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City of Casey

Casey Central

Phase 1 Environmental Site Assessment

Report

May 2006

INFRASTRUCTURE | MINING & INDUSTRY | DEFENCE | PROPERTY & BUILDINGS | ENVIRONMENT

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Executive Summary

GHD Pty Ltd was commissioned by Casey City Council to conduct a Phase 1 Environmental Site Assessment of development area known as Casey Central. The objective of the Phase 1 assessment was to provide an indication of the environmental conditions expected to be encountered at the site and to determine a strategy for future detailed Environmental Site Investigation works. This report was initially issued as a draft report in 15 July 2004.

The Casey Central site (**Figure 1**) is bound by Narre Warren – Glasscocks and Pound Roads to the north, Berwick Cranbourne Road to the east, Thompson Road to the south and Narre Warren Cranbourne Road to the west. The site is generally rectangular in shape and occupies an area of 500 hectares.

The Tertiary aged Baxter Sandstone of ferruginous sandstone, sand, sandy clay and minor gravels is the dominant surface geology across the site. Minor occurrences of overlying Quaternary sediments and outcrops of underlying Silurian bedrock are also present at the Site.

A desktop review of groundwater indicated that the Baxter Sandstone is the watertable aquifer and primary aquifer at the site. Groundwater was documented to be approximately 7 m below ground level and of varying water quality.

The site history was reviewed in order to identify the potential for contaminated soil or groundwater. The review indicated that the site has been progressively converted from grazing land to market gardens. Quarrying in the south central part of the site began in the early 1960s and this land is subsequently used for two concrete batching plants.

GHD conducted a site inspection on 6 May 2004. A number of potential sources of environmental impact were identified during the site inspection. These were typically associated with various aspects of market garden usage and storage of chemicals and machinery on farm sites.

Detailed investigation, including soil and groundwater sampling would be required for the site to be redeveloped. GHD proposes a strategy whereby individual areas of the site are investigated separately based on the program of development, proposed land use and the need for an environmental audit.

A staged approach for soil and groundwater investigations has been proposed. Soil investigations would involve soil sampling in the vicinity of identified potential sources of impact and a broad sampling pattern across areas not identified as potential sources of impact. Additional sampling would be conducted for delineation of any identified contamination. Proposed initial groundwater investigations would involve characterising the groundwater flow conditions and chemical characteristics beneath the entire site, followed by characterisation beneath individual areas of the site prior to redevelopment. This second stage of investigation would focus on the potential sources of impact identified in this report and any areas of identified soil impact within the investigation area.

1. Introduction

1.1 Background

The City of Casey has initiated a development plan, "Casey Central Development Plan, Overall Study Brief & Work Program 24 February 2004" for a 500 hectare area of land in Narre Warren South for proposed redevelopment for residential and commercial precinct in line with the Melbourne 2030 development plan. The study area was identified in the South Eastern Growth Area Plan and the Municipal Strategic Statement of Casey Planning Scheme as provided by City of Casey.

The development area is to be known as Casey Central and is to comprise a large mixed-use town centre, with a variety of residential allotments (i.e. high density, medium and low density dwellings) with 6,000 to 7,000 lots. A detailed Development Plan has been prepared by the City of Casey to identify the specific outcomes of the project that are required to achieve the objectives of the development.

GHD Pty Ltd (GHD) was engaged by the City of Casey to conduct a Phase 1 Environmental Site Assessment (ESA) of the study area to provide baseline environmental data to assist the City of Casey to identify potential areas of environmental concern that may give rise to contamination of soil or groundwater. It was recognised that with such a large study area and numerous land owners, undertaking a detailed baseline study at the outset was required to better define the degree of input and advice required to complete a full environmental study including intrusive investigations which will likely be required prior to redevelopment of the Site.

1.2 Objectives

The objective of this investigation was to provide baseline environmental information relating to the potential for contamination of both soil and groundwater, which is necessary to develop a site-specific environmental assessment and audit strategy targeted towards a cost effective and efficient process.

1.3 Scope of Work

The Phase 1 Environmental Assessment was carried out in accordance with Australian Standard: *Guide to the sampling and investigation of potentially contaminated soil*, AS 4482.1-2005, and the NEPC 1999, *National Environment Protection (Assessment of Site Contamination) Measure* (NEPM), and comprised the following scope of works:

- Review of available site history information including historic titles and historic aerial photographs to identify possible sources of soil and groundwater contamination;
- Review of information from EPA;
- Desktop review of the regional geology and hydrogeology to assess likely physical characteristics of the soil and groundwater;
- Site inspection to verify desktop review of the site and identify site based activities that may require further investigation;

- Based on information available, attempt to identify of areas of potential environmental impact; and
- Development of a recommended site-specific assessment strategy for further investigations.

This report documents the history of the site, the results of the site inspection and presents a proposed strategy for further investigation of the site to assist with the proposed redevelopment of the land.

2. Site Characterisation

2.1 Site Location and Description

The Site is bound by Narre Warren – Glasscocks and Pound Roads to the north, Berwick Cranbourne Road to the east, Thompson Road to the south and Narre Warren Cranbourne Road to the west (the Site). A site location plan is provided on **Figure 1**.

The Site is generally rectangular in shape and occupies an area of approximately 500 ha. The area comprises grazing land, agricultural land, market gardens, commercial uses, a gun club, and natural vegetation areas; each owned and or managed by a number of different stakeholders. The Site comprises eleven parcels of land that are made up of various land titles, which have been modified and sub-divided over the past century.

