land Use
May 1952	# Council of the Shire of Wyong	Council / None indicated (Quarry/Landfill)

Denotes current registered proprietor

Table 6 – Results of Title Deed Search, Lot 521 DP 594725

Date	Registered Proprietor	Occupation/Possible Land Use
July 1957	Jerrabombera Limited	Company / None indicated (Vacant)
November 1977	Neville Roy Thompson Christine Susan-Anne Thompson	Diesel Mechanic (Job) & Wife / Joint Tenants
December 1987	Phillip Martin Moore Dianne Farr (now Moore)	Not Indicated / Joint Tenants (Nursery)
March 2002	# Fabcot Pty Ltd	Company / Vacant (Abandoned Nursery)

Denotes current registered proprietor

Table 7 – Results of Title Deed Search, Lot 51 DP561032

Date	Registered Proprietor	Occupation/Possible Land Use
August 1934	Olga Vali	Unknown / None indicated (Vacant)
September 1960	Helene Busch	Unknown / None indicated (Vacant)
May 1962	Maybel Hayden	Liverpool Married Woman / Vacant
June 1973	George Alfred Alexander Cannon & Leonie Mary Frances Cannon	Warnervale Carpenter / Joint Tenants
July 1987	Austin John Woodbury	Unknown / Tenant
June 1995	Austin John Woodbury & Florita Woodbury	Unknown / Joint Tenants
May 2000	# Wyong Shire Council	Council / Vacant

Denotes current registered proprietor

Table 8 – Results of Title Deed Search, Lot 52 DP561032

Date	Registered Proprietor	Occupation/Possible Land Use
August 1934	Olga Vali	Unknown / None indicated (Vacant)
September 1960	Helene Busch	Unknown / None indicated (Vacant)
May 1962	Maybel Hayden	Liverpool Married Woman / Vacant
May 1974	Rodney James Hayden & Lynette Patricia Hayden	Warnervale Contract Painter / Joint Tenants
June 1979	Alice Doreen Cummins	Wentworthville Married Woman / Vacant
June 1993	John Dixon Cummins	Of Blackburn Victoria / Vacant
September 1995	Barry Richard Young	Of Wamberal / Vacant
May 2000	# Wyong Shire Council	Council / Vacant

Denotes current registered proprietor

Table 9 – Results of Title Deed Search, Lot 4 DP 7738

Date	Registered Proprietor	Occupation/Possible Land Use
June 1923	Joseph Wilfred Fisher	Warnervale Farmer / Tenant
December 1958	Ellen Lell	Bexley Hand Bag Manufacturer / Tenant
May 2002	# Wyong Shire Council	Council / Vacant

Denotes current registered proprietor

Table 10 – Results of Title Deed Search, Lot 3 DP 7738

Date	Registered Proprietor	Occupation/Possible Land Use
October 1947	Helene Busch	Warnervale Farmer / None indicated (Vacant)
May 1957	Roman Edward Simson	Unknown / None indicated (Vacant)
December 1964	Alfred Alister White	Strathfield Dresscutter / None indicated (Vacant)
August 1981	Graham Frederick Smith & Maree Kathleen Smith	Unknown / Joint Tenants
March 2003	# Landcom	Company / Property Development

Denotes current registered proprietor

Table 11 – Results of Title Deed Search, Lot 2 DP 7738

Date	Registered Proprietor	Occupation/Possible Land Use
October 1947	Helene Busch	Warnervale Farmer / None indicated (Vacant)
May 1957	Roman Edward Simson	Unknown / None indicated (Vacant)
August 1958	Ernst Hayden Duffy	Woolahra Public Servant / Vacant
August 1988	Louis Vanallo & Rosey Vanallo	Unknown / Joint Tenants
March 2003	# Landcom	Company / Property Development

Denotes current registered proprietor

Table 12 – Results of Title Deed Search, Lot 1 DP 700096

Date	Registered Proprietor	Occupation/Possible Land Use
July 1957	Jerrabombara Limited	Company / None indicated (Vacant)
August 1960	Phillip John Hyde Western Third (Appendix B)	Gorokan Research Officer/ None indicated (Vacant)
June 1966	Leslie Hilton Greentree & Ronald John Greentree Western Third (Appendix B)	Wyong Contractors / None indicated (Vacant)
April 1968	John Aubrey Fleay Cornell Eastern Two Thirds (Appendix B)	Toukley Estate Agent / None indicated (Vacant)
August 1968	John Aubrey Fleay Cornell Western Third (Appendix B)	Toukley Estate Agent / None indicated (Vacant)
November 1970	Patricia Denise Cockrell (Whole Lot)	Beecroft Married Woman / None indicated (Vacant)
June 1973	Oliver Wendell Cockrell	Asphley Business Consultant / None indicated (Vacant)
June 1973	Elaine Mary Nealon	Gorokan Drawing Instructress / None indicated (Tenant)
October 1975	Donald William Falstead & Valerie Alice McDonald	Umina Plasterer / Joint Tenants
June 1976	Richard Charles Mathews & Jean Mathews	Wyongah Plumber / Joint Tenants
November 2002	# Landcom	Company / Property Development

Denotes current registered proprietor

A summary of the historical title deeds does not indicate any specific contaminating activities at the site, although nursery land use for Lot 521 probably commenced in 1987 and ceased in 2002 when Fabcot P/L purchased the property. WSC has owned Lots 54, 55 and Lot 1 DP 376264 since the 1950's and these were used for quarrying and landfilling activities. No other pertinent information was acquired.

