ASBESTOS CONTAMINATED SOIL
VALIDATION REPORT
NORTH EAST PORTION OF
BUSSELTON HEALTH CAMPUS
MILL ROAD, WEST BUSSELTON WA

Prepared For: Department of Finance - Building Management and Works
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Asbestos Contaminated Soil Validation Report
North East Portion of Busselton Health Campus
Mill Road, West Busselton WA

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INTRODUCTION

Aurora Environmental was engaged by the Department of Building Management and Works (BMW) to conduct validation soil sampling following removal of asbestos contaminated soil. The soil removal occurred at a portion of the Busselton Health Campus was subject to vegetation rehabilitation as part of a Conservation Zone Revegetation Management Plan (CZRMP) by Natural Area Consulting (2013). The soil had been identified to have Asbestos Containing Material (ACM) at surface and ACM and Asbestos Fines (AF) extending to a depth of approximately 0.3m below ground level (mBGL). The rehabilitation work was being undertaken on behalf of BMW who are managing redevelopment works at the Busselton Health Campus which is operated by the WA Country Health Service. The location of the Busselton Health Campus is shown in Figure 1.

1.1 BACKGROUND

The presence of ACM in an area of the site redevelopment works was first reported via a hazardous materials assessment conducted by GHD (2013). As part of the assessment fragments of fibre cement sheeting that were located in the north-eastern corner of the site were collected for analysis which confirmed the material contained asbestos minerals.

On the basis of the GHD report Aurora Environmental was engaged to delineate the extent of ACM impacts within a portion of the site that was to be subject to planting activities required under the CZRMP. The BMW Project Team defined the area for which Aurora Environmental was required to undertaken the ACM delineation investigation, which is shown in Figure 2. The resultant investigation comprised a soil screening assessment via hand-dug test pits at ten locations, evenly spaced in a grid-like pattern within the investigation area. The report detailing this work is titled Asbestos In Soil Assessment Report, Busselton Health Campus, Busselton 6281 (Aurora Environmental, 2014) (Appendix 1). Data collected from 10 test pit locations distributed evenly across the area of investigation identified that ACM and AF contamination was present in the soil to a depth of approximately 0.3m, and the impacts tended to be associated with the shallow grey to black quartz sands present at the site (Aurora Environmental, 2014).

The results of the Aurora Environmental (2014) assessment were used by the Project Team to develop and prepare a plan for removal of the impacted soil. A removal management plan (RMP) which detailed the clean-up and remedial works to be undertaken was prepared by Natural Area Consulting (2014; Appendix 2). The plan observed that the nature and location of the asbestos contaminated soil at the Busselton Health Campus Site meant that there was a risk of future exposure through an eroding coastline and continued traffic along a dual-use path; furthermore, in order to remove the risk ‘the decision has been made to manually remove the affected soil to a depth of 40cm’. Natural Area Consulting (2014) also stated:

- Asbestos contaminated soil would be disposed to the Stanley Road Landfill, Australind;
- The excavated area would be rehabilitated in accordance with Rehabilitation Management Plan after being backfilled with imported clean fill;
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- Dust management and fibre monitoring was to be undertaken as detailed (in the RMP).

Aurora Environmental was engaged to complete wall and floor sampling and conduct airborne fibre monitoring for the purpose of validating whether asbestos-impacts had been remediated and whether airborne asbestos fibres were present during the earthworks activities.

1.2 OBJECTIVES AND SCOPE

The objectives of the remedial works was to remove asbestos-contaminated soil from an area within a conservation zone that was planned to be revegetated to protect rehabilitation workers and ensure the area was fit for the proposed purpose of vegetation rehabilitation. The scope of work was therefore to safely remove the asbestos contaminated soil for appropriate off-site disposal, and then to validate the clean-up area to confirm that the impacts were removed and that there were no human health risks to site workers undertaking the revegetation works.

1.3 SCOPE OF WORK

To achieve the aforementioned objectives this report details the asbestos contaminated soil clean-up activities and documents the results of the and validation sampling. The scope of work comprises:

- Description of the Site details;
- Description of the Site Clean-up activities
- Details of contaminated soil disposal;
- Details of imported backfill;
- Description of validation sampling methodology;
- Description of validation assessment criteria;
- Assessment of results;
- Recommendations.

It should be noted that Aurora Environmental’s scope of work did not include delineating the extent of the remedial earthworks or provision of comprehensive contractor supervision during the clean-up activities. However whilst on-site for the purpose of monitoring and validation sampling, Aurora Environmental acted in a supervisory role to ensure the Contractor was undertaking the earthworks in accordance with the Removal Management Plan (Natural Area Consulting, 2014).
2 SITE INFORMATION

The following sections provide available site information relating to both the cadastral entity (Lot) containing the Busselton Health Campus and the location where the clean-up activities were undertaken.

2.1 SITE DETAILS

The Busselton Health Campus Site (the Lot) details comprise the following:

- Site Owner: Department of Health (DoH), WA Country Health Services;
- Address: Mill Road Busselton (Lot 189 Bussell Highway, West Busselton);
- Approximate co-ordinates (Landgate, 2014):
  - North-west corner 115.31776E, -33.652853N;
  - North-east corner 115.321423E, -33.652119N;
  - South-east corner 115.320349E, -33.655955N;
  - South-west corner 115.317807E, -33.656345N.
- Lot area: approximately 127,000m² (12.7ha);
- Current and planned landuse: Public health services;
- LGA: City of Busselton;
- Locality Map: See Figure 1.