2.2 Surrounding Land-use and Zoning

The majority of the land was zoned Rural (RUZ6). An area in the southeast was zoned Urban Flood Way (UFZ). The Casey Central Shopping Centre is zoned business (B1Z) and local government (PUZ6).

At the time of the site inspection the following land uses surrounded the Site:

- Residential to the west;
- Farming land use to the north east;
- Rural to the east and south east;
- Quarrying, concrete batching and an abattoir to the south west;
- A service station was present to the south west of the site followed by residential properties; and
- Rural to the northwest.

2.3 Hydrology

An unnamed drainage system runs across the site from the central west of Thomson Road to the east of the site at Berwick Cranbourne Road. At the time of the site visit no water was flowing in this drainage system.

2.4 Regional Geology

The Geological Survey of Victoria Cranbourne map sheet (1:63 360 scale) indicates the majority of the Site is located on the Tertiary aged Baxter Sandstone Formation. This geology is characterised by ferruginous sandstone, sand, sandy clay and occasional gravel (Douglas and Ferguson, 1976).

The map sheet shows the Baxter Sandstone in the south of the site to be overlain by Quaternary aged siliceous sand dunes and sheets. In the central north of the site the Baxter Sandstone is indicated to be overlain by peaty clay and clay.

The map sheet also indicates that in the northeast corner of the site Silurian aged deposits outcrop, which are usually present as sandstone, siltstone, mudstone and shale.

Based on our review of the geological map, the geology of the site from surface to depth would generally be expected to consist of:

Topsoil
Sand
Sandy Clay
Mudstone

2.5 Hydrogeology

The Baxter Sandstone is likely to form the primary aquifer beneath the site. The Hydrogeological Map of Western Port Basin (1980) indicates that the Baxter Sandstone forms a sub regional unconfined to confined aquifer of unconsolidated sand and gravel, the formation can weather to form clay soils that may partially confine the groundwater. Beds of clay, lignite and cemented limestone impart a marked anisotropy in hydraulic conductivity. The aquifer is expected to have a hydraulic conductivity of 1 to 4 m/day.

In the area of the Site, regional groundwater flow is expected to be towards the southwest in the direction of Port Phillip Bay. Groundwater is expected to be encountered at approximately 7 m beneath the ground surface, this will vary depending on the local geology and topography.

2.6 Victorian Groundwater Database

A search of the Victorian groundwater database was carried out to locate registered wells in the vicinity of the site. A total of 62 well were located within a 1 km radius of the site, 11 of which were located on the Site. The locations and uses of the wells are shown in **Figure 2**.

A summary of well use is provided in **Table 1** below:

Table 1 Summary of Well Use

Well Use	Total Wells within 1km from site
Not Known	16
Irrigation	15
Domestic	16
Stock	5
Observation	1

Well Use	Total Wells within 1km from site
Domestic & Stock	1
Not Used – capped	1
Non Groundwater Wells	7

The earliest groundwater well was installed in 1959. Additional wells were installed progressively through the 1960's 1970's and 1980's with the most recent well installed in 1992 for the purpose of irrigation. Eight wells were installed by Department of Energy and Minerals in 1974, 7 of which were most likely for the purpose of sand investigation (as they are less than 4 m depth) and are, therefore not identified as groundwater wells.

The total depths of the wells varied from 9 m to 114 m. Most of the wells were screened in either basalt, mudstone, sand or sand stone, while information on the deepest well was not known. Information on the standing water level (SWL) of the wells was available for twenty-one of the wells and varied from 1.2 m to 18.3 m below ground level depending on the screened interval and lithology.

Information on total dissolved solids (TDS) was available for twenty-four of the wells, fifteen of which were in the range of 1,000 to 3,500 mg/L, three were in the range of 500 to 1,000 mg/L and six were in the range of 0 to 500 mg/L.

3. Regulatory Framework

Victorian environmental legislation focuses on the protection of existing and potential beneficial uses of the environment. Potential beneficial uses of land and groundwater at the site are detailed below.

3.1 Land Beneficial Uses

The State Environment Protection Policy (SEPP), *Prevention and Management of Contamination of Land (2002)*, provides a framework for determining the beneficial uses of the land need to be protected having regard for the existing and intended land uses. **Table 2** provides a summary of the categories of land use and the beneficial uses to be protected for each category.

Table 2 Protected Beneficial Uses of Land

Beneficial Use	Parks & reserves	Agricultural	Sensitive Use		Recreation/ Open Space	Commercial	Industrial
			High density	Other			
Maintenance of ecosystems							
- Natural	✓						
- Modified	✓	✓		✓	✓		
- Highly modified		✓	✓	✓	✓	✓	✓
Human health	✓	✓	✓	✓	✓	✓	✓
Buildings and structures	✓	✓	✓	✓	✓	✓	✓
Aesthetics	✓		✓	✓	✓	✓	
Production of food, flora and fibre	✓	✓		✓			

Current development plans indicate that parts of the site may be redeveloped for residential and recreation use. With reference to **Table 2**, the beneficial uses to be protected for residential and recreation use are:

- Maintenance of ecosystems (modified and highly modified);
- Human health;
- Buildings and structures;
- Aesthetics*; and
- Production of food, flora and fibre.

*The contaminated land SEPP states that the aesthetics beneficial use of land has not been maintained where there is a substance or chemical present that may be offensive to the senses.