4.5 Section 149(2) Planning Certificate

A certificate issued under Section 149(2) of the Environmental Planning and Assessment Act 1979 was obtained for selected lots within the site. Certificates for the remaining lots were sourced for a previous environmental assessment undertaken for lots within the site (Ref 7). Table 13 summarises any notations made on the Section 149 Certificates, with regard to potential land contamination issues. Copies of the acquired certificates are provided in Appendix D.

Table 13: Section 149(2) Certificate Details

Lot Identification	Section 149(2) Certificate Details
Lot 1 DP 371647	N/A
Lot 1 DP 375712	N/A
Lot 1 DP 376264	N/A
Lot 54 DP 7527	The land is considered to be potentially contaminated land by reason of its past/present use as a tip
Lot 55 Lot 7527	The land is considered to be potentially contaminated land by reason of its past/present use as a tip
Lot 521 DP 594725	The land is considered to be potentially contaminated land by reason of its past/present use as a Nursery
Lot 52 DP 561032	N/A
Lot 51 DP 561032	N/A
Lot 4 DP 7738	N/A
Lot 3 DP 7738	N/A
Lot 2 DP 7738	N/A
Lot 1 DP 700096	N/A

The certificates provides no additional information on the areas utilised for landfilling other than to indicated that only Lots 54 and 55 were utilised for this land use. Based on the information it is suspected that the landfill operations were unlicensed and no management of the landfilling activities was undertaken.

4.6 WorkCover Dangerous Goods Licence Search

A search of the WorkCover NSW Stored Chemical Information Database (SCID) and the microfiche records held by WorkCover has not located any records pertaining to the abovementioned premises. The WorkCover search result is presented as Appendix E.

4.7 Council Supplied Information

The historical review included discussions with the WSC employees with the objective of obtaining more information with regard to the former quarry and landfill area. No existing WSC employees were directly involved with the quarrying or landfilling activities at the site. Notwithstanding this, the indirect information collated indicated the following:

- The site was used for quarrying/landfilling for more than 20 years with some cleanup operations occurring 8-10 years ago.

- WSC provided approval to the Department of Main Roads (RTA) for the extraction of 30,000 to 40,000 m³ of fill from the quarry in March 1985 for the construction of Wallarah Road (Sparks Road).
- WSC Roadwork's Section was the only official users of the site. Materials placed at the site were described as road construction debris including; broken concrete, vegetation, asphalt, asbestos cement pipes and general clean fill.
- The site was not used by WSC for general rubbish however the site was not secured and some illegal dumping may have occurred at the site.

Further WSC has no records pertaining complaints made with regard to the site. A review of council records including development applications and trade waste agreements revealed the following:

- Lot 3 DP 7738 – Approval to erect dwelling (February 1981).
- Lot 2 DP 7738 – Approval for attached dual occupancy and machinery shed (April/June 1996), approval for absorption trench septic tank (June 1996) and approval for community facility for primary health care and training purposes (August 2003).
- Lot 1 DP 700096 – Approval for demolition of existing house and sheds (October 2003).
- Lot 52 DP 561032 – Approval for existing dwelling as administration office for CampDARE (October 2004) and approval of dwelling and all outbuildings (May 2005).
- Lot 51 DP 561032 – Approval for clearing of land and construction of dam (October 1991) and demolition of dwelling, outbuildings and pool (May 2005).
- Lot 521 DP 594725 – Approval for Wholesale Plant Nursery (December 1987) and removal of tree and extension of garden beds (June 1996).

5 SITE INSPECTION / OBSERVATIONS

A site walkover and inspection was undertaken as part of the site activities outlined in Section 2. The site walkover was undertaken on the 6 and 7 February 2006 by Brent Kerry of DP. The site features observed during the inspection are summarised below and are identified in Drawing 1A and 1B (Appendix A) where appropriate. Site features noted in Ref 3 are also incorporated into this section of the report.

Lot 521 DP 594725

Lot 521 is accessed from Hakone Road and appeared to comprise derelict wholesale nursery land use located centrally within the lot and open spaces consisting of grass paddocks with scattered trees in areas adjacent to the northern and southern boundaries. It was estimated that approximately 3.0 – 4.0 ha of the total lot area utilised for nursery land uses.

The former nursery land uses consisted of several derelict and partially demolished buildings, levelled cleared land and several dams. Buildings at the site consisted of brick veneer cottage, corrugated iron storage sheds and a glass house. Areas around the buildings were generally gravel surface with smaller areas of bitumen spray seal and concrete pavements. The areas marked as “cleared” on Drawing 1B appeared to be the former growing beds and were generally surfaced with gravels and geofabric (Photo 1). The greenhouses observed in the 2001 aerial photograph had been removed. Surface levels of the former growing beds had been modified to create level working areas. Visual inspection indicated that the level working platforms are likely to be the result of on-site cutting and filling.