The following site details are provided for the portion of Busselton Health Campus that was the subject of the asbestos-contaminated soil remediation activities and which is the subject of this report (Site):

- Name of Area (within this report): Conservation Zone Rehabilitation Area subject to asbestos-contaminated soil clean-up activities;
- Location: In the north-east portion of the of the Busselton Health Campus, Mill Road Busselton (Lot 189 Bussell Highway, West Busselton);
- The approximate co-ordinates of centre of the clean up area are Australian Map Grid (AMG) Zone 50, Northing 6,275,086, Easting 344,339 and the area was estimated to have a perimeter length of 130m with an area of approximately 1200m², the indicative boundaries of the clean up area are shown in Figure 2;
- The remediation area is also bisected by an east-west oriented dual-use pathway;
- Current landuse: POS within Busselton Health Campus;
- Proposed Landuse: Conservation Zone Rehabilitation Area;
Managing Authority: WA Country Health Services, Busselton Health Campus;
Locality map: See Figures 1 & 2.

2.2 PREVIOUS INVESTIGATIONS

The following previous investigations with regard to the Lot and the Site are known and have been made available to Aurora Environmental:

- *Additional Hazardous Material Sampling, Additional Sampling and Analyses of Potentially Contaminated Materials* (GHD, 2013);
- *Asbestos in Soil Assessment Report, Busselton Health Campus Busselton, WA, 6280* (Aurora Environmental, 2014);

2.3 SITE HISTORY

No previous reports regarding the history of the Busselton Health Campus (Lot 189 Bussell Highway) were able to be provided and a desktop review of the site history is outside the scope of this report, although some information is able to be provided about the Site of the clean-up activities, as follows:

- The history of the Site area that was subject to the clean-up activities is relatively unknown except for information resulting from recent investigations, commenced as part of the Busselton Health Campus Redevelopment activities.
- Evidence of the presence of ACM was first confirmed GHD (2013) in a letter report regarding a hazardous material survey at the site. The scope of work for this report included the collection and analysis of fragments of potential ACM which were confirmed to contain asbestos minerals.

2.3.1 Observations Relating to the Site History

Additional information includes anecdotal evidence provided to Aurora Environmental by members of the redevelopment Project Team and also members of the public that stopped to discuss the site and situation whilst field work was being conducted. The information provided indicates a few possibilities regarding the source of the ACM as described below:

- The ACM was possibly present as the relict of uncontrolled demolition of asbestos shacks located in the area.
- The ACM (and other wastes) were dumped in this location as part of uncontrolled waste disposal.

Using observations made during field work by Aurora Environmental, some additional information can be provided and some additional scenarios inferred that may assist to explain the presence of the ACM:
• Several large sized ACM fragments (estimated to be up to 30cm width) and numerous small fragments of ACM appeared to be from typical corrugated and flat sheets of cement fibre product that are commonly seen as roofing, wall or fence sheeting products. This is consistent with historical construction of dwellings in the area and consistent with the structure of many houses, sheds and fences in the West Busselton area.

• It is notable during the site works some glass and ceramic fragments were observed in the near surface profile; however no steel or aluminium cans or plastic waste, automotive parts, chemical drums, structural timber, waste steel or other common and recent types of domestic or commercial types of waste were observed co-located with the ACM.

• The lack of evidence of recent types of common waste such as aluminium or steel drink cans and plastic of any sort may be indicative of the time that the waste materials were deposited in the current location, which could be considered to be at least prior to the 1970s.

• The small volume of waste materials encountered may be indicative that the activities that resulted in the presence ACM and the other waste was possibly an isolated occurrence.

• The presence of mature trees may be indicative that the area has not been subject to historical development or large scale disturbance, such as for dwellings, sheds, storage of goods or the like.

• No clear evidence of ground subsidence was noted, subsidence features could indicate the presence of a former excavation that had been filled or backfill, such as a waste burial pit.

These lines of evidence are considered to give weight to the likelihood that the ACM is not a result of on-going or large scale waste disposal activities and is more likely to be related to the demolition and/or disposal of material from a single or small structure.

2.4 NEIGHBOURING LANDUSES

Landuses in the vicinity of the Site comprised:

• Health care activities that were conducted to the south and west of the clean-up area within the Lot bounds;

• Residential landuses south-east of the Site area along Mill Road;

• Public parking and public beach access to the north of the Site;

• Public pedestrian and bike use of along the dual-use pathway that bisects the Site.

2.5 ENVIRONMENTAL SETTING

Lot 189 and the Site are located on the north facing shore of Geographe Bay. The Site is low lying and estimated to be at a height of 1 -2m AHD. Overall the Lot is generally flat but the area around the Site also exhibits gently undulating topography consistent with low lying dunal features and the environmental mapping by the Geological Survey of Western Australia (GSWA) indicates that the
area forms part of the relict foredune plain of the Quindalup Dunes geomorphological unit (Belford, 1987).

Field observations made by Aurora Environmental were that the vegetation within in the area comprises relatively mature Peppermint Trees, with a grassy understory. It is notable that the area of the remedial activities was generally sandy and the only understory vegetation appeared to be invasive grasses. These observations are consistent with the description of the Lot and Site provided in Natural Area Consulting (2013) which specifically notes that the Site is degraded, and infested with grassy weeds such as Couch.

The soil profile that was typically encountered at the Site comprised a shallow (100-300mm) relatively organic rich, greyish, fine grained, quartz sand that overlays generally whitish, well sorted, fine grained quartz sand at depth. These observations are consistent with the geological mapping by Belford (1987) which shows that the surface geology is mapped as belonging to the Safety Bay Sand units which were described as white, medium grained, sub-rounded quartz and shell debris, of eolian origin”.