3.2 Groundwater Beneficial Uses

The State Environmental Protection Policy (SEPP): *Groundwaters of Victoria*, 1997 provides a framework by which the potential uses of groundwater can be assessed. Under the groundwater SEPP the salinity of the water, measured by the concentration of total dissolved solids (TDS) in the water, determines what segment the groundwater is classified in and, hence what potential uses the groundwater has. Protected beneficial uses of groundwater are presented in **Table 3**.

Table 3 Protected Beneficial Uses of Groundwater

	Segments (mg/L TDS)				
Beneficial Use	**A1 (0-500)**	**A2 (501-1000)**	**B (1001-3500)**	**C (3501-13000)**	**D (greater than 13000)**
1. Maintenance of ecosystems	✓	✓	✓	✓	✓
2. Potable water supply:					
desirable	✓				
acceptable		✓			
3. Potable mineral water supply	✓	✓	✓		
4. Agriculture, parks and gardens	✓	✓	✓		
5. Stock watering	✓	✓	✓	✓	
6. Industrial water use	✓	✓	✓	✓	✓
7. Primary contact recreation	✓	✓	✓	✓	
8. Buildings and structures	✓	✓	✓	✓	✓

The Department of Natural Resources, *Victorian Groundwater Beneficial Use Map Series*, 1995, indicates that groundwater beneath the site is Segment A1 and B water. The Victorian Groundwater Bore Database had recorded TDS values within 1 km raidius from the site ranging from 147 mg/L to 3183 mg/L. Under the groundwater SEPP groundwater of this quality lies within Segment A1 to Segment C categories. Information contained in the Victorian Groundwater Database is presented in **Appendix A**.

During the site inspection land owners indicated that the salinity of groundwater beneath the site varies spatially but were unable to provide details on such variation. Without further clarification of this issue, groundwater beneath the site is assumed to be classified as Segment A1 water.

The Groundwaters of Victoria SEPP indicates that groundwater beneath the site may have the following beneficial uses, which are to be protected:

- Potable drinking water;
- Maintenance of ecosystems;
- Stock watering;
- Industrial water use;
- Primary contact recreation; and
- Buildings and structures.

The Victorian Groundwater Database indicates that two of these beneficial uses are occurring within the site boundary with seven wells registered as supplying domestic water and two wells registered as supplying water for irrigation.

4. Site History

The site history of the study area was reviewed in order to identify the potential for contaminated soil or groundwater to be present. Information on the site history was obtained from the following sources:

- Examination of historical aerial photographs;
- Review of historical Certificates of Title;
- A review of the EPA List of Issued Certificates and Statements of Environmental Audit;
- A search of the EPA Priority Sites Register; and
- Discussions with site land owners and managers.

The findings of the site history investigation are presented in the following sections.

4.1 Review of Aerial Photographs

A review of historical aerial photographs was conducted to develop a site history of the site and surrounding area. A summary of observations made during the viewing of historical aerial photographs (1960, 1963, 1970, 1974, 1980, 1988 and 1990), is included in **Table 4** below. Copies of selected historical aerial photographs are presented in **Appendix B**.

Table 4 Summary of Aerial Photograph Review

Photograph Information	Year	Observations
1:9 600 scale, taken from 8 200 ft.	1960	The land was being used for arable farming. Major roads only were present. No buildings were visible across the site. A small building on the opposite side of Berwick-Cranbourne Road was visible in approximately the current location of Willow Park Vet Clinic.
1:9 600 scale, taken from 5 100 ft	1963	The site was predominantly open space. Buildings were visible in northeast corner of the site in approximately the current location of “Tulliallau”. Buildings were also present in the southwest corner of the site. Quarrying was occurring at the centre of the southern boundary of the site. Rural land-use surrounded the site.
1:9 600 scale, taken from 5 100 ft.	1970	Market gardens were visible in the northeast corner and central north of the site, both areas had an associated dam. Further small buildings were dispersed across the site. The size of the quarry had expanded from 1963.
Aerial photographs, 1:10 000 scale, taken from 5 200 ft.	1974	In general the site was unchanged from 1970.

Photograph Information	Year	Observations
1:10 000 scale, taken from 5 400 ft.	1980	The area of land occupied by the quarry had increased from 1974. A shooting range was visible in approximately the current position of the RSL Gun Club. Evidence of earth movements on the land to the west of the quarry.
1:10 000 scale, taken from 5 400 ft	1988	The area of the site occupied by market gardens had increased. The firing range had expanded. A group of buildings in the north west of the site had been replaced with market gardens. Further buildings have been constructed at the site. Land to the north of the quarry had been divided into rectangular 'lots' (likely to be horse stables); small buildings were present in the corners of these 'lots'.
1:25 000 scale, taken from 12 700 ft	1990	The land was generally unchanged from 1988. Residential development had increased in the north and west of the site. The firing range was not visible.

4.2 Historic Land Title Review

An historical title search was undertaken to determine previous owners/uses of the land comprising the Site. For ease of site descriptions and assessment, each of the current land titles have been grouped together based on land ownership and usage (labelled A to M). The relevant Certificates of Title for each sub-region is provided in **Table 5** and sub-regions are depicted **Figure 3**.

Copies of the Historic Land Titles are provided in **Appendix C** including a list of titles and key information. The names and occupations of previous owners of the titles within the site boundaries provide an indication of possible land uses that may have been conducted.