Photo 1

Three dams appeared to be associated with former nursery land use were located on the southern side of the former nursery and were likely to have been used for irrigation purposes. A small dam was also located towards the north eastern corner of the site, although this did not appear to be linked to the former nursery land use.

Various materials were dumped around the formerly operational areas of the site. The materials included nursery items (plastics, metal, and paper work), a small number of paint tins (Photo 2), miscellaneous items and building products. Fibrous cement sheeting was observed to have been dumped at one location and was used in the construction of the brick veneer building. No evidence of fuel storage tanks were observed during the site walkover, and no records were evident from the Workcover search.

Inspection of the main dam observed car parts placed below the water line (Photo 3) which may have resulted in water contamination from heavy metals, petroleum hydrocarbons and asbestos.



Photo 2



Photo 3

Lot 1 DP 376264, Lot 54 DP 7527 & Lot 55 DP 7527

These lots were observed to be generally densely vegetated, except for the former quarried areas located in the southern half of Lots 1 and 54. Vegetation in the former quarry area consisted of long grasses and small to medium sized trees. Visual inspection indicated that some regrowth of the surrounding bushland had occurred in areas surrounding the former quarry. No buildings or evidence of former structures were observed within the lots.

Inspection of this portion of the site was generally via cleared trails. This portion of the site was accessed along trails from Hakone Road, Lot 521 or from Lot 51. The former council access road within Lots 1 DP 371647 and Lot 1 DP 375712 had been blocked off and appeared overgrown where the trail historically entered Lot 1 DP 371647.

As noted in Ref 7 various materials had been dumped along the side of the access trails and extended up to approximately 30 m into the surrounding bushland in some locations. The materials observed were generally considered to be consistent with those recorded in Ref 7 and included excavated soils, concrete, road construction materials, general garbage, engine parts and demolition waste including bricks, tiles, fibrous cement sheets/pipes (Photo 4)



Photo 4

Further dumping was observed where the access track entered the cleared area (Photo 5), skirting the southern side of the cleared area and then to the south east of the cleared area where the access track existed into Lot 51.



Photo 5

Maximum dimensions of the cleared area were approximately 250 m by 100 m and as noted in Ref 7 surface levels in the former quarry/landfill area were considered to be significantly modified from natural surface levels, Ref 7 indicated that depth of filling may have been up to 7 m base on the surrounding surface levels. Ref 7 noted unvegetated surface soils/filling in the south eastern section of the cleared area contained waste materials including bricks, concrete and fibrous cement sheeting and piping. Photo 6 was taken from the south eastern corner of the cleared area facing north west.



Photo 6

Lot 1 DP 700096

Lot 1 was accessed from Sparks Road, with site surface levels approximately 2 – 6 m below that of Sparks Road. The lot is generally grass covered with some scattered trees. A dam was located towards the north western corner of the site and an intermittent watercourse/open channel cuts through the centre of the site, appearing to flow in a south west direction. Two minor earth berms had been constructed between the dam and the intermittent watercourse.

The buildings noted in Ref 7 and formerly located towards the south western corner of the site had been demolished and removed. Removal must have occurred some time prior to the inspection, based on the degree of regrowth of the grass surface cover. Some surface filling and/or inclusions in the surface soils were noted in this area of the lot and included at one location fibrous cement fragments.

Ref 3 noted that various building and demolition materials were stored amongst the sheds, including fibrous cement sheeting and unbanded oil drums. Furthermore, it was also noted that one of the building was clad in fibrous cement sheeting.

Building and waste materials were observed to have been dumped in areas scattered between the south western corner of the site and the open drain. Specifically, building materials were observed to have been placed in what appeared to be a small pond/dam (Photo 7) and also in the open drain in at least two locations.



Photo 7

A rusted leaking oil drum was also observed on the boundary of the unformed Nikko Road (Photo 8) and a small volume of soil had been recently dumped in the south western corner of the site.



Photo 8

Lot 2 DP 7738

Entry to Lot 2 was via the old Sparks (Wallarah) Road alignment. Site topography generally slopes up to the north east. The lot consisted of bitumen spray sealed carpark, a brick veneer building (Photo 9) operated as a medical centre and a small weatherboard cottage, all located within approximately 60 m of the southern boundary. The southern third and a central strip extending to the north are generally cleared of vegetation, with the remainder of the generally comprising of medium to dense bushland.



Photo 9

Both the medical centre and cottage appear to be connected to an on-site effluent disposal system with two concrete in ground tanks located to the north west of the main building. Both buildings on-site are constructed on level building platforms. Visual inspection indicated that the level building platforms are likely to be the result of on-site cutting and filling, although some material may have been imported for the platform supporting the brick veneer building.

Lot 3 DP 7738

Entry to Lot 2 was via the old Sparks (Wallarrah) Road alignment. Topography generally slopes up to the north east. As noted in Ref 7 the lot was largely cleared, apart from scattered trees throughout the lot. A small area of bushland remained along the northern boundary of the lot. A dam is located towards the centre of the lot, with a smaller dam located further to the north. Ref 7 noted building and other waste materials had been placed into the edge of the smaller dam, although these were not observed during the recent inspection.