2.6 PROPOSED LANDUSE

A conservation revegetation plan (Natural Area Consulting, 2013) has been prepared for the Busselton Health Campus to support State and Federal environmental approvals for redevelopment of the facility. The overall revegetation methodology for the site is detailed in Natural Area Consulting (2013) and includes the following:

- Infill planting of Peppermint Trees (*Agonis flexuosa*);
- Infill planting of under and middle story species;
- Cessation of mowing around nominated bush pockets with mulching around them to promote the natural regeneration of the Sword Sedge (*Lepidosperma gladiatum*).

The asbestos impacted area will be rehabilitated following the remediation and clean-up activities. Specifically, the revegetation and rehabilitation within this area comprises only mulching and infill planting of understory species. These activities will limit the depth of soil disturbance in this area and it is understood that infill replanting will comprise shallow rooted tube stock that will not extend to a depth greater than 300mm below ground level (M. Blunt, 2014, pers. comm., 8 July 2014).

2.7 SOIL ASSESSMENT CRITERIA

For the purpose of validating the excavation of asbestos-contaminated soil and to consider whether asbestos impacts remain within the residual soil in the floor and wall of the cleaned-up area, assessment criteria from the *Guidelines for the Assessment, Remediation and Management of Asbestos-Contaminated Sites in Western Australia* (DoH, 2009) have been adopted. The minimum number of sampling points recommended by DoH (2009) for excavation validation is summarised below:
At least one sample per 5m length of strata of interest (or per 1m depth) should be collected from the excavation walls;

The excavation floor should be visually inspected and if suspect, it may need to be sampled at twice the density outlined in DoH (2009; Appendix A).

The results of sampling are then compared to the following criteria to determine the contamination status of the residual soil (DoH, 2009);

- 0.02% w/w asbestos for ACM – Parks, public open spaces, playing fields etc.
- 0.001% w/w asbestos for fibrous asbestos (FA) and asbestos fines (FA) in all land use scenarios.
- Presence/Absence of free asbestos fibres as determined via soil analysis (as there is no validated method of reliably estimating the concentration of free asbestos fibres, soil contamination by free asbestos fibres is determined simply by the presence of or absence of fibres as determined by laboratory analysis of soil samples).

The methodologies to determine the concentration of ACM, FA and AF are detailed in DoH (2009). Soil asbestos analysis should be undertaken in accordance with Australian Standard Method for Qualitative Identification of Asbestos in bulk samples (AS 4964-2204) or be demonstrated to by the following equation and assumptions consistent with DoH (2009) guidance as shown below:

\[
\% \text{ Soil Asbestos (}\%\text{ w/w)} = \frac{(\text{asbestos content } \% \times ACM \ kg)}{(\text{soil volume } L \times \text{soil density } \text{kg}/\text{l})}
\]

Assuming:

1. Assumed asbestos content in the ACM is 15%.
2. Soil density is assumed to be 1.65kg/L.

**2.8 AIR QUALITY ASSESSMENT CRITERIA**

The guidelines (DoH, 2009) recommend that the only practical limit and methodology for airborne fibre monitoring is the membrane filter method with a 0.01 fibre per millilitre (f/ml) limit to protect the public around contaminated sites. Although this limit has been adopted as the assessment criterion for the airborne fibre monitoring, it is noted in DoH (2009) that results below this criterion are not definitive with regard to whether asbestos fibres have been released or not.
3 SITE CLEAN-UP ACTIVITIES

The planned site clean-up activities were detailed in the Removal Management Plan (Natural Area Consulting, 2014) which is provided as Appendix 2. The plan included the following scope of remedial work for the asbestos-contaminated soil:

- Remove 400mm of soil from the area identified as the clean-up area;
- Dispose soil to the Stanley Road Landfill as asbestos contaminated waste;
- Validation the clean-up activities via soil sampling for ACM and FA;
- Backfill the area with clean fill;
- Conduct airborne fibre monitoring to assess the effectiveness of the dust management;
- Report the results.

The duration of work was four days, from Monday 7 July 2014 until Thursday 10 July 2014. A summary of the remedial work is presented below.

3.1 SELECTION OF SITE REMEDIATION OPTION

The selected method of asbestos-contaminated soil remediation was detailed in Natural Area Consulting (2014). The rationale provided for the preferred method was that:

“The nature and location of the site where the asbestos contamination is found at the Busselton Health Campus site means that there is a risk of future exposure through an eroding coastline and continued human traffic along the dual-use path. In order to remove this risk the decision has been made to manually remove the affected soil to a depth of 40cm (400mm).”

This method and approach meets the DoH (2009) considerations to:

- Minimise public risk by removing asbestos-contaminated soil from an area of public access;
- Minimise the amount of asbestos contaminated soil disposed to landfill by limiting the excavation depth to the depth demonstrated to be impacted by ACM.

3.2 EARTHWORKS AND CONTRACTOR DUST MANAGEMENT

All clean-up and earthwork activities were conducted by the nominated Contractor, Silverbay Enterprises Pty Ltd., who provided the personnel and machinery to execute the planned clean-up. The Contractor held a valid restricted Asbestos Licence. The approximate location of the soil removal area was detailed in Natural Area Consulting (2014) and is shown on Figure 3 which provides the indicative boundary of the remediation area.