Table 5 Summary of Certificates of Title

Site No.	Title	Current Land Owner/Occupier	Land Use
A	Volume 8881, Folio 255 Volume 9552, Folio 931	Graham Facey	Farm/Grazing
B	Volume 7395, Folio 993	D. Petzke	Grazing
C	Volume 7125, Folio 825	R. Males	Farm House
D	Volume 9552, Folio 930 Volume 7503, Folio 142 Volume 9946, Folio 245	Silvio Favero (Favero Gardens)	Market Gardens
E	Volume 8122, Folio 681	R.H Roden S.S. Hall and N.C Sharp	Farming/Grazing
F	Volume 9028, Folio 618	Dandy Concrete	Concrete Batching

Site No.	Title	Current Land Owner/Occupier	Land Use
	Volume 10013, Folio 794	Broadway and Frame	Plant. Sand & Gravel Store
G	Volume 9256, Folio 005	Collins	Farming/Grazing
	Volume 9256, Folio 006		Cranbourne RSL Gun Club
H	Volume 8693, Folio 470	Wagstaff	Farming, Effluent discharge
I	Volume 8693, Folio 465	Dore & Farmer	Farmhouse
	Volume 8693, Folio 466	Fernando	Vacant Land
	Volume 8693, Folio 467	Antonino	Vacant Land
	Volume 8693, Folio 468	Antonino	Farmhouse
J	Volume 9511, Folio F336	Cornell	Farmhouse
K	Volume 8490, Folio 501	Wagstaff	Farmhouse
L	Volume 8694, Folio 732 & 733	R.W Allen	Grazing
M	PC 364261	Casey Central Shopping Centre	Shopping Centre

4.3 EPA Verification

Reference was made to EPA lists and databases that are related to contaminated sites or other sites known to the EPA in order to determine the potential for contamination.

4.3.1 EPA List of Certificates and Statements of Environmental Audit

The Site is not listed in the EPA's 17 May 2004 list of properties for which a Certificate or Statement of Environmental Audit had been issued. This indicates that a Statutory Environmental Audit had not been completed for any portion of the land at the time as at the time of publication of the list.

4.3.2 EPA Priority Sites Register

A search of the EPA Priority Sites Register database showed that the site subject to the assessment was not listed on, and was not in the vicinity of a site listed on the Priority Sites Register.

A copy of the verification provided by Landata for the Priority Sites Register has been included in **Appendix D**.

4.4 Summary of Site History

Based on the site history review, the land has been generally used for grazing and agricultural use for most of the time. With the exception of Wagstaff, Dandy Concrete, Broadway Fame and the gun club, there is no evidence of ownership by potentially contaminating industries.

In the northwest of the Site, companies Favgazz Pty Ltd and Favgar Pty Ltd have owned the land since 1984. Since this time market gardens have been developed over this land. It is assumed that these companies are owned or linked to Favero Gardens who, more recently have established a vegetable packing facility at Hillcrest farm, in the centre of the Site between 2002 and 2004.

G.F. Allen, R.W. Allen and P.E. & G.R. White currently own land in the north east of the site. Market Gardens have been established on the land owned by G.F.Allen while the other areas appear to be used for grazing.

In 1959 an area of land at the centre of the southern boundary of the site was separated from its parent title and purchased by J.F.&S. Watson Pty Ltd. The historic aerial photographs indicate quarrying began at the site around this time. In 1971 the land was further divided and the smaller easterly portion were sold first to the Oakleigh Pistol Club followed by Peninsula Mixed Concrete Supply and then to Readimix Holdings Pty Ltd, who are the current owners of this portion of the Site.

Other areas of the Site appear to have been used for grazing, with some residential and storage buildings present.

5. Site Inspection and Review

5.1 Site Observations and Interviews

GHD conducted a site inspection on 6 May 2004. The site inspection was undertaken by an experienced environmental engineer. Due to the large investigation area, the review has been summarised for each of the sites listed in **Table 5** above. A summary of the observations made during the site inspection is provided below. Site photographs of some of the potential sources of contamination are included in **Appendix E**.

5.1.1 Site A: Titles V8881-F255 and V9552-F931 (Facey)

This property was situated in the southwest portion of the study area on the corner of Narre Warren Cranbourne Road and Thompsons Road. The site was generally a farm property with open paddocks for cattle grazing, though at the time of the site inspection, less than 15 cattle head were grazing on the property with the intention that it is phased out in the coming years.

The site was mostly grassed with elevated ground in the central east of the site on which the farmhouse and workshops are located. The eastern portion of the property was partly treed which would have originally been part of the existing woodland covering most of the mid-north eastern extend of the property.

There was a farmhouse and workshops on the property. The workshops were corrugated iron construction on concrete sealed surface and housed farm machinery. At some time they were used for the 'hobby scale' construction of vehicle exhaust systems. Historically the sheds have been used for machinery maintenance.

Adjacent to the sheds was a manure store with approximately 1m high concrete bund walls on three sides.

Discussions with Mr Facey indicated a sheep dip was located approximately 15m to the northern east of the farmhouse. No evidence of the sheep dip remains.

A small dam existed on Thompsons Road near the corner of Narre Warren – Cranbourne Road. Mr Facey indicated the dam was originally a gravel pit for the construction of Thompsons Road.