Buildings on-site consisted of two separate dwellings and a large shed. The access driveway and trafficable area on-site was surfaced with coal wash waste (coal chitter). The small fibrous cement clad dwelling, the larger brick veneer residence and the large metal shed were all constructed on level platforms. Whilst some evidence of cutting and filling activities were identified there is the potential for imported material to have been used in the building platform. Two other smaller metal sheds were observed in the northern half of the lot.

Visual inspection identified various mechanical parts, oil drums, batteries and other miscellaneous items placed on the ground surface in the area directly to the west of the large metal shed (Photo 10). Ref 7 noted various pieces of machinery and construction materials including fibrous cement sheeting and piping in this area.



Photo 10

None of the existing site tenants were available to interview at the time of the site walkover. Notwithstanding this, Ref 7 interviewed Mr Graeme Smith (occupant of the site for approximately 25 years). He indicated that both of the dwellings on-site were constructed approximately 20 years ago and the metal shed constructed more recently. He indicated that the smaller residence (cottage) was constructed from on-site cutting and filling activities, whereas the larger dwelling and shed were constructed with a combination of site soils and soils imported during the construction of the Sparks Road upgrade.

Lot 4 DP 7738

Entry to Lot 3 was via the old Sparks (Wallarah) Road alignment. Site topography generally slopes up to the north. As noted in Ref 7, the site appears largely undeveloped, with dense vegetation covering the majority of the site. A small cleared area adjacent to the southern boundary leads to a derelict timber cottage (Photo 11). Ref 7 noted a burnt out car was located in the south of the site, although inspection only encountered several car body panels. Evidence of a recent test pit excavation was noted adjacent to the derelict cottage and was considered to be associated with Ref 9.



Photo 11

Lot 51 DP 561032

Entry to Lot 51 was via the old Sparks (Wallarrah) Road alignment. Site topography generally slopes up to the north and north west. The southern half of the lot was generally cleared with some scattered trees where the northern half was generally more densely vegetated with some trails accessing the area. An access road located adjacent to the western boundary lead to the former quarry/landfill area in Lot 54. A dam was located approximately mid-way along the western boundary and inspection of the dam wall indicated that imported filling may have been used in its construction (Photo 12). No evidence of the dam observed in the 1954 aerial photograph was encountered during the site walkover.



Photo 12

Visual inspection indicated that all buildings formerly located within the lot had been previously demolished and removed from site. The surface soils/filling in the vicinity of the former building footprints were disturbed with minor quantities of building/demolition materials at the soil surface. The materials observed included bricks, plastic, imported gravels, concrete fragments and fibrous cement fragments (Photo 13).



Photo 13

Towards the northern boundary of the site some illegal dumping was observed adjacent to the access trails. The materials observed were consistent with that observed in Lot 1 DP 376264, Lot 54 DP 7527 and Lot 55 DP 7527.

Lot 52 DP 561032

Entry to Lot 52 was via the old Sparks (Wallarah) Road alignment. Site topography generally slopes up to the north and north west. The southern half of the lot was generally cleared with some scattered trees and the northern half was generally more densely vegetated with some cleared trails accessing the area.

Visual inspection indicated that all buildings formerly located within the lot had been previously demolished and removed from site. The surface soils in the vicinity of the former buildings contained some minor inclusions including concrete fragments and gravels. Two small concrete building pads were observed approximately midway along the eastern boundary. Isolated areas of illegal dumping were observed to be concentrated in the northern half of the lot (Photo 14). Materials dumped included soils, paint/chemical tins, municipal waste and fibrous cement fragments.



Photo 14

Lot 1 DP 371647 & Lot 1 DP375712

Both lots form a narrow strip of land previously providing access from the old Sparks (Wallarrah) Road alignment to the former council quarry/landfill area. The northern end was blocked off and the access trail was observed to be partially surfaced with bitumen spray seal, gravels and unsealed in some areas.

Some isolated areas of illegal dumping were observed adjacent to the western boundary and these are described in the Lot 52 description.

6 CONTAMINANTS OF CONCERN

6.1 Potential Contamination Sources

Based on the findings of the desktop review and detailed site walkover, the principal sources of potential contamination within the site are presented in Table 14 below:

Table 14 – Potential Contamination Sources

Lot	Potential Contamination Source/Activity	Potential For Contamination	Primary Potential Contaminates of Concern
Lot 521 DP 594725	Nursery Activities	Moderate to High (Soil)	Heavy Metals, OCP, OPP & Cyanide
	Quarrying Activities	Low (Soil & Groundwater)	Heavy Metals, TPH, BTEX, PAH & Phenols
	Illegal Dumping	Moderate (Soil)	Heavy Metals, OCP, TPH, BTEX, PAH, Phenols, PCB, Cyanide Asbestos & Sulphate
	Importation of Filling	Low (Soil)	Heavy Metals, OCP, TPH, BTEX, PAH, PCB & Asbestos
Lot 1 DP 376264 & Lot 54 DP 7527	Quarrying Activities	Low (Soil & Groundwater)	Heavy Metals, TPH, BTEX, PAH & Phenols
	Landfilling	Moderate to High (Soil, Groundwater and Soil Vapour)	Heavy Metals, TPH, VOC, SVOC, Asbestos & Landfill Gases
	Illegal Dumping	Moderate to High (Soil)	Heavy Metals, OCP, TPH, BTEX, PAH, Phenols, PCB, Cyanide Asbestos & Sulphate
Lot 55 DP 7527	Quarrying Activities	Low (Soil & Groundwater)	Heavy Metals, TPH, BTEX, PAH & Phenols
	Illegal Dumping	Moderate (Soil)	Heavy Metals, OCP, TPH, BTEX, PAH, Phenols, PCB, Cyanide Asbestos & Sulphate
Lot 1 DP 700096	Surface Filling or Inclusion in Surface Soil (Former Building Footprints)	Low to Moderate (Soil)	Heavy Metals, OCP, TPH, BTEX, PAH, PCB & Asbestos
	Illegal Dumping	Moderate (Soil)	Heavy Metals, OCP, TPH, BTEX, PAH, Phenols, PCB, Cyanide Asbestos & Sulphate
Lot 2 DP 7738	Importation of Filling (Building Footprints)	Low (Soil)	Heavy Metals, OCP, TPH, BTEX, PAH, PCB & Asbestos
Lot 3 DP 7738	Importation of Filling (Building Footprints & Access Roads)	Low (Soil)	Heavy Metals, OCP, TPH, BTEX, PAH, PCB & Asbestos
	Storage of Mechanical Equipment & Products adjacent to Shed	Low (Soil)	Heavy Metals, TPH, BTEX, PAH & Phenols
Lot 51 DP 561032	Surface Filling or Inclusion in Surface Soil (Former Building Footprints & Dam)	Low to Moderate (Soil)	Heavy Metals, OCP, TPH, BTEX, PAH, PCB & Asbestos
	Illegal Dumping	Moderate (Soil)	Heavy Metals, OCP, TPH, BTEX, PAH, Phenols, PCB, Cyanide Asbestos & Sulphate
	Small Scale Greenhouses	Low (Soil)	Heavy Metals, OCP, OPP & Cyanide
Lot 52 DP 561032	Surface Filling or Inclusion in Surface Soil (Former Building Footprints)	Low (Soil)	Heavy Metals, OCP, TPH, BTEX, PAH, PCB & Asbestos
	Illegal Dumping	Moderate (Soil)	Heavy Metals, OCP, TPH, BTEX, PAH, Phenols, PCB, Cyanide Asbestos & Sulphate
Lot 1 DP 375712 & Lot 1 DP 371647	Importation of Filling (Access Roads)	Low (Soil)	Heavy Metals, OCP, TPH, BTEX, PAH, PCB & Asbestos

Notes:

The potential for contamination is based Stage 1 scope of work.

Heavy Metals = Arsenic, Cadmium, Chromium, Copper, Lead, Mercury, Nickel & Zinc

TPH = Total Petroleum Hydrocarbons, BTEX = Benzene, Toluene, Ethyl Benzene & Xylene

PAH = Polyaromatic Hydrocarbons, PCB = Polychlorinated Biphenyls

OCP = Organochlorine Pesticides, OPP = Organophosphorus Pesticides

VOC = Volatile Organic Compounds & SVOC = Semi Volatile Organic Compounds

The potential for off site sources of contamination were generally considered not to be significant based on the following factors:

- Surrounding land uses generally semi-rural residential with the exception of the Main Northern Railway and Mackillop Catholic College.
- Historical land uses adjacent to the site were not identified as potentially contaminating.
- The topography at the site generally slopes down towards all boundaries and such surface migration of contamination from off site locations is unlikely.

The non-intrusive walkover assessment identified various potential sources of asbestos contamination to the surface soils, filling or waste disposal areas on-site. This walkover assessment undertaken does not constitute a hazardous building materials assessment. Further, a hazardous building materials assessment is recommended prior to undertaking demolition of the remaining buildings at the site.

Based on the work undertaken to date, the highest risk for potential for contamination at the site, would generally be to surface soils, filling and sediments. Notwithstanding this, the former landfilling activities indicate that there is the potential for impacts to the underlying groundwater regime and also indicates the potential for landfill gases to impact any proposed future development.

6.2 Fate of Contaminants

Based on the works undertaken, it is possible to provide comment on the potential fate of any contaminant releases to the environment. The potential fate of contamination depends on a number of factors including: type of contamination applied (physical state & solubility), location applied (surface or at depth) and site factors (soil permeability, topography & groundwater regime).

With the exception of the landfilling activities, potentially contaminating activities such as application of chemicals, illegal solid waste disposal and importation of filling would generally not be expected to move away from the area of release, unless they are relatively soluble. Notwithstanding this, migration of potential contaminants applied to the land surface may occur and as such assessment of nearby down-gradient drainage lines or surface water bodies would be prudent.

Depending on the composition of the landfilled waste materials placed in the former quarried area, there is the potential for contamination to migrate via the groundwater regime into adjacent areas.

The licenced groundwater bore search identified that groundwater was being used for domestic purposes approximately 400 m from the site boundary. Furthermore, based on the landfill topography there is the potential for some migration of seepage through the landfill, with effluent exiting to the surface water regime (intermittent drainage line to the north east of landfilled area).