Prior to the earthworks the Contractor was required to conduct an emu-bob to collect any visible ACM fragments within the clean-up footprint. This included the soils around several mature peppermint trees (*Agonis flexuosa*) that were located within the clean-up area. Hand methods (emu-bob and raking) were used to remove ACM and soil from around the base and root zone of the trees.
(once earthworks had commenced). The earthworks were then conducted using a track-mounted bo-b-cat to scrape the soil from surface to a depth 400mm from the area. The soil was loaded onto trucks for transport to the landfill. All soil was transported by trucks with wind-on tarpaulins which were utilised to reduce the release of dust during transport.

The Contractors were required to undertake the dust management protocols that were described in the RMP (Natural Area Consulting, 2014). This comprised dust suppression using water spray on an as required basis (i.e. whenever the soil being worked was sufficiently dry and capable of generating dust when disturbed or used).

### 3.3 ASBESTOS-CONTAMINATED SOIL REMOVAL

The Contractor was required to provide landfill receipts to confirm that the material was disposed appropriately. The documentation is provided in Appendix 3 and a summary is shown in the following table.

#### TABLE A: SUMMARY OF CONTAMINATED SOIL DISPOSAL

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<th>VOLUME OF SOIL DISPOSED</th>
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<tr>
<td>Stanley Road Landfill Lot 43 Stanley Road Australind (DER License No. L7060/1997/12)</td>
<td>Asbestos Contaminated Soil 120m³</td>
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</table>

### 3.4 DETAILS OF CLEAN BACKFILL

The Contractor was also required to provide evidence regarding the suitability and volume of backfill soil that was used to re-instate the ground levels. Documentation is also provided in Appendix 3 and a summary shown in Table B below.

#### TABLE B: SUMMARY OF BACKFILL MATERIAL

<table>
<thead>
<tr>
<th>BACKFILL SOURCE LOCATION AND DETAILS</th>
<th>SAND TONNAGE</th>
<th>CALCULATED VOLUME OF BACKFILL SOIL</th>
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<tbody>
<tr>
<td>BCP Kaloorup Sand Pit, Vasse</td>
<td>231 tonnes (based on receipts)</td>
<td>Assume bulk density of sand is 1.6kg/m³ then assumed volume approximately 150m³</td>
</tr>
</tbody>
</table>

### 3.5 AIRBORNE FIBRE MONITORING

Airborne fibre monitoring using the membrane filter method was conducted by Aurora Environmental for the purpose of assessing the potential presence of airborne asbestos fibres that may have been generated by the work activities. Two static airborne fibre monitors were deployed each day, located to target the upwind and downwind boundaries of the clean-up Site. The indicative location of monitors is shown on Figure 3. Filters from the monitors were submitted to a National Association of Testing Authorities (NATA) accredited laboratory for analysis. The
documentation relating the airborne fibre monitoring is provided in Appendix 4 and the results discussed in Section 4.1.

3.6 VALIDATION SAMPLING

Soil validation sampling was conducted by Aurora Environmental. The validation was conducted on a progressive basis throughout the works program. The validation methodology was undertaken in accordance with the Guidelines for the Assessment, Remediation and Management of Asbestos-Contaminated Sites in Western Australia (DoH, 2009). Sample quality procedures were used to ensure that the sample and data collected from the site was of suitable quality and were in accordance with the Australian Standards for collection of contaminates soil samples (AS4882.1-2005). These procedures included logging the location and description of all soil samples, double bagging soil samples in appropriately labelled ziplock bags and the use of chain of custody documentation for transporting the samples to a laboratory for suitable analysis. Field documentation is included in Appendix 5.

The lateral extent of remedial earthworks (excavation and backfill) was defined by the area where rehabilitation planting was required to occur, shown as the approximate asbestos removal location in the Removal Management Plan (Natural Area Consulting, 2014; Figure 1). When these extents were reached, the walls were visually inspected and tilled using an appropriate sized rake (teeth spaced at less than or equal to 7mm, and at least 10mm long). Any ACM fragments uncovered during this process were removed and collected for appropriate disposal. Soil sampling was then undertaken using the recommended test pit/trenching sampling method (DoH, 2009), that is, by spreading out a 10L soil sample on a contrasting colour tarpaulin and inspecting for ACM, as well as collecting a 500ml wetted sample for laboratory analysis of AF. Samples were spaced approximately 5m apart along the excavation walls. The indicative area of the soil clean up area is shown on Figure 3, and Figure 4 shows the location of the wall validation samples is shown in Figure 4.

The Removal Management Plan (Natural Area Consulting, 2014) indicated that the vertical extent of excavation was planned to approximately 400mm below ground level. This would ensure that the area was suitable for the proposed future landuse and also to minimise the amount of contaminated soil sent to landfill. Validation of the residual floor soils comprised a visual inspection using a grid pattern with two passes and a 90 degree direction change between passes, using a rake to till suspect areas. Any fragments of ACM that were identified were collected for appropriate disposal. Several areas were identified as suspect and additional floor material was removed using the bobcat. Once the floor excavation was completed, soil samples were collected and screened for ACM using the same method described previously and 500ml wetted samples were also collected for validation AF analysis. The samples were located in an evenly spaced grid pattern across the floor area to ensure that twice the density shown in Appendix A (DoH, 2009) was achieved over the floor area. The indicative location of the floor samples is shown in Figure 4.
4 RESULTS

4.1 AIRBORNE FIBRE MONITORING

A total of nine samples were submitted to MPL Laboratory in Myaree for analysis of airborne asbestos fibres. The cowls comprise samples from two locations collected for each day of the work period and one sample blank. The Laboratory Certificate (Appendix 5) notes that the filters were examined in accordance with NOHSC:3003 (April 2005) Guidance Note on the Membrane Filter Method for Estimating Airborne Asbestos Fibres and Envirolab Group in-house method ASB-2. The sample results ranged from 0-1.5 fibres per 100 fields, which is less that the 10 fibres per 100 fields considered an acceptable background level when a minimum of 480l has passed over the filter. Photographs showing the monitors are provided in the showing the air monitoring units are provided Photographs 1 & 2 in the Plates.