5.1.2 Site B: Title V7395-F993 (Petzke)

This property was situated in the southwest portion of the study area on Thompsons Road. The site was generally a farm property with open paddocks for limited cattle grazing. The site was mostly grassed and slopes up to the north. The south of the site was partly wooded.

There was a farmhouse in the centre of the property and a long row of joined corrugated iron sheds with unsealed dirt floor. The sheds were housing disused farm machinery and parts, wood stack, horse float and a 44 gallon drum. The workshops were used for machinery and vehicle maintenance.

5.1.3 Site C: Title V7125-F825 (Males)

This property was situated in the southwest portion of the study area on Thompsons Road and was generally modified farmland with semi-open paddocks. The site contained the southern portion of the natural woodland and a large open dam along the south edge of the woodland and central to the property.

The depth of the dam was not known though it was noted through visual observations and discussions with Mr Males that the size and depth of the dam might have been progressively filled and altered. The source and type of material used to fill the dam was not confirmed however it was understood to have been site-derived material.

The entrance to the property was from Thompsons Road. A windrow of soil lines the Thompsons Road boundary and is understood to have been constructed as a noise and odour barrier from the Wagstaff property across the road. The source of material used to construct this mound was not known, however, it was also understood to be from site-derived material. The height of the mound was approximately 1.5 to 2m and several metres wide.

At that base of this mound was a pile of scrap metallic items including small tin cans, which appear to be empty, however, the prior contents could not be confirmed. Also near the mound was a small pile of timber.

There were three workshops on the property used for storage of vehicles, earth moving equipment and machinery maintenance. The workshops were of tin construction with a sawtooth style roof. Adjacent to the sheds was a large transport container. To the east of the sheds were two smaller sheds of tin construction that contained numerous items such as timber, and metal pieces. Adjacent to the small sheds was an above ground tank storing diesel fuel. The tank was housed on a metal frame, which appeared to be constructed on an embankment of re-located soil material.

At the time of the site inspection several piles of various waste and disused rusted mechanical items were distributed across the property. The items included numerous 44 gallon drums, metal frames, tyres, mechanical items, metal tanks and concrete.

The eastern portion of the property has been levelled and used for tanbark and topsoil storage.

5.1.4 Site D: Title V7503-142, V9552-930 and V9946-F245 (Favero)

This group of properties occupies the majority of the central and eastern portion of the study area and generally comprises land used for market gardening producing parsnips, celery and broccoli. The site was accessed via a narrow driveway from Thompsons Road. A valley runs east to west through the centre of the site with farm buildings present on elevated land in the south of the site. Three large dams were present in the centre of the site.

There was an internal north/south road joining the properties of which was lined with storage of old machinery parts, timber and trailer pieces

A large packing facility including cool room was located in the south of the site which was understood to be less than 5 years old. The cool room was housed in a large modern shed with concrete floor and roller door access. The shed was also used to sort and package the produce for loading and transport. Opposite this cool room and shed was the workshop area and chemical store. The workshop was of tin construction with concrete floor and was used to house small workshop area, dry fertiliser and oil drums.

Adjacent to the workshop was a chemical storage shed of tin construction and concrete floor, which appeared to be in good condition. To the north of the workshop was an above ground steel water storage tank.

At the time of the site visit two underground storage tanks (UST's) and a machinery workshop were present in the vicinity of the packing facility at these properties. The size of the USTs was not known however, one contained unleaded petrol and the other contained diesel. The USTs were covered with a concrete pad, housing the two fill points, which appeared to be relatively unstained. Surrounding the concrete pad was the dirt/gravel driveway and surrounds.

At the time of the site visit rainfall and water used at the site was directed to a main sump to be recycled. Chemicals used at the site may be transported by water and may concentrate at the sump area.

Chicken manure was stored in two concrete bunkers on these properties. Chicken manure is generally high in nitrogen and phosphorous which may be present of elevated concentrations in the vicinity of the manure stores.

5.1.5 Site E: Title V8122-F681 (Roden/ Sharp)

This property is located in the north central portion of the study area with access from Pound Road.

Coffey Geosciences Pty Ltd (Coffey) undertook qualitative environmental risk appraisal at this property in 2003. The appraisal indicated that possible sources of environmental impact on the property include:

- Agricultural chemicals used at the site;
- Asbestos from building materials;
- The possible presence of a sheep-dip;
- Farm machinery use and storage; and
- The above ground fuel storage tank.

The information presented by Coffey indicated that these possible sources of impact were located close to the buildings present on site.

The site had one residence. Various earth-moving machinery was present on the property and in three workshops.

At the time of the site visit, various wastes including drums and other machinery pieces were scattered across the property.

An above ground diesel storage tank was located near the residence.

The property contained a swamp which had been partially filled using site derived and imported material.

Earthen bunds had been constructed along the site boundary using site derived and imported material.

A concrete floor had been constructed over an area in the east of the site. This area has been used for tanbark and topsoil storage.

5.1.6 Site F: Titles V9028-F618 and V10013-F794 (Dandy Concrete/ Broadway and Fame)

This property was located in the south central portion of the study area with access from Thompsons Road.

Access to this site was not granted. Concrete batching plants were visible on this site from Thompsons Road. Wastes from concrete may be alkaline (high pH). Disposal of these wastes on site may have resulted in areas of high soil pH.

Historically there is evidence of a pistol club being present on title V10013-F794 prior to its current use.

Quarrying was carried out at these properties, the details of which are unknown.