7 ASSESSMENT CRITERIA

The results of future intrusive investigations and analytical testing should be compared to appropriate site assessment criteria selected from the following guidelines.

- NSW EPA (1998). Contaminated Sites - Guidelines for the Site Auditor Scheme (Ref 10);
- NSW EPA (1994). Contaminated Sites - Guidelines for Assessing Service Station Sites, (Ref 11);
- NSW EPA (1999). Environmental Guidelines: Assessment, Classification & Management of Liquid and Non-Liquid Wastes (Ref 12);
- ANZECC (2000) Fresh and Marine Water Quality Guidelines (Ref 13).
- NSW EPA (1996) Environmental Guidelines: Solid Waste Landfills (Ref 14)
- NSW DEC (2005) Contaminated Sites - Guidelines for Assessing Former Orchards and Market Gardens (Ref 15)

The *NSW EPA Guidelines for the NSW Site Auditor Scheme* contain National Environmental Health Forum (NEHF) levels for various beneficial use scenarios including: low density residential (A), high density residential (D), recreational (E) and commercial/industrial (F). These criteria are applicable where aesthetic and ecological concerns are not an issue. Where the subject site is to be developed for residential land use (sensitive) the aesthetic issues such as soils odours, appearance (anthropogenic inclusions) would also need to be considered.

The *NSW EPA Guidelines for Assessing Service Station Sites* should be used to assess Petroleum Hydrocarbons (Total Petroleum Hydrocarbons (TPH), Benzene, Toluene, Ethyl Benzene & Xylenes (BTEX)) contamination across the site. The criteria adopted for TPH and BTEX would be those for a sensitive land use as no criteria for a commercial/industrial land use are currently endorsed by NSW DEC.

The *NSW EPA Environmental Guidelines for the Assessment, Classification & Management of Liquid & Non-Liquid Wastes* should be used to assess soil conditions for possible off-site disposal options.

The *ANZECC (2000) Guidelines for Fresh and Marine Water Quality* should be used to assess surface and groundwater quality. The protection of aquatic ecosystem guidelines is considered to be relevant due to the proximity of the site to Tuggerah Lakes. The receiving waters are considered to be a slightly to moderately disturbed ecosystem within a freshwater (Wallarah Creek) or marine (Tuggerah Lakes) ecosystem. Further with a domestic groundwater user approximately 400 m from the site drinking water criteria are also applicable.

The *Environmental Guidelines: Solid Waste Landfills*, NSW EPA (1996) should form basis for assessing soil vapour concentrations in the vicinity of the identified former council landfill. The guideline indicates that landfills primarily produce methane and carbon dioxide. Other exposure standards for atmospheric contaminants in the occupational environment would be referenced and it is expected that the primary atmospheric analytes requiring measurement would be methane, carbon dioxide and oxygen.

The *Guidelines for Assessing Former Orchards and Market Gardens* (2005) should form the basis for assessing areas on-site used for the nursery activities.

8 SUMMARY OF FINDINGS

Within the limitations and constraints imposed by the study of background information and information gathered during the site walkover the following summary of findings are provided:

- The investigation area comprises part of the larger Warnervale Town Centre area, bounded by Mackillop Catholic College and existing semi-rural properties to the east; Hakone Road to the north; Sparks Road to the south and the Main Northern Railway to the west (individual lots identified in Section 1.1). The total area of the site is approximately 47.2 ha. The site layout is presented as Drawings 1A and 1B.
- Previous environmental and geotechnical investigation (Ref 7) undertaken within a portion of the current site area was undertaken in 2002 and 2003. The assessment included a site historical review, site walkover and a limited number of intrusive investigations. The area assessed included the council owned former quarry/landfill area. A summary of the conclusions made by the consultant stated that the site did not represent a significant risk of harm to human health or the environment and that the site was considered suitable for continued use or redevelopment for residential and commercial use without remediation. The report outlined a number of limitations and qualifications with regard to these conclusions. The report indicated that the filling within the quarry/landfill area would be unsuitable for residential or commercial development from a geotechnical standpoint.
- An additional investigation was undertaken by DP in 2005 (Ref 8) to further assess the depth of filling within the former quarry/landfill area. Some limited environmental testing was undertaken to provide a preliminary assessment of the fill materials for either on-site re-use or off site disposal. Whilst the previous investigation (Ref 7) suggested that the site development may be permissible from a contamination perspective without any further remediation, this investigation provided contradictory evidence. The report noted the limited scope of work undertaken and that this investigation was preliminary in nature, and as such at a minimum further investigation and testing was recommended.
- Desktop historical review identified the following potentially contaminating activities:
 - Aerial photographs (1954 and 1966) indicated that areas within of Lot 521 DP 594725, Lot 1 DP 376264, Lot 54 DP 7527 and Lot 55 DP 7527 were impacted by the former quarrying activities (clearance of vegetation and surface disturbance). This observation was consistent with findings of Ref 8 which encountered filling in test pits approximately 75 to 100 m north of former landfill area identified (Drawing 1B).