4.2 EXCAVATION VALIDATION SOIL SAMPLING

It was estimated that the excavation area perimeter length was between 120-130m and the area of the floor was approximately 1200m². Based on these estimates the following sampling regime was undertaken:

- Wall validation samples were evenly spaced at approximately 5m along the permitter walls and a total of 23 locations were sampled. This is consistent with the guidance in DoH (2009) for the collection of excavation wall samples.
- Based on the estimated maximum area of 1500m² a total of 14 floor samples were evenly spaced across the excavation floor, consistent with the twice the sampling density shown in the guidelines (DoH, 2009; Appendix A) which states seven locations is the minimum number of samples required for an area of 2000m².
- Photographs of the remedial area during the excavation and validation works are provided in the Plates section.

Copies of the handwritten excavation validation soil sample logs are provided in Appendix 5. A summary of the results from the validation sampling follows:

- ACM was identified during initial validation screening in the walls at the locations VW5, VW8 and VW10 (shown on Figure 5), as a result additional soil was excavated from these locations and secondary validation screening samples were collected and labelled VW5b, VW8b and VW10b.
- One area of the floor was identified to require additional excavation depth due to the presence of ACM during floor validation inspection and a small pit (shown on Figure 5) approximately 2m x 2m was dug to a depth of approximately 1m below ground level to remove visible ACM and associated waste such as glass and ceramic fragments. Screening of the ‘walls and floor’ of this small pit was conducted visually and by use of a rake to ensure that the small volume of waste material that was encountered was removed. Based on the small scale of the
• No ACM was encountered by the floor validation screening sampling.
• Final validation sample IDs were VW1-VW4, VW5b, VW6-VW7, VW8b, VW9, VW10b, VW11-VW23, VF1-VF14.
• No ACM was identified in any of the final validation samples, therefore all samples (listed above) were considered to have mass of ACM <0.001kg %w/w.

4.2.1 Calculated ACM Concentration

• The concentration of ACM can be calculated using the mass of ACM identified by the screening results (DoH, 2009) via the calculation detailed in Section 2.8. On the basis that no ACM was identified in any final validation sample it is considered the ACM concentration from all final samples was below the adopted assessment criterion of 0.02% w/w asbestos.

Notwithstanding the following statement is provided:
• The calculated concentration of ACM from all final validation sample locations is considered to be <0.01 %w/w asbestos for ACM, which is less stringent than the assessment criterion of 0.02% w/w asbestos for ACM for parks, public open space, playing field etc.

4.2.2 AF Validation Results

Analysis of the validation samples was conducted in accordance with AS4964-2004 and comprised qualitative identification of fibre type in bulk samples. A total of 37 primary samples and two duplicate samples were submitted and analysed. A summary of the results is:
• No asbestos was reported in any final wall validation sample (samples VW1-VW4, VW5b, VW6-VW7, VW8b, VW9, VW10b, VW11-VW23).
• No asbestos was reported in any final floor validation samples (samples VF1-VF14).
• No asbestos was reported in either of the duplicate sample pairs (Dup 1, VF8; Dup 2, VF10).

Laboratory certificates and chain of custody documentation are provided in Appendix 5.

4.2.3 Quality Procedures

Quality assurance procedures for soil sampling and analysis are detailed in Australian Standard (AS) 4482.1-2005. These include the collection of one duplicate sample for twenty primary samples, with the analytical results displaying a relative percent difference (RPD) between 30-50%. The sampling and analytical results therefore comply with AS 4482.1-2005.

4.3 RESULTS FROM INSPECTION OF UNEXCAVATED AREAS

Unremediated areas surrounding the excavation area were inspected for ACM during the validation works. It is important to note that although the area immediately external to the excavation was not subject to remedial earthworks, an inspection for ACM was conducted in approximately a 1m radius...
around the outer perimeter of the excavation area. Any ACM identified was collected for appropriate disposal. The outer perimeter plus 1m ACM inspection areas is shown on Figure 5.

The results from the inspection of unexcavated areas are qualitative only and the following observations are provided:

- Visible ACM was observed and removed from soils and fill associated with and located beneath the dual use pathway that bisects the clean up area.
- Visible and buried ACM was observed and removed from soil beneath the thick remnant vegetation identified as the Sword Sedge (*Lepidosperma gladiatum*). (M.Blunt 2014, pers.comms, 8 July) adjacent the clean up area in the south-west portion of the Site.
- Visible ACM was noted and removed from the sparsely vegetated surface as far as approximately 3m west of the north-west portion of the excavation area.

The results of the remedial work, validation sampling and inspection of the 1m perimeter of the excavation area are discussed in the Section 5.

### 4.4 Compliance with Regulatory Guidelines

This section presents a summary of the criteria, which achieve the DoH (2009) guideline requirements.