5.1.7 Site G: Title V9256-F005 & F006 (Collins)

The property was situated in the south central portion of the study area and is largely farmland used for cattle grazing. A central portion of the site is leased to the Cranbourne RSL Gun Club.

The site was generally flat with a slight rising slope to the west. The RSL club has established a clubhouse with concrete floor and children's outdoor play area. A number of corrugated iron temporary storage sheds were present and large transport containers, which were placed adjacent to each another. These areas were generally used to store ammunition. Car batteries were used to power the trap, which throw the clay targets into the air. The batteries were stored in a small shed at the corner of the property.

Shots are usually fired from the club's perimeter fence out into the surrounding property. Pellets were reported to fall out 400 m of the fence into neighbouring paddocks. Shotgun cartridges line the boundary fences. A small incinerator was also present on site.

5.1.8 Site H: Title V8693-F470 & 469 (Wagstaff)

This property was situated in the southeast corner of the study area and is generally open farmland. Occasionally stock are transported and grazed here prior to transport to the abattoir. The land was grassed and generally flat. Treated abattoir effluent was used to spray irrigate the site. The effluent is brought to site by truck and a small pump was used to pump the water via hose to the specified location.

The pump house was located in the centre of the site that was electrically powered. There was a circular driveway of soil/crushed rock construction for the easy transport of the effluent.

A farmhouse was located to the southwest corner of the site. This site was not inspected by GHD, however, discussions with Wagstaff personnel indicated that the house was occupied by a former employee of Wagstaff who was not known to undertake works of any nature other than to occasionally graze sheep.

5.1.9 Site I: Title 8693, Folio 465 to 468 (Antonino)

These properties were located in the southwest corner of the study area and comprise 5 small farmhouse style properties, however, only two of the properties contain a house.

GHD personnel did not inspect these sites, however, observations from outside the properties did not indicate significant potential for contamination.

5.1.10 Site J: Title 9511, Folio 336 (Cornell)

This property was located in the western portion of the study area on Berwick-Cranbourne Road. The property included a house and large sheds in the northeastern portion of the site.

GHD personnel did not inspect this site. Observations from outside the property did not indicate potential for significant contamination in the paddock areas.

5.1.11 Site K: Title V8490-F501 (Wagstaff)

This property was located in the northwest corner of the site and was generally open farmland with a slight slope up to the south. Some of the fences were lined with trees and there are two medium size dams in the centre portion of the site. There was also a farmhouse on the property.

GHD personnel did not inspect this site. Observations from outside the property did not indicate potential for significant contamination in the paddock areas.

It is noted that the temporary landing strip is located on this property. It is unclear if aircraft fuel was stored near the landing strip.

5.1.12 Site L: Title V8694-F732 & 733 (Allen)

This property was located in the north central portion of the study area and generally comprises market gardens. Two medium sized dams were present in the northern portion of the site. Adjacent to the dams was the packing shed.

GHD personnel did not inspect this site.

5.1.13 Site M: Title PC 364261 (Casey Central Shopping Centre)

This property was located in the north west of the study area and north of Pound Road. This site has been redeveloped into the Casey Central Shopping Centre, which comprises a large super market with ancillary stores and a car park to the west and north. The site was largely covered by shopping centre and car park.

5.2 Potential Environmental Issues

Based on the reviewed site history and the site inspection, a number of potential sources of environmental impact have been identified. For ease of locating these potential sources of impact, they have been grouped according to the property title they were identified in. **Table 6** details the potential environmental issues within the property title groups and locations are depicted in **Figure 4**. Contaminants that may be encountered in these potential source areas are also identified.

Table 6 Potential Environmental Issues and Recommendations

Site No.	Item	Potential for Contamination	Recommendation / Further Investigations	Comment
A	1. Workshop/Sheds	Fuels and oils from storage and maintenance of farm machinery	Target sampling in the area	
	2. Manure Store	Dispersion of nitrogen and phosphorus	Target sampling in the area	
	3. Sheep Dip	Arsenic, organochlorines and organophosphates, pesticides, carbamates and synthetic pyrethoids, fill material: heavy metals, PAHs, aesthetic contaminants (building debris etc)	Trenching excavations in area and targeted sampling and analysis.	
	4. Dam	Agricultural chemicals from runoff in water and sediments: pesticides, fungicides, herbicides etc.	Target sampling in the area	
B	1. Sheds	Unsealed floor, used for storage of machinery parts and maintenance, 44 gallon drum	Target sampling in the area	
C	1. Wetland/Dam	Progressively being filled with unconfirmed source of fill material that may be contaminated	Target sampling in the area	
	2. Windrow of soil	Unknown source of fill material that may be contaminated	Target sampling in the area	
	3. Piles of Waste	Hydrocarbons from fuel/oils spills and leaks, heavy metals (lead/zinc) from corrosion and weathering of waste items	Target sampling in the area	
	4. Workshops	Fuels and oils (hydrocarbons) from storage and maintenance of farm machinery	Target sampling in the area	
	5. Aboveground Storage Tank	Diesel fuels (hydrocarbons) from leaks and spills	Target sampling in the area	
	6. Small Sheds and Container	Fuels and oils (hydrocarbons) from storage and maintenance of farm machinery	Target sampling in the area	