- Landfilling activities were likely to be restricted to Lot 1 DP 376264 and Lot 54 DP 7527, based on the disturbed area indicated in the 1973 and subsequent aerial photographs. Anecdotal information provided by WSC indicated that the site was operated by Council's Roadworks Section and materials placed were likely to comprise mainly road construction wastes, although the site was unsecured. Ref 8 encountered conditions typical of municipal waste (bottles, metal shelving, timber, pots, chicken wire, plastic bags, carpet, concrete and fibrous cement sheeting) within the former landfill area.
- Historical title search results indicated that Lot 521 had a nursery land use from around 1987 to 2002. This is consistent with the aerial photographs showing nursery activities expanding from 1991 to 2001.
- The 2001 aerial photograph indicated that possibly three small greenhouses may have been located within Lot 51 DP 561032 in the area between dam and fibre glass shed noted on the Drawing 1. Further, a dam identified in the 1954 aerial photograph was reinstated prior to 1966. No evidence of this former land use was observed during the site inspection other than disturbance of the surface soils.
- The site walkover inspection identified the following additional potential contamination issues:
 - Lot 521 DP 594725 – Derelict nursery activities, filled platforms (likely cut/fill) and illegal dumping.
 - Lot 1 DP 376264 & Lot 54 DP 7527 – Evidence of large scale landfilling and illegal dumping.
 - Lot 55 DP 7527 – Illegal dumping concentrated in areas adjacent to the access track from Hakone Road and towards the northern boundary.
 - Lot 1 DP 700096 – Surface filling and/or anthropogenic inclusions in surface soil in the vicinity of the former building footprints. Illegal dumping of materials mainly within the drainage alignment and adjacent surface depressions.
 - Lot 2 DP 7738 – Filling beneath the existing buildings (likely cut/fill).
 - Lot 3 DP 7738 – Filling beneath the existing buildings and on-site access roads, and storage of mechanical equipment and products adjacent to shed.
 - Lot 51 DP 561032 – Surface filling and/or anthropogenic inclusions in surface soils in the vicinity of the former building footprints. Illegal dumping of materials mainly concentrated towards the northern boundary of the property.

- Lot 52 DP 561032 – Surface filling and/or anthropogenic inclusions in surface soil in the vicinity of the former building footprints. Illegal dumping of materials mainly concentrated towards the northern and eastern lot boundaries.
- Lot 1 DP 375712 & Lot 1 DP 371647 – Surface filling within the access road alignment.
- The potential contamination sources/activities were considered to generally only have the potential to impact soils (surface soils, filling or sediments). The main exception to this, would be the former landfilling activities and to a lesser degree the former quarrying activities. The former landfilling has the potential to impact soil, groundwater and soil vapours at the site. Whereas, quarrying activities are considered to have the potential to impact both soil and groundwater.
- Potential contaminants of concern specific to each activity/land use are outlined in Section 6, although would generally include Heavy Metals, OCP, TPH, BTEX, PAH, phenols, PCB and Asbestos, with OPP associated with the former nursery land use and landfill gases (Methane) in the former landfilled area.
- The potential contamination source/activity assessed to have the greatest potential for affecting suitability of the site for the proposed future land use is the former landfill.

9 CONCLUSIONS AND RECOMMENDATIONS FOR FURTHER WORK

Douglas Partners Pty Ltd (DP) conducted a Stage 1 ESA at the Proposed Warnervale Town Centre Site. It is understood that redevelopment is in the planning stages and a mixed commercial and residential land use is proposed. Based on the information gathered, DP recommends that Stage 2 ESA is undertaken to further assess the site's suitability for the proposed mixed residential/commercial land use. The Areas of Environmental Concern (AEC) are highlighted in Drawings 2A and 2B.

A strategy for assessing the areas of environmental concern should be detailed in a Sampling and Analysis Plan prepared as a preliminary component of the Stage 2 ESA scope of work. Notwithstanding this, it is expected that a combined systematic and judgemental sampling strategy would be used to assess contamination status of the site initially with the main AEC being subject to the minimum sampling density recommended.

The potential contaminants of concern are outlined in Table 14 (Section 6) and the recommended systematic sampling scope is outlined in Table 15 below:

Table 15 – Recommended Stage 2 Systematic Sampling Scope of Work

Lot	Potential Contamination Source/Activity	Estimated Area Impacted (ha)	Minimum Number of Sampling Locations Required for Characterisation (Ref 15)	Suggested Minimum Number of Sampling Locations for Stage 2 ESA
Lot 521 DP 594725	Nursery Activities/Filling	3.4	44	44
Lot 1 DP 376264 & Lot 54 DP 7527	Landfilling	3.7	47	47
Lot 521 DP 594725, Lot 1 DP 376264, Lot 54 DP 7527 and Lot 55 DP 7527	Quarrying Activities	Total = 17.7 Less Other Assessment Areas = 10.7	118	54 (5 Locations per Hectare)
Lot 1 DP 700096	Surface Filling or Inclusion in Surface Soil	0.95	21	21
Lot 3 DP 7738	Storage of Mechanical Equipment & Products adjacent to Shed	0.1	6	6
Lot 51 DP 561032	Surface Filling or Inclusion in Surface Soil, Reinstated Dam & Possible Greenhouses	0.75	18	18
Lot 52 DP 561032	Surface Filling or Inclusion in Surface Soil (Former Building Footprints)	0.18	7	7