#### 4.4.1 Sample Size

*Requirement:* The DoH (2009) guidelines recommend a minimum sample size of 500ml from each relevant soil stratum at each location for laboratory analysis. The larger quantity can improve sensitivity of asbestos detection mainly during the standard laboratory pre-analysis screening of the sample through a 2mm sieve. As per AS4964-2004, the >2mm fragments are examined for presence of asbestos. Detection of any >2 mm asbestos fragments will be more likely within this volume of sample. A single 2x2x2 mm fragment would represent less than 0.001% w/w of the sample when factoring in an assumed 15% asbestos content of an asbestos cement fragment. The sub-2 mm fraction can then be used to prepare a representative subsample for further analysis, including trace analysis, in accordance with AS4964-2004 and the laboratory’s protocols. All sub-sampling uses an appropriate validated procedure and is reported with the analytical results.

*Compliance Achieved:* The majority of samples (83%) had a volume that exceeded the requirement, although seven samples were less than the recommended sample size (500mL). The average sample weight was 583mL and the range was 390mL to 830mL. It is considered that because the majority of samples and the average sample size complied with the recommended minimum weight it is the soil sampling generally complied with the guidelines. The selected analytical laboratory, ARL, sieved the full sample volume supplied by Aurora Environmental through a 2mm sieve. Material greater than 2mm is retained and analysed. The sub-2mm portion of material is sub-sampled in accordance with ARL NATA reviewed sub-sampling processes and the sub-sample analysed, with the greater than 2mm portion, for asbestos. Should asbestos not be detected from this analysis, trace analysis is
conducted in accordance with AS4964-2004. The ARL Laboratory Certificates note the full sample mass and the mass sub-sampled.

4.4.2 Statement of Limit of Detection

*Requirement:* The DoH (2009) guidelines require laboratory certificates to state the method’s limit of detection. This refers to the standard limit of detection (LOD) of the laboratory independently of what influence the application of the guidelines recommendations may make. It is intended to check whether or not the laboratory technique used achieves the common 0.01% w/w asbestos detection limit associated with AS4964-2004.

*Compliance Achieved:* Yes. Should asbestos not be detected in a sample, ARL reports a statement similar to, “No Asbestos Detected at the detection limit of 0.1g/kg”.

4.4.3 Asbestos Detected or Not

*Requirement:* The DoH (2009) guidelines require laboratory certificates to state if asbestos of any form is detected as AS4964-2004 may allow for a nil detection if the asbestos is less than a certain concentration and is non-respirable.

Although such qualifications may be appropriate for occupational health and safety purposes, which are the basis of AS4964-2004, this is not so in regard to public health. Factors that may raise the risk of public exposure include possible: involvement of sensitive groups; lifetime continuous exposure; and degradation of the material into respirable fibre over time. If there is any uncertainty about unequivocal identification of fibres as asbestos or if laboratory cross-contamination is possible, this should also be stated. A positive result would normally be considered by DoH to exceed the 0.001% w/w investigation criterion applied to fine asbestos material, especially given that a 0.01% LOD usually applies. However, a single such exceedence may not necessarily result in the sample source being deemed contaminated. A weight of evidence approach should be used when assessing the significance of any exceedences, which should take account of the history of the site and frequency and occurrence of other positive and negative results. Once unequivocal identification of asbestos type has been attained, ARL will report the type of asbestos present.

*Compliance Achieved:* ARL does not report nil detects of asbestos if the asbestos is less than a certain concentration and is non-respirable. Once the analysis of asbestos meets identification protocol from AS4964-2004 in either full sample analysis or trace analysis, a positive identification is reported, regardless of concentration or respirable range.

4.4.4 Description of the Asbestos

*Requirement:* DoH (2009) guidelines require that if asbestos is detected, laboratories should indicate the type of asbestos and provide a factual description.

*Compliance Achieved:* Yes. The type of asbestos and a factual description is included in both SGS and ARL analytical reports for heterogeneous samples, including soil.
4.4.5  Estimate of Concentration

Requirement: DoH (2009) guidelines require that if practical, laboratories should estimate the concentration of any asbestos. This is recommended information if practical, especially for >2 mm size asbestos material. For any sub-2 mm asbestos material an alternative to a calculation based on weighing would be to use rough measurements of dimensions combined with knowledge of asbestos density.

Compliance Achieved: ARL do not report estimated concentrations of asbestos. NATA Chemical Testing Field Application Document (5.10.1, page 28) states, “Quantitative estimates cannot be included on reports”. Similarly, AS 4964-2004 states in the preface that it is a qualitative technique and “PLM is qualitative technique only”. NATA News, September 2011-page 34, states, “Weighing of fibres is problematic and can lead to loss of fibres and potential exposure for laboratory analysts. To request laboratories to report information which is outside the scope of AS 4964-2004 and the scope of their accreditation is misleading and is most unwise.”

4.4.6  Consistency Statement

Requirement: DoH (2009) guidelines requirement that laboratories provide a statement as to whether the analysis report is consistent with these Guidelines or not. This is considered appropriate to help ensure that even if not evident in the responses to the previous recommendations that the Guidelines recommendations have been adhered to. It also makes for an easy way of checking such adherence.

Compliance Achieved: Yes. The ARL laboratory certificates include a statement to the following effect “This report is consistent with the analytical procedures in the Department of Health document "Guidelines for the Assessment, Remediation and Management of Asbestos-Contaminated Sites in Western Australia - May 2009. All samples received were sieved and the greater than 2mm fraction analysed, and the less than 2mm fraction sub-sampled and analysed.”