Site No.	Item	Potential for Contamination	Recommendation / Further Investigations	Comment
D	1. Dams (3)	Agricultural chemicals from runoff in water and sediments: pesticides, fungicides, herbicides etc.	Target sampling in the area	
	2. Storage of machinery parts	Hydrocarbons from fuel/oils spills and leaks, heavy metals (lead/zinc) from corrosion and weathering of waste items	Target sampling in the area	
	3. Cool Room/Packing Shed	Fuels and oils from transport trucks and minor use of mechanical operated fork lifts and motors	Target sampling in the area	Relatively low risk associated with cool room due to age of facility.
	4. Workshop	Fuels and oils from storage and maintenance of farm machinery	Target sampling in the area	
	5. Chemical Store	Agricultural chemicals: pesticides, fungicides, herbicides	Target sampling in the area	
	6. Underground Storage Tank (2)	Diesel fuels (hydrocarbons) from leaks and spills	Target sampling in the area, groundwater investigation including installation of at least 1 groundwater well.	
	7. Sump area	Fuels (hydrocarbons and lead) from leaks and spills, Agricultural chemicals: pesticides, fungicides, herbicides	Target sampling in the area	
	8. Manure Store	Dispersion of nitrogen and phosphorus	Target sampling in the area	
E	1. Workshops (3)	Fuels and oils from storage and maintenance of farm machinery	Target sampling in the area	
	2. Agricultural Chemicals	Agricultural chemicals: pesticides, fungicides, herbicides	Target sampling in the area	
	3. Sheep Dip	Arsenic, organochlorines and organophosphates, pesticides, carbamates and synthetic pyrethoids, fill material: heavy metals, PAHs, aesthetic contaminants (building debris etc)	Target sampling in the area	

Site No.	Item	Potential for Contamination	Recommendation / Further Investigations	Comment
	4. Aboveground Storage Tank	Diesel fuels (hydrocarbons) from leaks and spills	Target sampling in the area	
	5. Storage of Machinery/Waste	Fuels and oils from storage and maintenance of farm machinery	Target sampling in the area	
	6. Former Swamp	Agricultural chemicals from runoff in water and sediments: pesticides, fungicides, herbicides, fill material: heavy metals, PAHs, aesthetic contaminants (building debris etc)	Trenching excavations in area and targeted sampling and analysis.	
	7. Earthen Bund	Fill: source of fill material may be contaminated	Target sampling in the area	
	8. Tanbark Storage Area	Fine bark typically contains resin acids.	Target sampling in the area	Relatively low risk if bark more typically hard wood
F	1. Concrete Batching Plant	Alkaline soils, buried waste	Target sampling in the area	Could be confirmed through discussions with site occupiers
	2. Former Pistol Club	Heavy Metals especially Lead fall out in surface soils	Target sampling in the area	Could be confirmed through discussions with site occupiers
G	1. Storage Sheds (storage of ammunition)		Target sampling in the area	
	2. Car Batteries	Heavy metals, sulphuric acid	Target sampling in the area	
	3. Residual Shot	Heavy Metals especially Lead fall out in surface soils	Target sampling in the area	
	4. Cartridges	Residual lead/aesthetics	Target sampling in the area	
	5. Incinerator	Heavy metals	Target sampling in the area	
H	1. Abattoir Effluent	Heavy metals, nitrogen and phosphorus	Target sampling in the area	

Site No.	Item	Potential for Contamination	Recommendation / Further Investigations	Comment
	2. Pump House	Hydrocarbons from motor oils	Target sampling in the area	
I	Nothing of Significance			
J	Nothing of Significance			
K	1. Dam (2)	Agricultural chemicals from runoff in water and sediments: pesticides, fungicides, herbicides, etc.	Target sampling in the area	
	2. Aircraft Landing Strip	Indicated potential for aviation fuel leakage	Target sampling in the area	
L	1. Dam (2)	Agricultural chemicals from runoff in water and sediments: pesticides, fungicides, herbicides, etc.	Target sampling in the area	
	2. Agricultural Chemicals	Agricultural chemicals: pesticides, fungicides, herbicides	Target sampling in the area	
M	Nothing of Significance			

6. Recommendations

6.1 Introduction

To allow the site, or an area of the site, to be used for a more sensitive land-use, for example residential use, a detailed investigation of the environmental status of soil and groundwater conditions would be required. The purpose of this section is to present strategy to complete the more detailed phase of the investigation.

The objective would be to provide sufficient information likely to the extent where, an environmental audit for the site can be conducted, in order that the planning authority is satisfied that the site is suitable for its proposed use. The audit would be conducted by an Environmental Auditor (Contaminated Land) appointed pursuant to the Victorian EPA Act 1970 to audit the works of the environmental assessment consultant.

6.2 Soil Investigation Strategy

When developing this soil investigation strategy GHD has considered the following:

- The large area occupied by the site may limit the effectiveness of a single investigation of the entire site.
- Redevelopment of the site is likely to occur in stages.
- Historical site activities have varied across the site, generally the activities have been separated based on property boundaries for example irrigation with treated abattoir waste is only known to have occurred on property owned by Wagstaff.
- Initial redevelopment plans for the site, as presented on 2 April 2004, indicate that a variety of land-uses are likely to exist on the site. Areas within the site that area proposed for sensitive land-uses will require a more intensive investigation of environmental conditions. For example an area to be redeveloped for residential use should be the subject of a more intensive environmental investigation than an area to be used for commercial.

Considering these four points GHD proposes that the site be investigated in line with the redevelopment program, including timing of redevelopment. This approach would involve investigating individual areas prior to redevelopment. For example a school may be constructed on part of the site before the surrounding land is redeveloped. Detailed investigation of the area occupied by the school would occur before investigation of the surrounding land.