Notes:

1. NSW EPA Contaminated Sites: Sampling Design Guidelines (1995) (Ref 15) Table A – Minimum Sampling Points Required for Site Characterisation Based on Detecting Circular Hot Spots by Using a Systematic Sampling Pattern
2. If contamination is encountered or subsurface conditions are considered to be significantly variable then additional sampling locations would be recommended

In addition to the scope of work proposed in Table 15, is it recommended that some broad space systematic assessment is undertaken on the remaining site areas (approximately 27.3 ha). It is noted that Ref 15 requires a minimum of approximately 300 sampling points for site characterisation. Notwithstanding this, it is recommended that initially approximately 100 locations be investigated. This assessment would include a combination of visual observation and limited composite sampling (for a limited suite of analytes). If contamination is encountered or subsurface conditions are considered to be significantly variable then additional sampling locations would be recommended.

The following further judgemental sampling scope is recommended in addition to the systematic sampling scope of work outlined above:

- Sediments and surface waters within drainage alignments and dam.

- Existing building footprints where the natural topography has been modified for the construction of buildings.
- Supplementary Stage 2 ESA targeting areas where illegal dumping had occurred. This assessment would include the identification and demarcation of areas affected, classification of wastes and validation of the area following appropriate disposal/re-use of the materials.
- Assessment of access roads/tracks affected by surface filling or disturbance.

The recommended Stage 2 ESA scope of work outlined above, would be further developed/modified at the Sampling and Analysis Plan preparation stage with review/input from the appointed site auditor.

Due primarily to the number of issues identified within the proposed Warnervale Town Centre area, sub-division of the site into a number of assessment areas may allow future assessment to be undertaken in a more timely and cost-effective manner.

10 LIMITATIONS OF THIS REPORT

DP have performed investigation and consulting services for this project in accordance with current professional and industry standards for Stage 1 Environmental Site Assessments. The scope of the work was detailed in DP's proposal (Ref 1813) dated 16 December 2005 and accepted by Wyong Shire Council in a written communication dated 18 January 2005.

DP's assessment is necessarily based on the result of a desktop site historical search and site inspection only and did not include surface or subsurface sample screening and/or chemical testing. DP does not assume any liability for site conditions not observed or accessible during the time of the inspection. It is noted that this assessment does not constitute a hazardous material building assessment.

Given the site's historical land use there is the potential for isolated areas of filling to be identified prior to and during development of the site. These areas may need to be excavated and the waste materials generated disposed of. If areas of filling are identified during redevelopment of the site then advice should be sought from an appropriately qualified environmental consultant.

This report and associated documentation and the information herein have been prepared solely for the use of Wyong Shire Council and any reliance assumed by third parties on this report shall be at such parties own risk. Any ensuing liability resulting from use of the report by third parties cannot be transferred to DP.

DOUGLAS PARTNERS PTY LTD

Reviewed by

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References:

1. Australian Standard: *Guide to the Sampling and Investigation of Potentially Contaminated Soil, Part 1: Non-Volatile and Semi-Volatile Compounds* (AS 4482.1).
2. Managing Land Contamination, *Planning Guidelines SEPP 55 – Remediation of Land*, 1998.
3. NSW EPA, *Contaminated Sites: Guidelines for Consultants Reporting on Contaminated Sites*, November 1997.
4. *Dooralong 1:25 000 Topographic Map*, 9131-I-S First Edition, 1986.
5. Department of Conservation and Land Management, *Soil Landscapes of the Gosford – Lake Macquarie*, 1993.
6. *Dooralong Acid Sulphate Soil Risk Map*, prepared by the Soil Conservation Service of NSW, Edition 1, June 1995.
7. Property at Warnervale, Report on Stage 2 of Environmental and Geotechnical Investigations (GHD, July 2003)
8. *Report on Additional Investigation, Proposed Development Hakone Road, Warnervale* (DP, September 2005); and
9. *Preliminary Geotechnical Investigation, Warnervale Town Centre* (RCA Australia, November 2005).
10. NSW EPA, *Contaminated Sites: Guidelines for the Site Auditor Scheme*, June 1998.
11. NSW EPA, *Contaminated Sites: Guidelines for Assessing Service Station Sites*, December 1994.
12. NSW EPA, *Environmental Guidelines: Assessment, Classification & Management of Liquid & Non-liquid Wastes*, May 1999.

13. Australian and New Zealand Environment and Conservation Council (ANZECC) *Australian Guidelines for Water Quality Monitoring and Reporting*, 2000.
14. NSW EPA, *Environmental Guidelines: Solid Waste Landfills*, January 1996.
15. NSW EPA, *Contaminated Sites: Sampling Design Guidelines*, September 1995.

APPENDIX A
NOTES RELATING TO THIS REPORT
& DRAWINGS

APPENDIX B
REGISTERED GROUNDWATER BORE SEARCH

APPENDIX C
HISTORICAL TITLE SEARCH

APPENDIX D
SECTION 149(2) CERTIFICATES
& COUNCIL SUPPLIED INFORMATION

APPENDIX E

WORKCOVER DANGEROUS GOODS LICENCES