4.4.7  Qualifications

In accordance with DoH guidelines (2009), the following information is presented to document the qualifications and experience the project team has with respect to working with similar asbestos/ACM contaminated sites. The Project Director (Dr Greg Milner) together with the Project Manager (Glen Alexander) devised the validation sampling strategy for the site. All validation sampling and airborne fibre monitoring was conducted by the Project Manager (Glen Alexander). A description of the Aurora Environmental staff members involved and their qualification to undertake asbestos related assessment work is described below.

Dr Greg Milner (Project Director) holds a PhD in Geology and has been involved in the environmental consulting industry for approximately 19 years. He has considerable experience with brownfields redevelopment projects such as the East Perth, Subiaco and Midland Redevelopment Projects where he has implemented, or been responsible for teams undertaking, the assessment and remediation of former industrial areas into high quality residential and mixed use developments. Asbestos is a common contaminant at brownfields sites. Greg has been involved was Project Director responsible
for assessment and remediation of asbestos contaminated fill (in excess of 100,000m$^3$) for the Midland Redevelopment Authority at the former WA Government Railway Workshops in Midland. His role included site assessment and reporting and providing advice on: remedial design, contractor procurement and management, site supervision and closeout documentation. Recent asbestos projects include several sites for the Water Corporation (eg. Kokardine and Bridgetown Depots, High Road Water Treatment Plant Decommissioning, Two Peoples Bay pipeline), Port Hedland Airport Precinct contamination investigation and clean up, Albany and Carnarvon Hospital redevelopments.

*Glen Alexander* is an Environmental Scientist with over 12 year experience in contaminated land assessments, investigations and remedial works. Glen has recently assessed several sites in Western Australia that have been impacted with asbestos, including assessment of asbestos contaminated stockpiled waste material at the Karratha Waste Water Treatment Plant, and assessment and remediation of ACM impacted soil at the Water Corporation Depot, Nelson Street, Bridgetown. In addition Glen has been involved in numerous contaminated soil assessment and remediation projects such as the Mt Lawley High School middle school redevelopment, where asbestos was a contaminant of concern in former landfill waste that was being remediated.
CONCLUSIONS AND RECOMMENDATIONS

The results indicate that the while successful remediation has been completed in the clean-up area, it is apparent that ACM impacts potentially remain present within the lot bounds in close proximity to the area subject to remedial works and documented in this report. The results from the air quality monitoring indicate that the airborne fibre levels were below the acceptable background levels and therefore it is concluded that dust monitoring and management were acceptable.

REMEDIATION AREA

The remediation area has been successfully managed by removing surface ACM-contaminated soil to a nominal depth of 400mm below ground level. Inspection and wall and floor validation sampling indicates that no ACM or AF was detected in residual soil associated with the excavation area. The excavation area was backfilled with clean soil to reinstate the ground level. On the basis that the remediation area has been shown to be free from ACM impacts to a depth of 400mm below ground level; this area is suitable for revegetation by shallow planting.

It should also be noted however that as part of a limited inspection, fragments of ACM were identified and removed from the surface in an area up to 1m outside the excavation area (as part of an ACM inspection for the remediation earthworks). Therefore a 1m perimeter area around the cleaned-up zone should be treated as generally free from ACM fragments, but the potential presence of AF and/or other ACM fragments cannot be discounted. Section 5.2 discusses areas of suspect-ACM outside the ACM-free zone.

POTENTIAL RESIDUAL ACM

The remediation area comprised the area of excavation plus the 1m outer perimeter where a limited surface inspection for ACM was undertaken. Due to the presence of thick ground covering vegetation it was not possible to inspect all surface soil in the 1m outer perimeter zone and it is therefore not possible to conclude that no ACM remains in this 1m perimeter zone. This outcome was in part a result of the need to preserve some remnant native vegetation, such as Sword Sedge (Lepidosperma gladiatum) which was considered desirable to retain, to meet the requirements of the CZRMP.

Notwithstanding the above conclusion, the presence of remnant vegetation, as mapped in Natural Area Consulting (2013), in the vicinity of the remediation area appears to indicate that those vegetated areas are unlikely that have been heavily disturbed historically and therefore have a relatively lower likelihood of ACM being present. Furthermore, if ACM is present (in the heavily vegetated areas), it is unlikely that a significant volume of material would exist and therefore the ACM concentration is likely to be low and easily managed via a Site Management Plan.

ACM may also potentially be present in the residual soil beneath the dual use pathway that bisects the remediation area. If it is present, buried ACM would be considered to pose little to no risk to human health while it remains buried and undisturbed. However the potential for ACM to exist...
beneath the dual use pathway should also be managed via a Site Management Plan to ensure that disturbance of this material, if necessary, is managed appropriately.

5.3 MANAGEMENT RECOMMENDATIONS FOR POTENTIAL ACM-CONTAMINATED AREAS

The presence of potential ACM contamination leads to the following suggested management approach:

- Address the obligations of the Contaminated Sites Act (2003) commencing with the duty of owner/occupier to report a site that is potentially contaminated, this may lead to a requirement to assess the full extent of ACM in the area of the remediation zone and or within the lot bounds.
- Inform relevant stakeholders about the risk of associated with the potential ACM, for example Local Government and service or utility providers that may conduct works in the area, including any disturbance to the dual-use pathway.
- Any surface disturbances in these areas (areas in the immediate vicinity of the clean-up area) should be managed as potentially ACM disturbing.