GHD recommends that for each investigation area, a phased investigation approach be adopted after determining with the Council the proposed land use and the need for an audit so that the asset can be designed on that basis. The initial investigation phase would focus on investigating the potential sources of environmental impact identified in Section 5.2. Investigation of the remainder of the area should also be conducted at this stage. Where appropriate we recommend that prior to undertaking the investigation, the scope should be agreed with the appointed environmental auditor.

The second phase of investigation would be conducted if significant soil contamination was identified by the initial investigation. This phase would focus on delineating the extent of impact and assessing the requirement for remedial works.

The shopping centre site presents a low risk of contamination as the site is completely re-developed into a commercial shopping centre. There would be no further proposed environmental investigation warranted for this site, should it continue its use as a commercial retail centre.

6.3 Groundwater Investigation Strategy

The objective of the groundwater investigation will be to assess if groundwater has been impacted by site activities or the presence of contamination within the soils. As with the soil investigation, GHD recommend that a staged investigation approach be adopted for groundwater investigations.

The initial phase of the investigation should focus on assessing the groundwater flow regime and geochemical characteristics of the groundwater across the site as a whole. Existing groundwater extraction wells could be used in this stage if possible.

This Phase 1 investigation has identified the potential for groundwater contamination resulting from USTs present on Site D. It is, therefore, recommended that at least 1 groundwater well be installed adjacent to the USTs.

6.4 Further Considerations

An archaeological desktop assessment of Casey Central, Cranbourne North, Victoria Biosis March 2004 indicates that a number of archaeologically sensitive sites have been identified within the site. Biosis should be consulted when planning the detailed intrusive investigations to prevent disturbance of sensitive sites.

Prior to redevelopment, and road construction geotechnical assessment of the site will be required. To limit investigation costs GHD recommends that, as far as possible, geotechnical investigations are coordinated with environmental investigations.

7. Conclusions

The conclusions presented in this section are based on the information presented in the preceding report. The conclusions made by GHD are subject to our standard limitations as set out in Section 9 and must be read in conjunction with all other sections of this report.

The Casey Central site is bound by Narre Warren – Glasscocks and Pound Roads to the north, Berwick Cranbourne Road to the east, Thompson Road to the south and Narre Wareen Cranbourne Road to the west. The site is approximately rectangular in shape and occupies an area of 500 ha.

Published geological and hydrogeological information for the area of the site indicates the majority of the site is located on the Tertiary aged Baxter Sandstone Formation. This geology is characterised by ferruginous sandstone, sand, sandy clay and occasional gravel (Douglas and Ferguson, 1976).

The Baxter Sandstone is likely to form the primary aquifer beneath the site. The Hydrogeological Map of Western Port Basin (1980) indicates that the Baxter Sandstone forms a sub regional unconfined to confined aquifer of unconsolidated sand and gravel. Groundwater is expected to be encountered at approximately 7 m below ground level, dependant on the local geology and topography.

The site history indicates that the majority of the site has been progressively converted from grazing land to market gardens. In the central south of the site quarrying began in the early 1960's this land is now being used for two concrete batching plants.

A number of potential sources of environmental impact were identified during the site inspection relating to current and historic uses. These are typically associated with various aspects of market garden usage and storage of chemicals and machinery on farm sites.

Detailed investigation, including soil and groundwater sampling would be required for the site to be redeveloped. GHD proposes a strategy whereby individual areas of the site are investigated separately based on the program of development, proposed land use and the need for an environmental audit. GHD further proposes that a staged approach be adopted for the soil investigations. The first stage would involve the collection of soil samples from the immediate vicinity of the identified potential sources of impact and a broad sampling pattern across areas not identified as potential sources of impact. The second stage of soil investigations would include collection of additional samples to delineate contamination identified in the initial stage.

GHD also proposes a staged approach for groundwater investigations. The first stage of the investigations would characterise the groundwater flow conditions beneath the site and the general chemical characteristics of the groundwater.

The second stage of investigations would include investigation of the groundwater beneath individual areas of the site before they are redeveloped. This second stage of investigation would focus on the potential sources of impact identified in this report and any areas of identified soil impact within the investigation area.

8. Statement of Limitations

This report has been prepared by GHD for Casey City Council. No warranties, expressed or implied, are offered to any third party and no liabilitiy will be accepted for the use of this report by any third party.

The work conducted by GHD under this commission has been to the standard that would normally be expected of professional environmental consulting firm practising in this field in the State of Victoria. However, although strenuous effort has been made to identify and assess all significant environmental issues required by this brief we cannot guarantee that other issues outside of the scope of work undertaken by GHD do not remain.

It should be noted, that in gathering facts for the study, GHD relied on verbal information supplied by client, on site records, and on visual inspection of the site, which may not have been independently verified. No sampling or analytical testing nor any intrusive inspection was undertaken. Evidence of soil contamination is not always obvious by visual inspection and environmental issues may not have manifested themselves at the time of inspection.

An understanding of the site conditions depends on the integration of many pieces of information, some regional, some site specific, some structure-specific and some experienced based. Hence, this report should not be altered, amended or abbreviated, issued in part and issued incomplete in any way without prior checking and approval by GHD. GHD accepts no responsibility for any circumstances that arise from the issue of this report that has been modified other than by GHD.

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Document Status

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