Activities that may require management due to the possibility of ACM disturbance such as:

- Use of mechanised equipment such as mowers, blowers, whipper-snipper;
- Vehicular movement of any description;
- Any sort of digging, trenching or any form of earth disturbance including horizontal boring;
- Large scale natural soil disturbances such as tree fall which may disturb soil from around the root ball, or erosional mechanisms such as storm surges.
- Other activities with potential to generate dust, expose fragments of ACM, break fragments of ACM and or lead to movement of presently undisturbed ACM present location.

5.4 ON-GOING MANAGEMENT

Guidance in regard to on-going management of the asbestos remaining on-site is provided in DoH (2009). This guidance indicates that where an on-going management approach is acceptable, a contaminated site classification of ‘remediated for restricted use’ is likely to be necessary as well as a memorial on the Certificate of Title for the Lot. The restrictions on use would likely comprise a warning that asbestos is present and that precautions should be taken to avoid disturbance; where disturbance cannot be avoided, it should be managed in a safe manner (DOH, 2009).

It is recommended that the Site Owner seek advice regarding the potential for continuing presence of asbestos on-site, which is beyond the scope of works for this report. It is considered likely that an on-going site management plan will be required and furthermore it is recommended that this plan is prepared by a Consultant with appropriate asbestos credentials such as a minimum of three years continuous experience with asbestos soil contamination as specified by DoH (2009).
6 REFERENCES


Belford (S.M), (1987), Busselton Sheet 1930 I, Environmental Geology Series, Geological Survey of Western Australia.

Department of Health (DoH) (2009), Guidelines for the Assessment, Remediation and Management of Asbestos-Contaminated Sites in Western Australia. Toxicology Branch, Environmental Health Directorate.


FIGURES
Department of Finance, Building Management & Works

ASBESTOS-CONTAMINATED SOIL CLEAN-UP AND VALIDATION REPORT

NORTH-EAST PORTION OF BUSSELTON HEALTH CAMPUS, MILL ROAD, WEST BUSSELTON

SITE LOCATION

Figure 1
Department of Finance, Building Management & Works
ASBESTOS-CONTAMINATED SOIL CLEAN-UP AND VALIDATION REPORT
NORTH-EAST PORTION OF BUSSELTON HEALTH CAMPUS, MILL ROAD, WEST BUSSELTON

SITE CLEAN-UP AREA

Figure 2
INDICATIVE LOCATION OF SOIL CLEAN UP AREA

Department of Finance, Building Management & Works
ASBESTOS-CONTAMINATED SOIL CLEAN-UP AND VALIDATION REPORT
NORTH-EAST PORTION OF BUSSELTON HEALTH CAMPUS, MILL ROAD, WEST BUSSELTON

Figure 3

SCALE 1:400 at A4 (MGA)

Legend
- - Indicative Boundary of Soil Clean-up Area
--- Cadastral Boundary

VALIDATION SAMPLE LOCATIONS
Figure 5

INDICATIVE LOCATIONS OF THE ADDITIONAL EXCAVATION AREAS AND THE PERIMETER ACM INSPECTION AREA

Department of Finance, Building Management & Works
ASBESTOS-CONTAMINATED SOIL CLEAN-UP AND VALIDATION REPORT
NORTH-EAST PORTION OF BUSSELTON HEALTH CAMPUS, MILL ROAD, WEST BUSSELTON


DRAWN: G. Alexander
DATE: 31 Jul 2014

SCALE 1:400 at A4 (MGA)

Legend
- Indicative Boundary of Soil Clean-up Area
- Cadastral Boundary

ACM Inspection Area
Outer Perimeter +1m

ACM Likely in Fill Beneath Dual Use Path

Additional Excavation Pit to ~1m BGL

Additional Wall Excavation & ACM in Sword Sedge Vegetation

Additional Wall Excavation

Additional Excavation & ACM in Sword Sedge Vegetation

Additional Wall Excavation
PLATES
Photograph 1 7 July 2014
Looking north from the clean-up area at the northern airborne fibre monitoring unit

Photograph 2 7 July
Looking south from the clean-up area at the southern airborne fibre monitoring unit

Project Name
Asbestos Contaminated Soil Clean-up and Validation Report,
Busselton Health Campus, Mill Road Busselton
<table>
<thead>
<tr>
<th>Photograph 3</th>
<th>8 July 2014</th>
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<tbody>
<tr>
<td>Wall validation sample (VW6) showing the residual wall soil and the residual surface soil at the boundary of the clean-up area.</td>
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<table>
<thead>
<tr>
<th>Photograph 4</th>
<th>10 July 2014</th>
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<tbody>
<tr>
<td>Looking at the north west extent at the clean-up area prior to backfill</td>
<td></td>
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</table>

**Project Name**

Asbestos Contaminated Soil Clean-up and Validation Report, Busselton Health Campus, Mill Road Busselton

![Aurora Environmental Logo]
**Photograph 5** 10 July 2014
Looking at south west extent of clean up area following backfill

**Photograph 6** 10 July 2014
Looking west at the excavation along the northern boundary of the dual use pathway

**Project Name**
Asbestos Contaminated Soil Clean-up and Validation Report, Busselton Health Campus, Mill Road Busselton
Looking north at the wall of the clean-up area following raking, the darker soil is organic rich surface soil typically seen as a ~5-10cm thick horizon at the surface, in this photo this material had shed downwards during the raking to visually assess for ACM. The lighter soil in the foreground is typical of undisturbed soil seen at 0.4m below ground level.

Look at the north west extent at the clean-up area prior to backfill

Project Name
Asbestos Contaminated Soil Clean-up and Validation Report, Busselton Health Campus, Mill Road Busselton